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Assessing the Consumption Tax Burden on Japanese Households:
Is It Truly Regressive?

Masahiro Hori
Tokyo Keizai University

and

Koichiro Iwamoto
Aichi Toho University

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Assessing the Consumption Tax Burden on Japanese Households: Is It Truly Regressive?

Masahiro Hori^{a*} and Koichiro Iwamoto^b

^a Tokyo Keizai University

^b Aichi Toho University

Abstract

This study empirically assesses the widely held public perception that Japan’s consumption tax is regressive. Using microdata from the *Family Income and Expenditure Survey* (FIES), supplemented with data from the *Survey of Household Economy* (SHE) and *National Accounts*, we estimate the household-level consumption tax burden in Japan from 2005 to 2013. To examine the distribution of the tax burden, we construct several affluence indicators to serve as proxies for lifetime income and categorize households into deciles accordingly. Our findings challenge the prevailing view, revealing that the consumption tax burden rate—defined as tax paid relative to adjusted annual income—remains consistent across affluence brackets, suggesting that the tax is proportional in terms of lifetime income. Furthermore, among retired households, a modest degree of progressivity emerges, with wealthier retirees bearing a comparatively higher burden. These results align with the economic argument that a uniform consumption tax effectively functions as a proportional tax over the life cycle. Given public concerns regarding the distributional burden of the consumption tax, these findings underscore the importance of evidence-based public discourse and effective policy communication.

JEL Classification: H22, H24, D12, E21

Keywords: household consumption, life-cycle (permanent income) hypothesis, VAT, consumption tax, affluences indicator, tax burden structure

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1. Introduction

Japan is currently grappling with a significant budget deficit, making fiscal consolidation an urgent policy priority. While structural budget reform has been widely discussed, relying solely on spending cuts—often favored by the public—presents significant limitations in achieving fiscal sustainability. Many economists argue that increasing the consumption tax represents a stable and efficient means of revenue generation, given its broad tax base, revenue stability, and neutrality.¹ However, a major criticism of the consumption tax is its perceived regressivity, as it disproportionately impacts lower-income households, who allocate a larger share of their income to taxable goods and services.² This concern has fueled public opposition across a wide range of demographic groups.

Despite this perception, some economists challenge the regressivity hypothesis, arguing that the consumption tax should be assessed relative to lifetime income rather than annual income. According to the life-cycle hypothesis, household consumption is primarily determined by lifetime income, which better reflects overall tax-paying capacity. From this perspective, the consumption tax—applied uniformly to consumption—functions as a proportional tax rather than a regressive one. Ohtake & Kohara (2005) support this argument, contending that regressivity disappears when the tax burden is measured relative to lifetime resources rather than temporary income fluctuations.

From this theoretical perspective, Japan's rapidly aging population adds another layer of complexity to the debate. A growing number of retired households—which typically rely on pensions as their main source of income—report low annual incomes despite sustaining relatively high consumption levels. These households, having accumulated substantial financial and real assets over their working years, retain a high tax-paying capacity that is not reflected in their current income. Unlike income taxes, which primarily target working-age households, the consumption tax effectively captures wealthier retirees, ensuring a broader and more equitable tax base across generations. Given Japan's shrinking workforce, the consumption tax therefore is likely to play an increasingly critical role in funding social infrastructure through a broad and sustainable revenue base.

Despite the significance of the consumption tax and the stark divide between economic theory and public perception, empirical evidence on the actual burden of the consumption tax across different household types in Japan remains limited. While there are some studies on Japan (e.g., Yashio & Hasegawa, 2008; Hashimoto, 2010; Takayama & Shiraishi, 2010; Ohno et al., 2013) that have sought to estimate its burden, they have failed to reach a consensus, largely due to data constraints in accurately capturing household consumption patterns. In contrast, international research on the

¹ Surveys of economists' views on the consumption tax include Umeda et al. (2018) and a series of reports by the Tokyo Foundation Policy Research Institute (Sato, 2023; Kato & Maeda, 2023; Kato, 2023).

² The idea that the consumption tax is regressive is based on the perception that the higher a household's wealth, the higher the savings rate. However, this view has been called into question from the perspective of the permanent income hypothesis and other factors, and Hori et al. (2016) have empirically shown that the evidence on a positive relationship between household wealth and the savings rate is not that clear.

regressivity of value-added tax (VAT) has been more extensive (e.g., Caspersen & Metcalf, 1994; Chernick & Reschovsky, 2000; Thomas, 2022³), providing valuable insights into how consumption taxes function across different economic contexts. However, studies specifically focusing on Japan's consumption tax are scarce, necessitating a reassessment using more refined empirical techniques.

This study conducts a rigorous empirical reassessment of Japan's consumption tax regressivity, which has long been viewed as one of its most critical shortcomings. Evaluating whether the tax is truly regressive involves two major challenges. First, no dataset directly records how much consumption tax each household actually pays, so household-level tax burdens must be indirectly estimated based on the best available data on household consumption. Second, there is no standardized indicator for measuring households' economic affluence or tax-paying capacity, which complicates the accurate assessment of the tax burden distribution. Traditional analyses often use annual income or consumption as proxies for household economic status, but these short-term indicators fail to capture households' long-term ability to pay. In this study, we therefore use the concept of affluence, by which we mean a household's long-term economic capacity to bear taxes over its lifetime rather than its income or consumption at a particular point in time. This broader concept of affluence encompasses not only lifetime income and accumulated wealth but also takes a household's stage in the life cycle into account, offering a more comprehensive measure of tax-paying ability. By constructing a comprehensive indicator of how "well off" households are in terms their income, wealth, and consumption at a particular stage of the life cycle, and using this to classify households into tiers, we aim to address the limitations of previous studies and provide a more accurate assessment of the distributional impact of the consumption tax.

The key takeaway from our findings is that the consumption tax is not regressive in terms of households' affluence but rather proportional. In FY2010, the average annual household consumption tax burden was JPY 175,000, with a median of JPY 150,000. For employee households, the figures were slightly higher, at JPY 193,000 (average) and JPY 169,000 (median)—equivalent to approximately half of the direct tax burden per household in the same year.⁴ The average annual consumption tax burden rate—that is, the average of the annual consumption tax paid divided by adjusted annual income—was just under 3% and more or less constant across wealth levels. Moreover, for retired households, the tax burden exhibited a mildly progressive pattern, likely due to their reliance on accumulated assets for consumption.

The remainder of this study is structured as follows. Section 2 outlines the statistical surveys

³ In his latest study, Thomas (2022) analyzed data from 27 OECD countries after reviewing numerous previous studies on the distributional effects of value-added tax. He found that although value-added tax is regressive when viewed as a proportion of current income, it is generally proportional or slightly progressive when viewed as a percentage of current expenditure, and the expenditure-based results are a more meaningful estimate of the distributional effects of VAT.

⁴ These figures are for the period when the consumption tax rate was 5%. It is therefore likely that the burden has increased to almost double that amount now, given that the current consumption tax rate is 10%.

and methodologies used to estimate household consumption and the consumption tax burden, along with their limitations. Section 3 starts with the description of our methodology and addresses the first challenge in examining the regressivity of the consumption tax burden, namely, the absence of direct data on the household-level tax burden. Section 4 then introduces the affluence indicators we develop to address the second challenge—measuring households’ affluence and hence ability to pay taxes—and explains how we use them to classify households. Section 5 presents the empirical results on the distribution of the consumption tax burden. Finally, Section 6 concludes with a summary of the key findings and policy implications.

2. Household Consumption and Consumption Tax Burden: Estimates and Limitations

This section, together with the next, addresses the first of the two key challenges in evaluating the regressivity of Japan’s consumption tax: the lack of directly observed household tax burden data. There are no statistical records of the consumption tax paid by individual households. Therefore, the tax burden must be estimated indirectly by treating household consumption as the tax base and applying the relevant rates. Reliable household consumption data are essential for accurately estimating the tax burden. In this study, we address this challenge by using microdata from the *Family Income and Expenditure Survey* (FIES), the most comprehensive dataset on household consumption in Japan, which serves as the foundation of our analysis.

2.1 Existing Surveys on Household Consumption Expenditure and Their Limitations

As highlighted by Hamaaki et al. (2016), collecting detailed data on individual household consumption expenditures is inherently challenging due to the complexity of the process (e.g., requiring households to maintain detailed expenditure records), the burden it places on respondents, and concerns over privacy. Given these challenges, this study relies primarily on the FIES microdata for its empirical analysis, as it provides the most detailed and continuous records of household consumption expenditures available in Japan. In addition to the FIES, which is the primary data source for this study, other official statistics capturing household expenditure in Japan include the *Comprehensive Survey of Living Conditions* (CSLC), the *National Survey of Family Income and Expenditure* (NSFIE), and the *Survey of Household Economy* (SHE). Academic research into consumer behavior has also used panel surveys such as the *Japan Household Panel Survey* (JHPS/KHPS) from the Panel Data Design and Analysis Center at Keio University and the *Japanese Panel Survey of Consumers* (JPSC), which used to be compiled by the Institute for Household Economics but now is also conducted by Keio University.

Table 1 compares major household consumption expenditure surveys in Japan, highlighting key differences in their coverage, data collection methods, and scope of consumption and income data.

These datasets are valuable for understanding household consumption behavior and serve as a basis for estimating the consumption tax burden. However, they also present several limitations in this context. Many surveys, except for the *Family Income and Expenditure Survey* and the *Survey of Household Economy*, collect data only for specific months or a short period (e.g., two to three months). As a result, annual consumption estimates must often be extrapolated, but simple multiplications (e.g., averaging a few months and multiplying by 12) can distort household-level comparisons, given the significant variation in seasonal consumption patterns. Additionally, most surveys, except for the FIES and the NSFIE, provide only broad consumption categories. This limitation prevents precise calculations of the consumption tax burden, as tax-exempt or reduced-rate items cannot be separately identified.

Table 1. Major surveys on household consumption expenditures in Japan

Survey name	Comprehensive Survey of Living Conditions (CSLC)	National Survey of Family Income and Expenditure (NSFIE)	Family Income and Expenditure Survey (FIES)	Survey of Household Economy (SHE)	Japanese Panel Survey of Consumers (JPSC)	Japan Household Panel Survey (JHPS/KHPS)
Conducting Organization	Ministry of Health, Labour and Welfare	Statistics Bureau of the Ministry of Internal Affairs and Communications	Statistics Bureau of the Ministry of Internal Affairs and Communications	Statistics Bureau of the Ministry of Internal Affairs and Communications	Institute for Research on Household Economics	Panel Data Research Center at Keio University (PDRC)
Survey Start Year	1986	1959	1953	2001	1993	2004
Survey Frequency	Every 3 years (June-July)	Every 5 years	Monthly	Monthly	Annually (October)	Annually (January)
Approximate Sample Size	About 40,000 households	About 57,000 households	About 9,000 households	About 20,000 households	About 2,000 households	About 4,000 households
Structure	Repeated cross-section	Repeated cross-section	Monthly panel (6 months)	Monthly panel (12 months)	Annual panel	Annual panel
Consumption Expenditure	One-month expenditure before the survey	Monthly expenditure (household ledger)	Monthly expenditure (household ledger)	Monthly expenditure	One-month expenditure before the survey	One-month expenditure
- Breakdown	Total amount only	Detailed itemized expenditures	Detailed itemized expenditures	Total amount, food expenses, and 48 specific items	Total amount and 14 categories	Total amount and 17 categories
Survey Months per Household	One month (May)	Up to three months (September to November)	Up to six months	Up to 12 months	One month (September)	One month (January)
Income	Annual income (previous year)	Monthly and annual income (previous year)	Monthly and annual income (previous year)	Annual income (previous year)	Monthly and annual income (previous year)	Annual income (previous year)

2.2 Estimating Annual Household Consumption Expenditure Using the FIES Microdata

We conduct the empirical analysis in this study using the microdata from the *Family Income and Expenditure Survey* (FIES), as it provides the most detailed records of household consumption expenditures. The FIES has been widely utilized in previous studies and is one of the key statistical surveys for understanding household income and expenditure in Japan. It plays a crucial role in informing national economic and social policy planning. The survey is conducted monthly and covers approximately 9,000 households across Japan, which are asked to record their monthly income and expenditure in a household account book. Each sampled household is surveyed for a period of six months, after which it is replaced by a new household in the seventh month. As a result, one-sixth of the sample households are replaced each month, enabling the collection of consumption expenditure

data for up to six months per household.⁵

Although the six-month survey period does not allow for a direct calculation of annual consumption expenditures, the number of survey months per household is longer than in many datasets used in previous studies.⁶ Moreover, by combining these data with information from other households, it is possible to cover every month of the year and make a reasonable estimate of annual consumption expenditures taking seasonal variations into account. Furthermore, the FIES provides granular data on household consumption expenditures based on detailed entries in the household account books. This allows for a relatively accurate calculation of the consumption tax burden borne by households, taking spending on items that are exempt from the consumption tax or subject to a reduced rate into account.

2.3 Calculating Household Consumption Tax Based on Itemized Expenditure

If the annual consumption expenditure for each item at the household level can be obtained, this means that it is also possible to calculate the annual consumption tax burden. We do this by categorizing expenditures into taxable and non-taxable items and calculating the consumption tax paid on each individual item. Specifically, let a_i represent the consumption tax rate. We then divide the expenditure on an item by $1 + a_i$ to obtain the expenditure excluding the consumption tax and multiply this by the consumption tax rate, a_i , to obtain the amount of consumption tax paid on that item. I.e., we multiply the expenditure on each item by $a_i/(1 + a_i)$, which we will refer to as the tax burden coefficient. Finally, we obtain the total consumption tax burden by summing the calculated taxes across all items.

However, as highlighted by Murasawa et al. (2005) and others, applying this method directly to microdata from the FIES (or the NSFIE) often leads to underestimation of the consumption tax burden.⁷ This underestimation arises because expenditure amounts in such microdata are often systematically underreported, particularly for infrequently purchased and high-value items like durable goods. These recorded amounts often fall short of the household consumption expenditures estimated in the *National Accounts of Japan*. Consequently, estimates of the consumption tax burden derived from itemized data in existing statistical surveys tend to be underestimated.

To address this issue, Takayama and Shiraishi (2010) proposed a method to improve the estimation of the consumption tax burden. Their approach involves reclassifying expenditure items in the NSFIE into 87 categories based on the Input-Output Table, matching these categories with expenditure amounts in the *System of National Accounts* (SNA), and calculating an adjusted conversion coefficient for each category. By multiplying the adjusted expenditure amounts by the tax

⁵ The panelization of microdata from the FIES, which is typically aggregated as cross-sectional data, was pioneered by Hayashi (1986) and further refined by Unayama (2011a).

⁶ As indicated in Table 1, the *Survey of Household Economy* (SHE) tracks household consumption expenditure over 12 months, enabling the calculation of annual consumption amounts. However, it does not provide as detailed a breakdown of consumption as the FIES, making it less suitable for calculating the consumption tax burden.

⁷ Iwamoto et al. (1995, 1996) provide an in-depth analysis of the discrepancies between consumption data in the household surveys and the national accounts.

burden coefficient $a_i/(1 + a_i)$, they sought to estimate the consumption tax burden more accurately.⁸

While Takayama and Shiraishi's approach marks a notable advancement in estimating the household-level consumption tax burden given the data limitations, it may still introduce distortions in the distribution of the tax burden. One potential source of such distortions is the underreporting inherent in microdata, as discussed in the next section. Since this research focuses on examining whether the consumption tax is regressive—a distributional issue—it is desirable to minimize potential distortions in the distribution to ensure reliable results.

3. Estimation of the Household Consumption Tax Burden

3.1 Conceptual Framework and Data Challenges

A central difficulty in evaluating the distributional effects of the consumption tax is that household-level tax payments are not directly observed in any official statistics. Unlike income taxes or social insurance contributions, consumption tax liabilities are embedded in market prices and cannot be separately identified at the household level. As a result, any empirical analysis of the consumption tax burden must rely on indirect estimation, using household consumption as the tax base and applying statutory tax rates to estimated expenditures.

In Japan, the most comprehensive source of micro-level information on household consumption is the Family Income and Expenditure Survey (FIES). While the FIES provides highly detailed itemized expenditure data, it is well known that estimates derived directly from this survey tend to understate aggregate consumption relative to macroeconomic statistics such as the System of National Accounts (SNA). Moreover, the survey design of the FIES introduces additional challenges for distributional analysis. Each household is observed for only six consecutive months, making raw expenditure data sensitive to seasonality, and the sample composition does not perfectly mirror the national household structure.

For the purpose of this study, which focuses on the distribution of the consumption tax burden across households, it is essential to construct household-level estimates that are not only plausible in aggregate terms but also reliable in their relative distribution across household types. To this end, we develop a multi-step estimation procedure that corrects for known limitations of the FIES while preserving the micro-level variation necessary for distributional analysis.

3.2 Overview of the Estimation Procedure

Figure 1 summarizes the overall procedure used to estimate annual household consumption and the associated consumption tax burden. Starting from the raw FIES microdata, the estimation proceeds

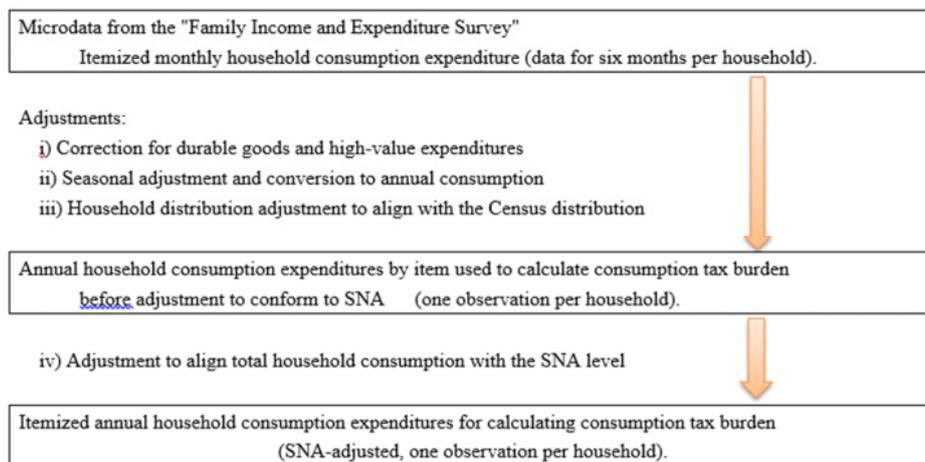
⁸ From the 87 industry classifications in the SNA input-output table, 17 categories with no recorded consumer spending and 6 categories without corresponding items in the NSFIE are excluded, leaving 64 categories for the actual calculations.

through several adjustment stages before tax liabilities are calculated.

First, monthly itemized expenditure data are converted into annual values, taking account of seasonal patterns in consumption. Second, reported expenditures on durable and other high-value goods are adjusted to address underreporting, which is particularly pronounced for infrequently purchased items. Third, the household sample is adjusted to improve representativeness, using information from the Population Census. Fourth, the resulting household consumption totals are aligned with the corresponding aggregates in the SNA in order to ensure consistency with macroeconomic statistics. Finally, statutory consumption tax rates are applied to taxable items to obtain annual household-level consumption tax burdens.

Each step serves a distinct purpose. Seasonal adjustment ensures comparability across households observed in different months. Corrections for underreporting mitigate biases that would otherwise distort the distribution of consumption. Sample adjustment improves the representativeness of the microdata, while alignment with the SNA anchors the estimates to a credible aggregate benchmark. The following subsection briefly discusses the rationale for the key adjustments that are particularly relevant for the analysis of tax burden distribution.

Figure 1. Adjustment of FIES microdata for estimating annual household consumption



3.3 Key Adjustments to the FIES Microdata

3.3.1 Underreporting of Durable and High-Value Goods

A long-standing issue in the use of household surveys for consumption analysis is the underreporting of durable and high-value goods. Comparisons between the FIES and other surveys, as well as between the FIES and the SNA, indicate that expenditures on items such as furniture, household appliances, and other infrequently purchased goods are particularly understated.

Evidence from comparisons with the Survey of Household Economy (SHE) suggests that this underreporting is driven primarily by omission rather than by systematic understatement of

reported amounts. In other words, households that record positive expenditures tend to report amounts comparable to those observed in alternative surveys, while a substantial fraction of households record zero expenditure despite having made purchases. In the context of distributional analysis, this distinction is important. Uniformly inflating reported expenditures would risk exaggerating inequality by disproportionately increasing spending among households that already report positive purchases.

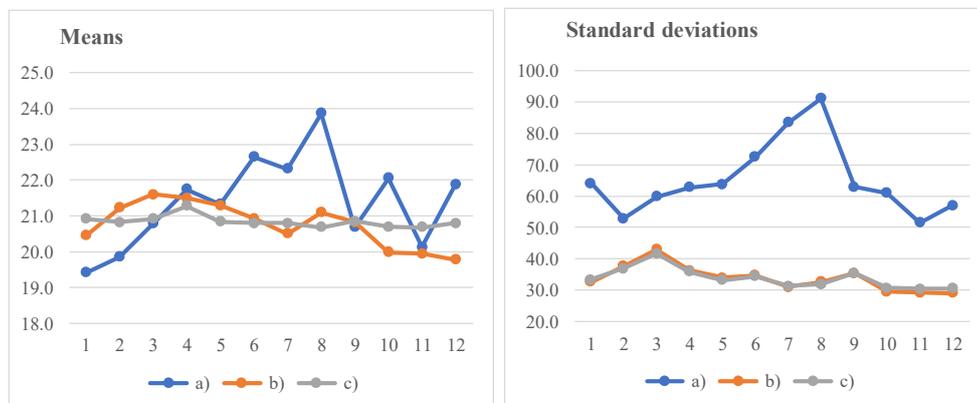
To address this issue, we apply a probabilistic adjustment method that imputes omitted expenditures for durable and high-value goods based on household characteristics. This approach increases average spending on these items while limiting distortions to the cross-household distribution of consumption. Details of the estimation and imputation procedure are provided in Appendix A.

3.3.2 Seasonal Adjustment of Consumption Expenditures

Because the FIES observes each household for only six consecutive months, raw expenditure totals are sensitive to the timing of the survey. Simple annualization methods, such as multiplying observed expenditures by a fixed factor, can lead to substantial seasonal bias and artificially inflate dispersion across households.

To obtain comparable annual consumption estimates, we construct conversion coefficients for major product groups that account for differences in survey months and household attributes. Applying these coefficients substantially reduces the dependence of estimated annual consumption on the survey start month and yields more stable expenditure measures across households. The effectiveness of this adjustment is illustrated in Figure 2, using leisure and cultural services as an example. Further details on the construction of the conversion coefficients are provided in Appendix B.

Figure 2. Impact of seasonal adjustment on the monthly mean and standard deviation of expenditure: the case of leisure and cultural services



- a) Simple annualization (monthly values multiplied by 12; strong seasonality remains)
- b) Annualization based on six-month cumulative expenditures
- c) Seasonally adjusted annual expenditures using regression-based conversion coefficients

3.3.3 Adjustment of Sample Representativeness

Although the FIES is designed to be nationally representative, its sample composition differs from the actual household distribution in Japan along several dimensions, including household size, employment status, and housing tenure. These discrepancies can affect both average consumption levels and their distribution.

To address this issue, we adjust the effective extraction rates of households in the FIES so that the distribution of key household attributes matches that observed in the Population Census. This procedure improves the representativeness of the microdata and ensures that the estimated tax burden reflects the national household structure more accurately. Summary statistics before and after this adjustment are reported in Appendix C.

3.4 Estimation of Household Consumption Tax Burden and Aggregate Consistency

After applying the above adjustments, we calculate annual household consumption tax burdens by classifying expenditures into taxable and non-taxable items and applying the statutory tax rate to taxable expenditures. The tax paid on each item is calculated using the standard tax burden coefficient, and household-level tax liabilities are obtained by summing across items.

When consumption tax burdens are calculated using adjusted but unaligned FIES data, the implied aggregate tax revenue remains substantially below the actual consumption tax revenue recorded in national tax statistics. To reconcile this gap, we further adjust household consumption totals so that aggregate expenditures by major product categories match the corresponding figures in the SNA. This alignment is applied uniformly within each category and preserves the relative distribution of consumption across households.

After this final adjustment, the estimated average annual household consumption tax burden rises to approximately JPY 170,000–190,000, and the implied aggregate tax revenue is broadly consistent with official statistics. While the precise level of the estimated tax burden is not the primary focus of this study, achieving consistency with macroeconomic benchmarks is essential for ensuring the credibility of the micro-level estimates.

The resulting dataset provides household-level consumption tax burdens that are suitable for distributional analysis. In the following section, we combine these tax burden estimates with alternative indicators of household affluence in order to assess whether the consumption tax is regressive when evaluated relative to households' long-term economic resources.

4. Construction of Household Affluence Indicator

The central objective of this study is to construct a household-based dataset that enables a reliable analysis of the structure of the consumption tax burden in Japan and its regressivity. The previous sections addressed the first major challenge in this endeavor: the lack of directly observed data on the

household consumption tax burden. We therefore derived the annual household consumption tax burden by estimating household consumption and applying the relevant tax rates, providing the basis for assessing how the tax burden is distributed across different household types. However, assessing the regressivity of the consumption tax requires tackling a second fundamental challenge: the absence of a definitive measure of household affluence. Without a reliable indicator of household affluence, even if the household tax burden is estimated, it remains impossible to properly evaluate the structure of the tax burden—or the extent of regressivity—relative to household resources. This section, therefore, explores the development of a suitable measure of household affluence, i.e., a household affluence indicator.

4.1 Assessment of the Tax Burden Based on Different Affluence Indicators: A Monte Carlo Simulation

To understand how the assessment of the consumption tax burden depends on the choice of household affluence indicators, this subsection employs a Monte Carlo simulation based on a simplified model where consumption follows the permanent income hypothesis (PIH). Specifically, we examine the relationship between the distribution of household affluence and the consumption tax burden under this assumption.

Income and consumption model

We start by assuming that the permanent income Y_i^P of household i follows a log-normal distribution:

$$Y_i^P = \exp(\mu + \sigma Z_i), \quad Z_i \sim N(0,1)$$

where μ and σ are parameters determined to match a given mean ($\bar{Y}^P = 550$) and standard deviation ($SD_{Y^P} = 180$) of permanent income.

The actual income Y_i is then defined as the sum of permanent income and a transitory income shock modeled as:

$$Y_i = Y_i^P(1 + u_i^Y) = Y_i^P + u_i^Y Y_i^P, \quad u_i^Y \sim N(0, \sigma_Y^2).$$

Similarly, household consumption C_i is determined by the permanent income component and an independent transitory consumption shock:

$$C_i = Y_i^P(1 + u_i^C) = Y_i^P + u_i^C Y_i^P, \quad u_i^C \sim N(0, \sigma_C^2).$$

For the simulation, we assume the standard deviations of the transitory income and consumption shocks to be $\sigma_Y = 0.25$ and $\sigma_C = 0.15$, respectively. Given a consumption tax rate of $\tau = 0.05$ (5%), the consumption tax burden T_i for household i is given by:

$$T_i = \tau C_i / (1 + \tau)$$

Thus, the effective tax burden rate is defined as:

$$\frac{T_i}{Y_i} = \frac{\tau C_i}{(1 + \tau)Y_i} = \frac{\tau}{1 + \tau} \frac{Y_i^P (1 + u_i^C)}{Y_i^P (1 + u_i^Y)} = \left(\frac{\tau}{1 + \tau}\right) \left(\frac{1 + u_i^C}{1 + u_i^Y}\right).$$

Following this procedure, we generate data for 5,000 households and classify them into deciles based on three different affluence indicators: actual income, consumption, and permanent income. For each decile, we compute the median consumption tax burden rate and its interquartile range. This process is repeated 1,000 times, and the average values across simulations are used to visualize the relationship between household affluence and the tax burden.

Figure 3. Consumption tax burden across different affluence indicators

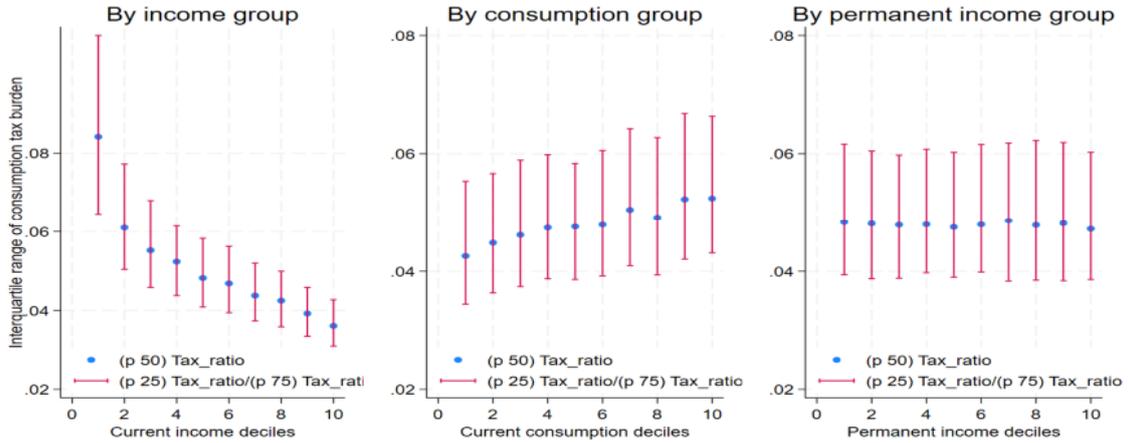


Figure 3 shows the results. The leftmost panel presents the case where actual income is used as the affluence indicator, highlighting the widely discussed regressive nature of the consumption tax. The middle panel, where consumption serves as the affluence indicator, reveals a slightly progressive tax burden structure, in line with previous studies (e.g., Ohtake & Kohara, 2005). Finally, the rightmost panel, which classifies households based on permanent income, indicates a proportional tax structure, in line with the theoretical argument that a consumption tax functions as a proportional tax when assessed against lifetime resources.

It is important to note that the findings presented here are based on a hypothetical simulation under the assumption of the permanent income hypothesis, rather than empirical data on actual tax burdens. However, one key implication of this analysis is that the assessment of the tax burden distribution is highly sensitive to the choice of affluence indicator. Even when the true tax burden rate remains constant across households, which indicator is used as a proxy for affluence to classify households in terms of their ability to pay the consumption tax can lead to different conclusions—

either exaggerating regressivity or suggesting progressivity where none exists. To avoid such misleading results, it is essential that the way households are classified is based on the appropriate measure of households' ability to pay taxes or what we refer to as their "affluence," i.e., their lifetime economic resources, consisting of their lifetime income and wealth.

4.2 Alternative Affluence Indicators

Based on the above consideration, and using data from the FIES, we propose various alternative affluence indicators as proxies for lifetime income, moving beyond the conventional reliance on income or consumption as primary measures of household affluence. Since no single metric can perfectly capture household affluence, all potential indicators are, by nature, imperfect proxies. However, we assume that all the proxy indicators we propose capture some aspect of household affluence, so that in this section we first classify Japanese households into deciles based on these various alternative indicators of affluence and then examine the structure of the consumption tax burden. Before turning to the alternative indicators, however, we first examine the structure of the consumption tax burden when households are classified using conventional indicators, namely income and consumption.

4.2.1 Conventional indicators and the tax burden structure

Since we have already calculated the consumption tax burden for individual households in Section 3, we can define the household-level consumption tax burden rate as follows:

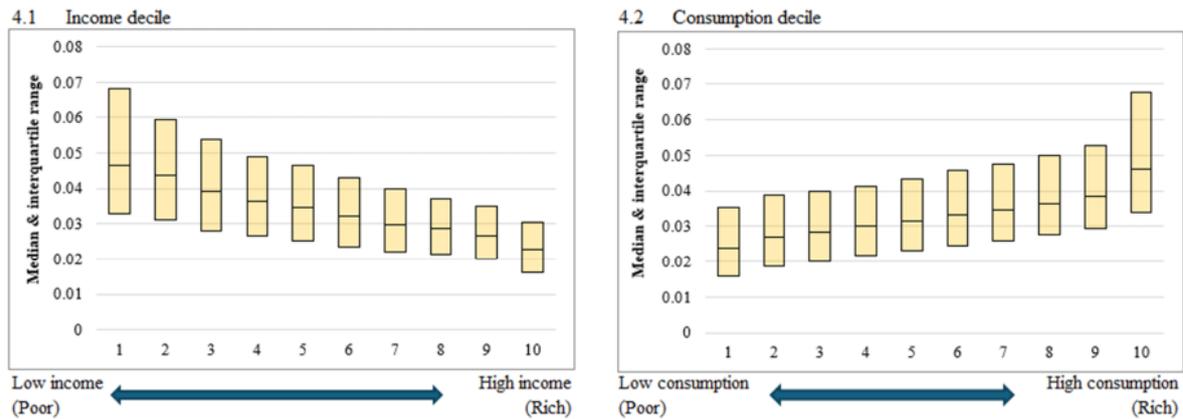
$$\text{Household consumption tax burden rate} = \frac{\text{Annual household consumption tax burden}}{\text{Annual household income}}$$

Using this definition, if households are classified based on a certain criterion and the median and interquartile range of the tax burden rate are calculated for each household group, the structure of the consumption tax burden based on that classification scheme can be visualized. Figure 4 illustrates the consumption tax burden structure when using income (household annual income in the previous year), which is commonly employed in public debates, and consumption (estimated annual household consumption), which is sometimes used as an alternative indicator of household affluence. In each panel, households are arranged from left to right in increasing order of affluence. In the left panel, where households are classified based on income, the consumption tax burden rate exhibits a downward-sloping pattern, indicating that poorer households bear a higher relative tax burden. This visual representation clearly explains why the consumption tax is often perceived as regressive.

This observed downward-sloping pattern in the tax burden when measured against income is exactly in line with the simulation results presented in Figure 3 when household tiers are classified by income. This confirms that such a pattern alone does not serve as evidence of true regressivity in the consumption tax. As noted in the introduction, Japan's rapidly aging population has led to a rise in

households that rely on pensions as their main source of income. Many of such households report low annual incomes but maintain high consumption levels due to accumulated wealth from their working years. On the other hand, some elderly households, despite having higher annual incomes since they continue to work, lack substantial assets and are not truly financially secure. This highlights the limitations of using current income alone as an indicator of households' affluence and the distribution of the tax burden.

Figure 4. Household affluence brackets and consumption tax burden: conventional indicators



Note: The center line of the rectangle drawn for each tier represents the median burden in the tier, while the top and bottom lines represent the 3rd and 1st quartiles, respectively.

Similarly, the upward-sloping pattern in the tax burden observed when households are classified based on consumption (right panel) is also in line with the results presented in Figure 3. Thus, regarding such a pattern as evidence of progressivity in the consumption tax is not appropriate. For instance, households forced to make large, one-time expenditures due to a natural disaster would be classified as wealthier under the consumption-based measure compared to otherwise similar households that did not face such expenses. As a result, they would appear to bear a higher consumption tax burden. However, interpreting this upward-sloping pattern as proof of tax progressivity would be incorrect. Ultimately, a more reliable measure of household affluence, such as a comprehensive affluence indicator, is essential for a meaningful evaluation of the structure of the consumption tax burden.

4.2.2 Five alternative affluence indicators

Building on the finding that conventional indicators such as income (and consumption) are not suitable for capturing the true structure of the consumption tax burden, we propose five alternative affluence indicators to replace annual income, based on information obtained from the FIES microdata.

Specifically, these five indices are: (1) the predicted value of equivalent⁹ income from a regression model, (2) equivalent financial assets, (3) the predicted value of equivalent consumption from a regression model, (4) the average price range of purchased goods, and (5) the share of expenditures on essential goods. The information on financial assets and purchase prices needed to calculate indices (2) and (4) is not available for single-person households in the FIES, as these items are included only in the survey for households with two or more members. For this reason, the following analysis is carried out only for households with two or more members, excluding single-person households.¹⁰ The following provides an outline of the different wealth indicators and the way they are calculated.

Predicted value of equivalent income

The main limitation of using annual income as an indicator of household affluence is its susceptibility to temporary income fluctuations, as expressed by:

$$\text{Income} \equiv \text{Permanent Income} + \text{Temporary Income}$$

To isolate permanent income, we estimate a regression model using household characteristics such as age, equivalent financial assets, equivalent living area, and dummy variables for region, workplace size, industry, occupation, and year.¹¹ The model's predicted values serve as a proxy for affluence. Our alternative indicator (1) follows this approach, deriving equivalent income as the dependent variable. Equivalent income is calculated by adjusting annual income for imputed rent¹² and scaling it by the square root of the number of household members, ensuring comparability between homeowners and renters while accounting for differences in household size.

Equivalent financial assets

As noted in the introduction, the example of elderly households illustrates that household assets capture a different dimension of household affluence than income. Based on this, we adopt equivalent financial assets as our household affluence indicator (2), defined as total household financial assets divided by the square root of the number of household members. Ideally, the indicator would encompass total assets, including real assets such as property. However, due to the lack of sufficient data on real assets in the FIES, we limit our measure to financial assets.¹³

⁹ To calculate the wealth indicators, we use equivalent measures for income, consumption, and assets, which we obtain by dividing these variables by the number of household members to account for differences in household size.

¹⁰ Moreover, the survey period for single-person households is only three months—half that of larger households—introducing potential noise in comparisons. This further justifies restricting the analysis to households with two or more members.

¹¹ The estimation results are detailed in Appendix H at the end of this paper.

¹² For details on the calculation method of imputed rent, please refer to Appendix D.

¹³ Conceivably, how well off individuals are may differ even if they have the same amount of financial assets, depending on their age. For example, a 20-year-old with JPY 10 million is likely to be better off than a 60-year-old with JPY 10 million. To account for this possibility, the next section narrows the sample to households that can be regarded as homogeneous in terms of age, family composition, and other characteristics, and examines the relationship between the consumption tax burden and tax payment capacity within this more comparable group.

Predicted value of equivalent consumption

The permanent income hypothesis posits that consumption is mainly determined by an individual's permanent income, making consumption the most reliable proxy for permanent income (\equiv household wealth). However, external shocks like health issues, weather, or accidents can cause temporary consumption fluctuations, creating a positive correlation between consumption and the consumption tax burden rate and biasing the tax burden structure toward progressivity. To mitigate this, we use the predicted value of equivalent consumption from a regression model as our wealth indicator (3) instead of actual consumption. Specifically, we estimate a regression model where the dependent variable is equivalent consumption—total consumption divided by the square root of the number of household members—using the same explanatory variables as in indicator (1).¹⁴

Average price rank of purchased goods

In addition to detailed consumption expenditures for approximately 500 items, the FIES provides data on the quantity purchased for many of these items. By dividing household expenditure on item i by the corresponding quantity, we derive the average purchase price, representing the price each household pays per unit. Since more affluent households tend to buy higher-priced, higher-quality goods even within a particular product category, this price information can serve as the basis for an affluence indicator. To construct this measure, we first identified the price range that items purchased by each household fell into for items for which price data are available. Specifically, for each product category, we classify households into deciles based on the price range of the item they purchased. That is, each household is assigned a rank from 1 (lowest price decile) to 10 (highest price decile) for each item. We then calculate the weighted average of these decile ranks across items, using the expenditure share of each item in the household's total consumption as weights. Finally, we again divide households into deciles based on this weighted average rank, which we refer to as the average price rank, and use this as our affluence indicator (4).¹⁵

Share of expenditures on essential goods

The FIES provides detailed data on household expenditures, allowing for an analysis of consumption patterns. According to Engel's Law, lower-income households allocate a larger share of their total consumption expenditure to food and other necessities. Based on this principle, the proportion of spending on necessities can serve as an inverse indicator of household affluence. Following this reasoning, we define our affluence indicator (5) as the share of total household expenditures allocated to necessities. Specifically, we focus on the share of expenditures on 12 items with a particularly low

¹⁴ The estimation results are provided in Appendix I.

¹⁵ For details on the calculation of households' average price rank, refer to Appendix E.

income elasticity, relative to total household consumption expenditures—which we refer to as the share of essential expenditures.¹⁶

4.2.3 Aggregate wealth indicator derived from the five indicators

The five affluence indicators presented in the previous subsection each capture a distinct aspect of household affluence. However, none provide a perfect measure; rather, each reflects affluence along with some additional factors (denoted by α , representing unique characteristics inherent to each indicator). If we can extract the common component shared across all five indicators, this underlying factor may represent the core essence of household affluence.

Following this logic, we introduce our sixth affluence indicator, constructed by aggregating information from indicators (1) through (5) using principal component analysis (PCA). Specifically, we employ the first principal component as a synthesized measure of household affluence. The results of the PCA are presented in Table 10.

Table 10. Results of principal component analysis

	Principal components (eigenvectors)				
	Component 1	Component 2	Component 3	Component 4	Component 5
Equivalent income predicted value	0.557	-0.165	-0.044	-0.480	0.656
Equivalent financial assets	0.587	-0.173	-0.108	-0.260	-0.739
Equivalent consumption predicted value	0.415	-0.094	-0.463	0.763	0.151
Average price of purchased goods	0.224	0.965	-0.113	-0.070	-0.007
Essential expenditures share	0.350	0.046	0.871	0.340	0.022
Share of contribution	0.505	0.185	0.161	0.131	0.018
Cumulative contribution	0.505	0.690	0.851	0.982	1.000

As shown in Table 10, the first principal component captures approximately half of the total variance in the five proposed wealth indicators. Notably, it is the only component positively correlated with all five indicators, making it a suitable candidate for an aggregate affluence measure. In the next section, we therefore examine the consumption tax burden by household affluence bracket using this principal component-based indicator.

5. Consumption Tax Burden by Affluence Group: Assessing the Regressivity of the Tax Burden

Based on the steps outlined in the previous sections, we now have both the consumption tax burden rate for individual households and multiple affluence indicators that position each household within

¹⁶ We measure the income elasticity for about 60 expenditure categories in the FIES, order the categories in terms of their income elasticity, and regard the 12 categories with the lowest elasticity, representing about one-fifths of total expenditure, as essential expenditures. The 12 items are communication, milk and eggs, vegetables and seaweed, pharmaceuticals, household consumables, fats & oils and seasonings, electricity, water and sewage, cereals, gas, tobacco, other utilities. Since this indicator decreases in household affluence, while the other indicators increase in household affluence, we multiply it by -1.

the overall distribution of their ability to pay taxes. In this section, we integrate these measures to calculate the consumption tax burden rate across different household affluence tiers to examine whether the consumption tax is regressive or not.

Going back to Figure 4, the left panel shows the structure of the consumption tax burden when households are stratified by income, as is commonly done. The resulting pattern aligns with the widespread perception that the consumption tax is regressive. However, our primary interest lies in examining how this pattern changes when households are stratified using the alternative affluence indicators proposed in the previous section.

Our analysis is based on data from fiscal 2005 to 2013, during which the consumption tax rate remained constant at 5%.¹⁷ Given the data constraints mentioned earlier, the analysis is restricted to households with two or more members.

5.1 Examining the Structure of the Tax Burden Based on Individual Indicators (1) to (5)

In this subsection, we categorize households into ten tiers (groups 1 to 10) based on each of the five individual indicators (1) to (5) introduced in Section 4.2.2, ranking them from the lowest to the highest. Group 1 consists of the least affluent households, while group 10 represents the most affluent households. We then analyze how the consumption tax burden varies across these tiers to assess its distributional characteristics and determine whether it exhibits a regressive pattern. The results of this analysis are summarized in Figure 5. In the following subsections, we analyze how the distribution of the consumption tax burden varies across household tiers and examine the different patterns depending on which indicator is used.

5.1.1 Affluence indicator (1): Predicted equivalent income

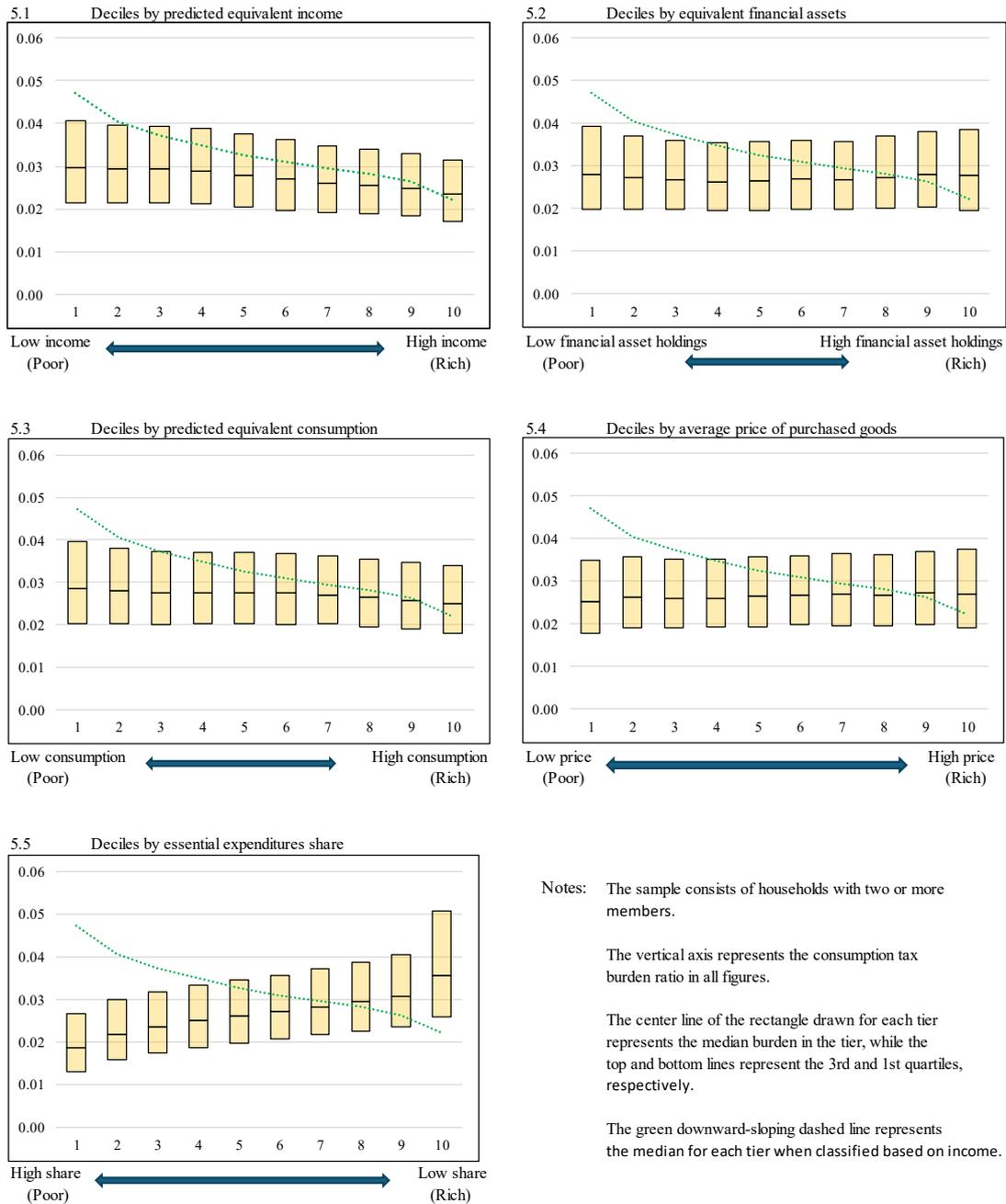
If consumption is driven by lifetime income (permanent income), households receiving temporary income tend to have a lower average propensity to consume, leading to a lower consumption tax burden rate. The regressive pattern seen in the left panel of Figure 4—where lower-income households appear to bear a higher tax burden—may result from households with significant temporary income being classified into higher equivalent income tiers.

To address this bias, we conducted a regression analysis with equivalent income as the dependent variable and household attributes as explanatory variables. Households were then grouped into tiers based on the predicted values from this model. Figure 5.1 illustrates the relationship between household affluence and the consumption tax burden rate. For comparison, the dashed green line represents the median burden rate when households are classified based on their annual income rather than their equivalent income. The results show that while a downward-sloping pattern—where the tax

¹⁷ Japan's consumption tax rate was raised to 8% on April 1, 2014.

burden rate declines as affluence increases—persists, it is considerably less severe once temporary income effects are controlled for. This suggests that much of the perceived regressivity of the consumption tax may not stem from the nature of the tax itself, but rather from the difficulty in selecting indicators that accurately reflect households' affluence.

Figure 5. Households' economic status and consumption tax burden rate



5.1.2 Affluence indicator (2): Equivalent financial assets

Figure 5.2 presents the consumption tax burden rate when households are classified based on equivalent financial assets. Under this classification, there is little indication of regressivity, as more affluent households—those with greater financial asset holdings—do not exhibit systematically lower tax burden rates. This finding supports the view that the consumption tax operates as a proportional tax, consistent with the permanent income hypothesis.

5.1.3 Affluence indicator (3): Predicted equivalent consumption

Figure 5.3 presents the relationship between household economic status/ability to pay taxes and the consumption tax burden when households are classified based on the predicted values of equivalent consumption from the regression model (wealth indicator (3)). This approach corrects for distortions caused by temporary consumption fluctuations, addressing the positive bias that may arise when using raw equivalent consumption. The results show that the consumption tax burden rate remains largely constant across tiers, supporting the view that the tax is proportional rather than regressive or progressive.

5.1.4 Affluence indicator (4): Average price rank

Figure 5.4 presents the results when households are classified based on the average price rank. As shown in the figure, the consumption tax appears to function as a proportional tax, with all households bearing a similar tax burden rate regardless of affluence. There is no evidence of regressivity, as households purchasing higher-priced goods do not exhibit a lower consumption tax burden rate than those purchasing lower-priced goods.

5.1.5 Affluence indicator (5): Share of essential expenditures

Figure 5.5 presents the relationship between household affluence and the consumption tax burden rate when households are classified based on the share of essential expenditures. To ensure consistency with the other indicators—where affluence increases toward the right side of the figure—the classification is based on the inverse of the essential goods expenditure share (i.e., households are ranked from smallest to largest based on 1 minus the share of expenditures on essential goods). The figure suggests a progressive pattern,¹⁸ indicating that households with a lower share of essential expenditures (i.e., better off households) tend to bear a higher consumption tax burden.

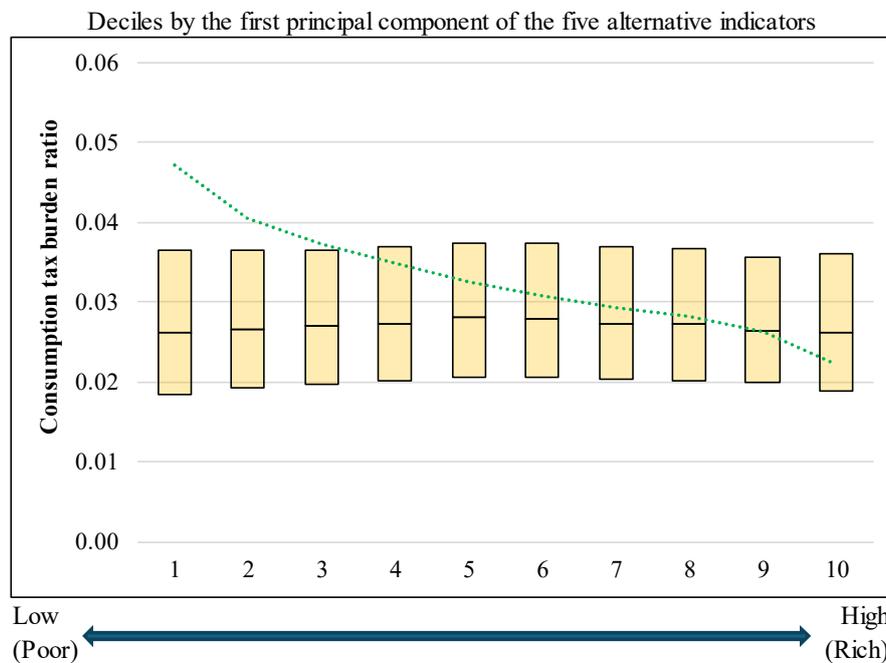
5.2 Analysis Based on the Aggregate Affluence Indicator

¹⁸ The apparent progressivity of the consumption tax observed here may be overstated due to temporary fluctuations in essential goods consumption, similar to when consumption itself was used as the affluence indicator, so that the results should be viewed with caution.

The results from the individual affluence indicators in the previous subsection suggest that classifying households in terms of their (equivalent) income tends to overstate the regressivity of the consumption tax burden. However, notable variations exist across different indicators. To address this, we introduce affluence indicator (6)—the first principal component obtained from a principal component analysis of indicators (1) to (5)—and examine the pattern of the consumption tax burden when households are classified using this aggregate measure.

Figure 6 presents the consumption tax burden rate by household tier when households are classified into ten groups (1 to 10¹⁹) based on the aggregate indicator. Group 1 represents the least affluent households, with affluence increasing as the group number rises, making group 10 the most affluent.

Figure 6. Consumption tax burden by household tier (aggregate affluence indicator)



The results based on this aggregate indicator suggest that the consumption tax burden rate remains largely constant across tiers. This finding empirically supports economists’ view that the consumption tax is proportional rather than regressive when measured relative to lifetime income. Since household consumption is primarily driven by lifetime income, a uniform consumption tax naturally conforms to a proportional tax structure.

¹⁹ Group 1 is the least affluent, and affluence increases as the number increases, with group 10 households being the most affluent.

5.3 Comparing the Consumption Tax Burden across Households at a Similar Lifecycle Stage

Our analysis in the previous sections focused on two-or-more-person households, examining the relationship between the estimated household-level consumption tax burden and various affluence indicators. Our findings suggest that the consumption tax burden rate remains largely constant across different affluence indicators, indicating a proportional tax structure. However, household life-cycle patterns introduce potential complexities in interpreting these indicators. Even when numerical values are identical, annual income, consumption, or financial asset holdings may not necessarily reflect the same level of affluence across different households.

For instance, under Japan's seniority-based wage system, middle-aged and older workers typically earn a higher income than younger workers. However, while their current income may differ, they may have a comparable lifetime income. Similarly, while retired households mainly living off their pensions may have lower incomes than working-age households, they may still have similar levels of lifetime wealth. In a similar vein, consumption patterns also differ by life stage: households with young children often exhibit higher spending levels than those in other stages of life, even though their lifetime wealth may be identical. And while it is uncommon for younger households to hold tens of millions of yen in financial assets, households nearing retirement may require such asset levels to ensure financial stability in old age; again, their lifetime wealth may be similar despite the difference in financial assets.

To address these considerations, we refine the household classification to increase comparability and reassesses the relationship between the consumption tax burden rate and household affluence to verify the robustness of our findings. Specifically, we focus on three household types: (i) middle-aged employee households with children, (ii) young married employee households without children, and (iii) retired couple-only households. The aim of this exercise is to focus on household groups at a similar stage of the lifecycle to mitigate lifecycle effects and provide a clearer assessment of the tax burden distribution.

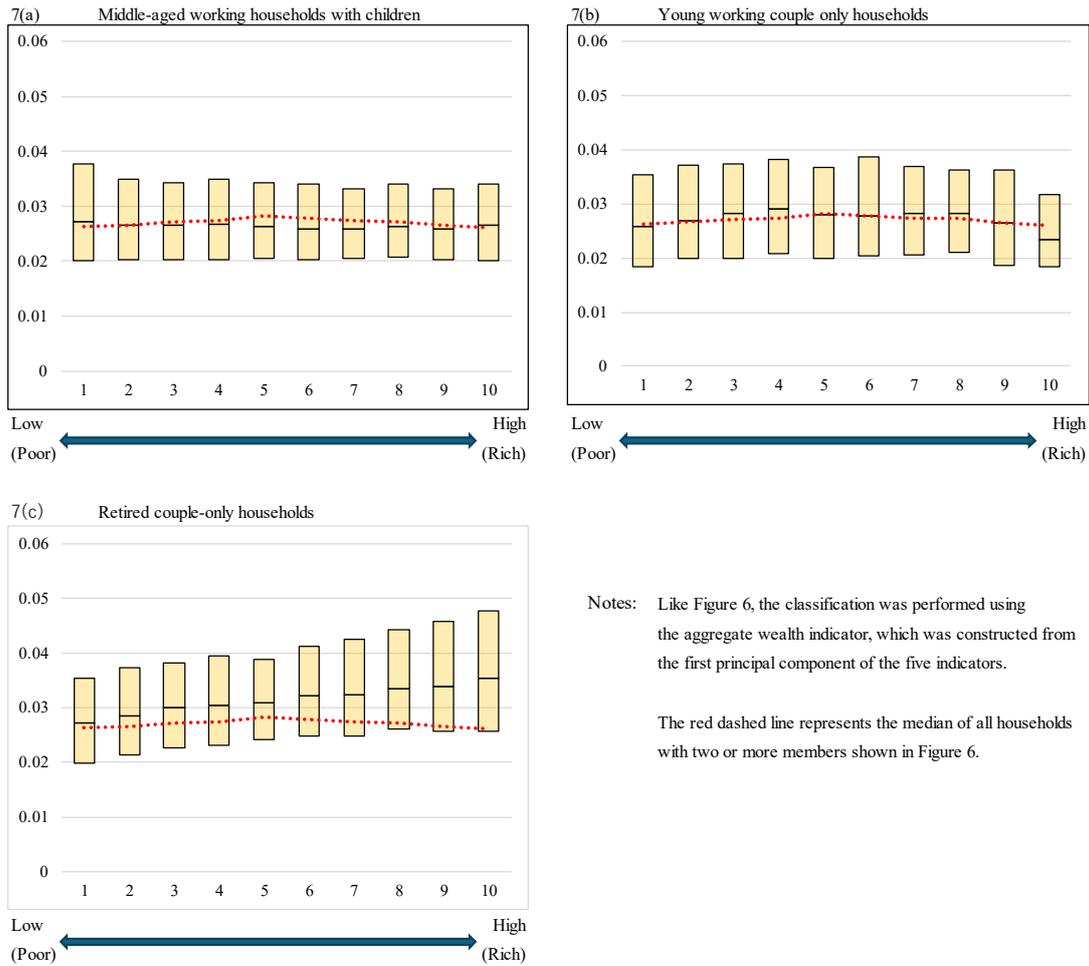
5.3.1 Middle-aged employee households with children

Our affluence indicator may vary even among households with similar levels of affluence due to factors such as the age of the household head, whether there are children in the household, and, if so, the age of the children. To mitigate potential biases arising from these differences, we first restrict our sample to middle-aged employee households with children, the typical nuclear family structure.

Specifically, we focus on households where the household head is a working individual aged 40 to 59 and the household consists exclusively of a married couple and their children, ranging from elementary to high school age. Using this restricted sample, we examine the relationship between the household consumption tax burden rate and affluence indicator (6) (the first principal component) to assess the robustness of our findings.

As shown in Figure 7(a), restricting the sample to middle-aged employee households with children does not significantly change the relationship between the consumption tax burden rate and household affluence. For comparison, the red dashed line represents the median tax burden rate for all two-or-more-person households, indicating that the overall pattern remains consistent.

Figure 7. Consumption tax burden across households at a similar lifecycle stage



5.3.2 Young married employee households without children

Next, we examine young employee couples without children. Specifically, we focus on households consisting solely of a married couple and where the head is a working individual under the age of 40. This selection restricts the sample to a younger demographic while eliminating potential effects associated with child-rearing.

In this case, too, the relationship between the consumption tax burden rate and household affluence remains largely unchanged, as shown in Figure 7(b). The results indicate that the tax burden

rate remains nearly constant across tiers, showing little to no correlation with the affluence indicator.

5.3.3 Retired couple-only households

Finally, Figure 7(c) presents the relationship between the aggregate affluence indicator and the consumption tax burden rate for retired couples without children, specifically those where the household head is 65 or older and not in employment. Interestingly, we find that among these households the consumption tax burden follows a progressive pattern. This pattern is particularly pronounced among more affluent households in the top three tiers (affluence tiers 8 and above).

The higher consumption tax burden rate observed among more affluent retired households can be better understood by looking at the results when households are classified based on equivalent financial assets (affluence indicator (2)) rather than the aggregate indicator (affluence indicator (6)). For retired households, the decline in annual income flows means that accumulated financial assets become the primary source of consumption expenditure. This means that households with larger financial asset holdings are likely to consume more, resulting in a higher absolute consumption tax burden. Consequently, when the consumption tax burden rate is measured relative to annual income, more affluent households—those with substantial financial assets—appear to bear a higher tax burden.

This finding is in line with the results obtained by Hori et al. (2016), who, using FIES microdata like this study, similarly found that elderly households tend to draw down their savings to sustain consumption, consistent with the permanent income hypothesis.

Using restricted samples to eliminate cross-life-stage comparisons, this section has provided a more precise examination of the relationship between the consumption tax burden rate and household wealth. The findings reaffirm the key conclusions from the previous sections: there is no clear indication of a pronounced regressive pattern where less affluent households bear a heavier tax burden while more affluent households bear a lighter one. Instead, the consumption tax largely functions as a proportional tax.

6. Conclusion

This study empirically examined whether the consumption tax is really regressive, as is widely argued and often regarded as its most significant drawback. Using microdata from the Family Income and Expenditure Survey (FIES)—the most comprehensive dataset on household consumption expenditures in Japan—for FY2005–2013, we estimated the household-level consumption tax burden. To address the limitations of the FIES, we incorporated additional insights from microdata in the Survey of Household Economy (SHE) and the System of National Accounts (SNA). Our estimation approach is based on annual consumption expenditure at the household and item level. Furthermore, we classify households into ten tiers based on their affluence using several indicators designed to capture their ability to pay taxes. This classification allows a systematic examination of the

relationship between affluence and the consumption tax burden rate across different household affluence levels.

Our results indicate that, in FY2010, the average annual household consumption tax burden in Japan was approximately JPY 175,000 per household, with a median burden of JPY 150,000. When restricting the sample to employee households, these figures rise to JPY 193,000 (average) and JPY 169,000 (median), accounting for just under half of the average direct tax burden on households in that year. The household consumption tax burden rate, defined as the annual consumption tax burden divided by the previous year's income (adjusted for imputed rent), was found to be slightly below 3%.

Across all household tiers of household affluence, our findings consistently suggest that the consumption tax burden remains largely constant, regardless of whether a household is classified as rich or poor. This result aligns with the widely held view by economists that the consumption tax is not regressive but rather proportional to lifetime income. Furthermore, when examining the tax burden by household type, we find that for retired households the tax burden is slightly progressive, with more affluent retirees facing a somewhat higher tax burden. Given the public's negative view on the consumption tax, raising awareness of these empirical findings through public outreach and education may be crucial in fostering a more informed debate on tax policy.

Finally, we highlight remaining challenges and propose future research directions. The dataset constructed in this study, which includes household-level annual consumption expenditure by item and an indicator of household affluence or the ability to pay taxes, is valuable not only for examining the regressivity or progressivity of the consumption tax, but also for analyzing income inequality and the broader interplay between taxation, social security, and redistribution policies in Japan. Building on the methodology developed in this study, we aim to extend our analysis to these broader issues. As a first step, we plan to investigate the impact of reduced tax rates and tax-exempt items within the consumption tax system on household-level inequality. Additionally, given that the consumption tax rate has already been increased to 10%, with further hikes potentially on the horizon, it is crucial to examine how these tax rate changes affect income distribution and household welfare.

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Appendix A. Adjustment for Underreporting of Durable and High-Value Goods

This appendix provides a detailed description of the procedure used to correct for underreporting of durable and high-value goods in the Family Income and Expenditure Survey (FIES), corresponding to the summary discussion in Section 3.3.1 of the main text.

Household expenditure surveys are known to understate spending on infrequently purchased and high-value items. An important methodological issue is whether such underreporting arises from systematic understatement of reported expenditures or from the omission of purchases altogether. This distinction is crucial for distributional analysis, because uniform scaling of reported expenditures may distort the cross-household distribution of consumption.

Comparisons between the FIES and the Survey of Household Economy (SHE), which employs precoded expenditure categories and imposes a lower reporting burden on respondents, indicate that omission is the dominant source of underreporting. Conditional on reporting a positive expenditure, average spending levels are similar across the two surveys, while the proportion of households reporting zero expenditure is substantially higher in the FIES.

Based on this evidence, we adopt a probabilistic imputation approach that explicitly models the likelihood that an observed zero expenditure reflects an omitted purchase rather than a true zero. The adjustment procedure proceeds as follows.

1. First, we create a dummy variable for each of the 29 durable, high-value goods (denoted by k) for which data are available in both the SHE and FIES datasets, where 1 indicates that household i purchased the item and, 0 otherwise.
2. Next, we use the dummy variable created in Step 1 as the dependent variable and household attributes Z_i as independent variables to estimate a probit regression model using data from both the FIES and SHE.²⁰
3. Based on the model estimated in Step 2, we calculate the predicted probability that a household with attributes Z_i reports expenditure on item k . This is done separately for both the FIES and SHE datasets.
4. We then define the probability of underreporting as the difference between the reporting probabilities for household i obtained in Step 3: $Prob_{SHE,k}(Z_i) - Prob_{FIES,k}(Z_i)$. This represents the likelihood that a household reports expenditure in the SHE but fails to do so in the FIES.
5. For households in the SHE that do not report expenditure on item k , we generate a binomial random variable using the underreporting probability calculated in Step 4 as the parameter. If the outcome is 1, we classify the household as having underreported its expenditure.
6. Using the FIES data, and focusing only on households that reported expenditure on item k , we estimate the following regression model: $C_{k,i} = F_k(Z_i) + e_{k,i}$, where $F_k(Z_i)$ is the predicted

²⁰ The household attributes Z , which serve as explanatory variables in the model, and estimation results are detailed in Appendix F at the end of this paper. Note that the information on household attributes for Z is consistent across both the FIES and SHE datasets.

expenditure on item k based on household attributes Z_i and $e_{k,i}$ is the error term.

7. For households identified as underreporting in Step 5, we calculate their expenditure on item k as the predicted value $\hat{C}_{k,i} = F_k(Z_i)$ from the regression model in Step 6, adjusted by adding:

- the estimated error term $e_{k,i}$, and
- a random variable drawn from a normal distribution with a mean of zero and variance equal to the variance of the residuals $\hat{e}_{k,i}$.

8. Finally, we repeat Steps 1 through 7 to generate a corrected dataset that adjusts the reported expenditure on durable, high-value goods.²¹

Table A1. Comparison of high-value goods expenditures per household: FIES vs. SHE

	a. Average monthly per household expenditure of all households			b. Average monthly per household expenditure of households reporting expenditure on item			c. Proportion of households reporting expenditure on item			
	FIES	SHE	Ratio	FIES	SHE	Ratio	FIES	SHE	Ratio	
	Mean	Mean	SHE/FIES	Mean	Mean	SHE/FIES			SHE/FIES	
1 Wardrobe	76	171	2.3	33,948	46,884	1.4	0.2%	0.4%	1.6	Expenditures on durable goods with adjustments
2 Bed	112	251	2.2	53,740	57,660	1.1	0.2%	0.4%	2.1	
3 Futon	263	516	2.0	18,460	27,430	1.5	1.4%	1.9%	1.3	
4 Desk and chair	72	195	2.7	36,269	30,972	0.9	0.2%	0.6%	3.2	
5 Dish cabinet	60	164	2.7	58,761	50,731	0.9	0.1%	0.3%	3.2	
6 Sofa set	127	262	2.1	67,884	88,316	1.3	0.2%	0.3%	1.6	
7 Business suit	474	889	1.9	43,796	43,982	1.0	1.1%	2.0%	1.9	
8 Car	5,214	15,832	3.0	1,421,912	1,541,648	1.1	0.4%	1.0%	2.8	
9 Motorized transportation equipment (excluding cars)	112	383	3.4	191,489	160,951	0.8	0.1%	0.2%	4.1	
10 Refrigerator	460	761	1.7	102,293	103,544	1.0	0.4%	0.7%	1.6	
11 Washing machine	315	499	1.6	64,507	65,576	1.0	0.5%	0.8%	1.6	
12 Air conditioner	639	1,071	1.7	126,781	125,399	1.0	0.5%	0.9%	1.7	
13 Sewing machine	42	88	2.1	43,254	51,604	1.2	0.1%	0.2%	1.8	
14 Stereo set	41	73	1.8	39,902	39,810	1.0	0.1%	0.2%	1.8	
15 Personal computer	792	1,389	1.8	32,946	53,313	1.6	2.4%	2.6%	1.1	
16 Telephone	163	373	2.3	19,987	24,854	1.2	0.8%	1.5%	1.8	
17 Television	1,034	2,006	1.9	112,183	109,501	1.0	0.9%	1.8%	2.0	
18 Video deck (from 2006)	217	374	1.7	43,832	44,517	1.0	0.5%	0.8%	1.7	
19 Video games (including software, from 2010)	213	177	0.8	8,125	10,821	1.3	2.6%	1.6%	0.6	
20 Camera	177	368	2.1	32,156	38,444	1.2	0.5%	1.0%	1.7	
21 Video camera	67	139	2.1	66,710	61,283	0.9	0.1%	0.2%	2.3	
22 Mobile phone charges	7,264	9,133	1.3	11,299	11,975	1.1	64.3%	76.3%	1.2	
23 Connection fees and subscription fees	2,567	3,091	1.2	5,625	5,896	1.0	45.6%	52.4%	1.1	
24 Vehicle maintenance costs	1,384	4,459	3.2	23,515	54,825	2.3	5.9%	8.1%	1.4	
25 Housing-related equipment and construction costs	4,402	12,878	2.9	94,096	173,789	1.8	4.7%	7.4%	1.6	
26 Supplemental education costs	2,490	3,093	1.2	31,431	33,499	1.1	7.9%	9.2%	1.2	
27 Driving school fees	266	632	2.4	85,424	122,600	1.4	0.3%	0.5%	1.7	
28 Airfare (domestic and international)	587	965	1.6	57,468	66,798	1.2	1.0%	1.4%	1.4	
29 Package travel expenses (abroad)	1,427	2,523	1.8	260,367	273,449	1.1	0.5%	0.9%	1.7	
30 Landline telephone charges	2,992	3,028	1.0	3,816	3,626	1.0	78.4%	83.5%	1.1	
31 Musical instruments	135	180	1.3	18,514	53,350	2.9	0.7%	0.3%	0.5	
32 Women's clothing	651	1,241	1.9	15,042	30,784	2.0	4.3%	4.0%	0.9	
33 Traditional Japanese clothing (kimono)	351	781	2.2	31,246	112,148	3.6	1.1%	0.7%	0.6	
34 Car insurance premiums	3,211	4,473	1.4	18,110	26,817	1.5	17.7%	16.7%	0.9	
35 Rent and land lease fees	10,876	9,122	0.8	49,369	53,003	1.1	22.0%	17.2%	0.8	
36 Medical services	6,041	10,251	1.7	9,683	15,137	1.6	62.4%	67.7%	1.1	
37 Tuition fees and related expenses	8,044	11,138	1.4	37,371	80,713	2.2	21.5%	13.8%	0.6	
38 Accommodation fees	1,679	2,135	1.3	29,241	34,937	1.2	5.7%	6.1%	1.1	
39 Package travel expenses (domestic)	2,849	3,621	1.3	27,670	58,449	2.1	10.3%	6.2%	0.6	
40 Ceremonial and funeral expenses	2,266	5,962	2.6	30,093	508,792	16.9	7.5%	1.2%	0.2	
41 Religious expenses	1,797	2,634	1.5	8,025	29,665	3.7	22.4%	8.9%	0.4	

²¹ The households that omitted reporting durable and high-value goods expenditure as well as the expenditure amounts are, of course, generated using random numbers and do not reflect actual data. In Section 5, which contains our main analysis, we repeat the analysis 1,000 times using different sets of randomly generated numbers. The results reported in Section 5 are the means derived from these iterations. The numerical information on the mean and standard deviation obtained from the repeated calculations is summarized in Appendix K.

Table A2. Changes in consumption resulting from adjustments for durable and high-value items

	Before adjustment	After adjustment	Rate of increase due to adjustment (After adjustment/Before adjustment)
Average monthly household consumption expenditure (in yen)	261,005	278,009	1.07
Of which: Expenditures on durable and high-value items	31,279	48,283	1.54
Expenditures on other items	229,726	229,726	1.00

As shown in Table A2, average expenditures on durable and high-value goods increase substantially after adjustment, by about 1.5 times relative to the unadjusted figures. As a result, overall average household consumption expenditure also rises. However, because durable and high-value goods account for only a small share of total household consumption—approximately 12 percent in the FIES microdata—the impact on total consumption remains limited. Consequently, the gap between aggregate consumption derived from the FIES and the corresponding SNA figures remains substantial. Overall, this adjustment improves the reliability of household-level consumption estimates without introducing excessive distortion into their distribution.

Appendix B. Seasonal Adjustment and Annualization of Consumption Expenditures

This appendix details the seasonal adjustment method used to convert six-month expenditure observations from the FIES into comparable annual consumption measures, corresponding to the discussion in Section 3.3.2 of the main text.

In the FIES, each household is surveyed for only six consecutive months, and the starting month varies across households. Simple annualization methods—such as multiplying monthly expenditures by 12 or doubling six-month totals—are therefore sensitive to seasonality and may generate artificial variation across households that is unrelated to underlying consumption behavior.

To address this issue, we construct regression-based conversion coefficients that adjust observed expenditures to annual values while accounting for both seasonality and household attributes. Consumption expenditures are first grouped into major product categories that exhibit similar seasonal patterns.

Table B1. Classification of expenditure items for seasonal adjustment

1	1. Food and non-alcoholic beverages	Non-durable goods
2	2. Alcoholic beverages and tobacco	Non-durable goods
3	3. Clothing and footwear	Semi-durable goods
4		Services
5	4. Housing, electricity, gas and	Non-durable goods
6	water supply	Services
7	5. Furnishings, household equipment	Durable goods
8	and household services	Semi-durable goods
9		Non-durable goods
10		Services
11	6. Health	Durable goods
12		Non-durable goods
13		Services
14	7. Transport	Durable goods
15		Semi-durable goods
16		Non-durable goods
17		Services
18	8. Communication	Services
19	9. Recreation and culture	Durable goods
20		Semi-durable goods
21		Non-durable goods
22		Services
23	10. Education	Services
24	11. Restaurants and hotels	Services
25	12. Miscellaneous goods and services	Durable goods
26		Semi-durable goods
27		Non-durable goods
28		Services

For each product group, we estimate a regression model in which the dependent variable is the household's total observed expenditure over the survey period. Explanatory variables include household characteristics (such as household size, age composition, and employment status), survey year dummies, and dummy variables indicating the month in which the survey began.

Using the estimated coefficients, we compute predicted expenditures that are independent of the survey start month by averaging predicted values across months, holding household attributes constant. The conversion coefficient for each household and product group is then defined as the ratio of this month-invariant predicted value to the predicted value conditional on the household's actual survey start month. Observed expenditures are multiplied by this coefficient to obtain seasonally adjusted annual values.

The effectiveness of this procedure is illustrated in Figure 2 in the main text, which compares alternative annualization methods and shows that the regression-based adjustment substantially reduces both seasonal fluctuations in mean expenditures and the associated dispersion.

Appendix C. Adjustment of Sample Representativeness and Alignment with the SNA

This appendix describes the procedures used to improve the representativeness of the FIES sample and to align micro-level consumption aggregates with the System of National Accounts (SNA), corresponding to Sections 3.3.3 and 3.4 of the main text.

Although the FIES is designed to be nationally representative, its sample composition differs from the actual household distribution in Japan along several dimensions, including household size, employment status, and housing tenure. To correct for these discrepancies, households are classified into cells defined by key attributes, and the effective extraction rates are adjusted so that the distribution of households across cells matches that observed in the Population Census.

Table C1. Household classification for extraction rate adjustment by household attribute

Family type		Age of household head		Place of residence		Residence ownership type	
Single person household	1	Under 45 years old	1	North	1	Owner-occupied house	1
Married couple only household	2	Between 45 and 64 years old	2	Central	2	Rental	2
Married couple with one child	3	65 years old or older	3	South	3		
Married couple with two or more children	4						
Other households	5						

North: Hokkaido, Aomori, Iwate, Miyagi, Akita, Yamagata, Fukushima, Niigata, Toyama, Ishikawa, Fukui, Yamanashi, and Nagano prefectures.
Central: Ibaraki, Tochigi, Gunma, Saitama, Chiba, Tokyo, Kanagawa, Gifu, Shizuoka, Aichi, Mie, Shiga, Kyoto, Osaka, Hyogo, Nara, and Wakayama prefectures.
South: Tottori, Shimane, Okayama, Hiroshima, Yamaguchi, Tokushima, Kagawa, Ehime, Kochi, Fukuoka, Saga, Nagasaki, Kumamoto, Oita, Miyazaki, Kagoshima, and Okinawa prefectures.

After applying this adjustment, the distribution of household types in the microdata more closely resembles the national distribution.

Table C2. Effect of the extraction rate adjustment on data distribution and basic statistics

	Before resampling			After resampling		
	Number of sampled households	Mean	Std. dev.	Number of sampled households	Mean	Std. dev.
Age of household head (years)	176,198	56.8	15.4	4,053,655	55.3	16.0
Household size (persons)	176,198	2.8	1.3	4,053,655	2.6	1.4
Previous year's annual income (million yen)	176,198	5.73	3.64	4,053,655	5.50	3.67
Seasonally adjusted consumer expenditure (million yen)	176,198	3.28	2.01	4,053,655	3.10	2.03
Share of single-person households	176,198	0.112	0.32	4,053,655	0.267	0.44
Share of households with no working members	176,198	0.247	0.43	4,053,655	0.219	0.41
Share of homeowner households	176,198	0.757	0.43	4,053,655	0.656	0.47

Even after applying the adjustments described in Appendices A and B, as well as the correction for sample representativeness, aggregate consumption derived from the FIES remains below the corresponding figures in the SNA. When household-level consumption tax burdens are calculated using these adjusted but unaligned data, the implied aggregate tax revenue falls short of official tax statistics.

Table C3. Estimated consumption tax payments by households

	All households			Working households		
	Number of sampled households	Mean	Std. dev.	Number of sampled households	Mean	Std. dev.
Consumption tax payment (thousand yen)	4,053,655	124.4	87.46	2,190,405	134.6	89.18
Consumption tax burden rate (%)	4,053,655	2.67	2.01	2,190,405	2.39	1.58
Direct tax burden rate (%)				2,190,405	5.91	5.56
Social insurance premium burden rate (%)				2,190,405	8.92	6.50

Note. The direct tax burden rate and the social insurance premium burden rate are simply the monthly averages obtained from the individual household survey data multiplied by 12.

To reconcile this discrepancy, we further adjust household consumption totals so that aggregate expenditures by major product categories match SNA benchmarks. Category-specific scaling factors are applied uniformly within each category.

Table C4. Comparison of itemized totals of the FIES and corresponding SNA consumption

		(1) SNA spending ratio	(2) FIES/SNA										
			Average for the whole period										
			2005	2006	2007	2008	2009	2010	2011	2012	2013		
1	1. Food and non-alcoholic beverages	Non-durable goods	17.2%	77.1%	79.0%	80.2%	79.3%	78.6%	78.4%	76.0%	75.7%	73.6%	73.4%
2	2. Alcoholic beverages and tobacco	Non-durable goods	3.4%	36.5%	33.7%	34.4%	36.4%	38.2%	38.3%	38.5%	37.0%	36.5%	35.3%
3	3. Clothing and footwear	Semi-durable goods	3.8%	88.7%	99.9%	97.0%	97.3%	92.5%	89.4%	87.8%	84.8%	79.3%	71.2%
5	4. Housing, electricity, gas and water supply	Non-durable goods	4.9%	107.9%	105.9%	107.0%	103.6%	110.3%	111.8%	111.1%	110.3%	105.8%	105.8%
6		Services*	5.9%	92.5%	92.6%	92.4%	92.0%	92.5%	90.3%	90.0%	93.5%	93.5%	95.5%
7	5. Furnishings, household equipment	Durable goods	2.3%	71.2%	65.1%	65.4%	68.1%	68.6%	68.7%	68.9%	82.1%	80.0%	73.8%
9		Non-durable goods	1.3%	40.4%	34.8%	37.3%	37.8%	39.7%	42.7%	42.4%	43.7%	42.7%	42.5%
13		Services	3.5%	53.1%	56.7%	59.6%	59.1%	54.1%	54.5%	49.1%	48.8%	49.3%	46.8%
14	7. Transport	Durable goods	3.5%	98.0%	106.3%	104.5%	111.2%	97.9%	98.6%	103.9%	79.4%	87.6%	93.0%
16		Non-durable goods	3.0%	47.0%	42.9%	43.9%	43.8%	47.6%	46.4%	47.3%	50.1%	50.6%	50.5%
17		Services	6.3%	44.5%	46.0%	43.7%	43.9%	43.8%	46.3%	45.8%	43.9%	44.1%	42.7%
18	8. Communication	Services	3.6%	79.7%	85.5%	85.5%	83.1%	81.1%	80.5%	77.5%	76.4%	75.8%	72.2%
19	9. Recreation and culture	Durable goods	3.3%	38.3%	33.4%	34.8%	36.6%	41.7%	49.6%	53.5%	38.8%	27.4%	28.9%
22		Services	6.5%	68.5%	62.9%	62.8%	67.3%	67.9%	70.1%	73.9%	71.2%	71.1%	69.2%
23	10. Education	Services	2.5%	110.4%	104.8%	108.8%	113.1%	113.9%	114.1%	111.3%	106.3%	112.0%	109.2%
24	11. Restaurants and hotels	Services	9.7%	43.3%	43.6%	42.5%	42.6%	43.5%	43.0%	43.2%	43.8%	43.9%	43.9%
27	12. Miscellaneous goods and services	Non-durable goods	1.7%	55.3%	52.7%	54.5%	56.1%	55.1%	56.5%	53.8%	55.8%	59.1%	54.4%
28		Services	12.1%	42.7%	42.1%	40.3%	40.8%	43.7%	44.9%	44.3%	43.0%	43.5%	41.6%

* Excluding imputed rent.

After this final alignment, aggregate consumption and implied consumption tax revenues are broadly consistent with official statistics.

Appendix D. Adjustment of annual income and consumption by imputed rent

When assessing household affluence using income or consumption expenditure data, a key issue is ensuring comparability between owner-occupied and renter-occupied households, particularly regarding the treatment of imputed rent. In renter households, rent and land rent constitute a significant share of total consumption expenditures, accounting for nearly 20% of the expenditure of households in privately rented accommodation, according to FIES data. This expenditure represents the cost of consuming housing and land services.

However, while owner-occupied households also consume these services, their equivalent rent and land rent costs do not appear in recorded consumption expenditures. To enable consistent comparisons between owner-occupied and renter-occupied households in terms of income and consumption, imputed rent should be estimated and added to both income and service consumption expenditures for owner-occupied households.

To make such adjustment, we first estimate a rent function using rent and land rent data from renter households in the FIES. The estimated parameters from this function are then used to calculate imputed rent for owner-occupied households. To estimate the rent function, we identify key factors influencing rent levels, specifically:

1. Size – Total floor area of the dwelling.
2. Construction type – Structural characteristics of the dwelling.
3. Region – Prefecture-level location and differences between urban and rural areas.

Using FIES data, we construct corresponding variables and estimate a rent function, incorporating household attributes such as annual household income, the age of the household head, and year dummies as independent variables. The dependent variable is log rent per unit area for privately rented dwellings.²²

Table D1 presents the basic statistics of the imputed rent data estimated for owner-occupied households using these parameters. The imputed rent-adjusted annual income and consumption expenditures used in our analysis are obtained by adding the estimated imputed rent to the previous year's income and consumption expenditures for owner-occupied households in the dataset.

Table D1. Estimated annual imputed rent for owner-occupied households (FY2005–2013, JPY)

Amount in JPY						
Estimated imputed rent			Estimated imputed rent (SNA adjusted)			
Number of owner-occupied households	Mean	Standard deviation	Number of owner-occupied households	Mean	Standard deviation	
2,660,498	926,229	345,411	2,660,498	1,561,856	582,328	

²² The estimation result is shown in Appendix J.

Appendix E. Average Price Rank of Purchased Goods

We assume that affluent households are more likely to purchase luxury goods (i.e., higher-priced goods and services), whereas less affluent households tend to buy lower-priced items. To construct a price measure of affluence, we first identified the price range that items purchased by each household fell into for items for which price data are available. Specifically, for each product category, we classify households into deciles based on the price range of the item they purchased. That is, each household is assigned a rank from 1 (lowest price decile) to 10 (highest price decile) for each item. We then calculate the weighted average of these decile ranks across items, using the expenditure share of each item in the household's total consumption as weights. Finally, we again divide households into deciles based on this weighted average rank, which we refer to as the average price rank, and use this as our affluence indicator (4).

The 202 items used to calculate the average price are categorized as follows:

1. Food & Beverages

- ✓ Grains & Noodles: Rice, bread, other bread, fresh udon & soba noodles, dried udon & soba noodles, instant noodles, Chinese noodles, spaghetti, cup noodles, other noodles, wheat flour, glutinous rice, other cereals.
- ✓ Seafood: Tuna, horse mackerel, sardines, bonito, flounder, karei, salmon, mackerel, sanma, sea bream, yellowtail, squid, octopus, shrimp, crab, assorted sashimi, other fresh fish, clams, oysters, shijimi clam, other shellfish, scallops, salted salmon, cod roe, dried shirasu, dried horse mackerel, dried sea urchin, dried sardines, other dried salted fish, bonito flakes.
- ✓ Meat & Dairy: Beef, pork, chicken, other fresh meat, ham, sausages, bacon, combined ground meat, milk, powdered milk, butter, cheese, eggs.
- ✓ Vegetables & Fruits: Cabbage, spinach, Chinese cabbage, leeks, lettuce, bean sprouts, broccoli, other leafy greens, sweet potatoes, potatoes, taros, radishes, carrots, gobo, onions, lotus root, other root vegetables, bamboo shoots, pod beans, pumpkin, cucumbers, eggplants, tomatoes, green peppers, fresh shiitake mushrooms, other mushrooms, other vegetables, shimeji mushrooms, enokitake mushrooms, dried shiitake mushrooms, wakame seaweed, kelp, apples, mandarin oranges, other citrus fruits, pears, grapes, persimmons, peaches, watermelons, melon, strawberry, banana, other fruits, grapefruit, orange, kiwi.
- ✓ Pickles & Seasonings: Tofu, dried plums, pickled radish, pickled Chinese cabbage, pickled kelp, cooking oil, margarine, salt, soy sauce, miso, sugar, vinegar, sauces, ketchup, mayonnaise & dressings, mayonnaise & mayonnaise-like seasonings, dressings, curry roux, jam.

- ✓ Beverages & Alcohol: Green tea, black tea, coffee, other tea leaves, sake, shochu, beer, whiskey, happoshu & beer-like alcoholic beverages, wine.

2. Housing & Utilities

Private rent, tatami mat replacement, electricity, late-night electricity, propane gas, kerosene.

3. Home Appliances & Furniture

Electric appliances for cooking, electric refrigerators, electric vacuum cleaners, electric washing machines, sewing machines, microwave ovens, air conditioners, stoves & warm air heaters, chests of drawers, cupboards, beds, bedding, mattresses, tea bowls & plates & bowls, pots & kettles.

4. Clothing & Accessories

- ✓ Men's & Women's Clothing: Women's kimonos, women's obis, suits, men's jackets, men's pants, men's coats, school uniforms for boys, women's clothing, skirts, women's slacks, women's coats, women's jackets, school uniforms for girls, children's clothing, infant clothing, shirts, other shirts, men's shirts, men's sweaters, blouses, other women's shirts, women's sweaters, children's shirts, children's sweaters.
- ✓ Accessories & Footwear: Hats, ties, gloves, men's socks, women's stockings, women's socks, children's socks, men's shoes, women's shoes, sports shoes, children's shoes, sandals.

5. Transportation & Entertainment

Gasoline, televisions, stereo sets, portable music and video equipment, video cameras, video recorders & players, notebooks, video game consoles.

6. Personal Care & Miscellaneous

Hairdressing fee, perms, cutting fee, umbrellas, handbags, school bags, travel bags.

Appendix F. Regression results for durable and high-value goods correction

	2004.4-2013.12		2004.4-2013.12		2004.4-2013.12		2004.4-2013.12		2004.4-2013.12		2004.4-2013.12		2004.4-2013.12	
	Mobile phone charges		Connection fees and subscription fees		Wardrobe		Wardrobe		Bed		Bed		Bed	
	(i) Probit estimation: SHE	(ii) WLS estimation: FIES	(i) Probit estimation: SHE	(ii) WLS estimation: FIES	(i) Probit estimation: SHE	(ii) WLS estimation: FIES	(i) Probit estimation: SHE	(ii) WLS estimation: FIES	(i) Probit estimation: SHE	(ii) WLS estimation: FIES	(i) Probit estimation: SHE	(ii) WLS estimation: FIES	(i) Probit estimation: SHE	(ii) WLS estimation: FIES
Urban area dummy	-0.030 ***	-0.117 ***	0.147 ***	0.035 ***	-0.029 *	0.049 ***	-0.006	0.119 **	0.002	-0.043 **	0.081 ***	-0.043 **	-0.022	0.141 *
Owner-occupied dummy	-0.025 ***	0.044 ***	0.223 ***	0.330 ***	0.049 ***	0.095 ***	0.043 *	0.169 **	0.081 ***	0.068 **	0.135 ***	0.068 **	0.141 *	
Household annual income dummies (base: 2-4.99 million)														
-2 million yen	0.198 ***	-0.347 ***	-0.494 ***	-0.473 ***	-0.097 ***	-0.082 ***	-0.007	-0.123 ***	-0.123 ***	-0.126 *	0.045 ***	-0.126 *	0.078 **	
5-9.99 million yen	0.221 ***	0.136 ***	0.704 ***	0.553 ***	0.188 ***	0.201 ***	0.201 ***	0.185 **	0.135 ***	0.220 ***	0.135 ***	0.220 ***	0.220 ***	
Household annual income (log-JPY)	0.008 ***	0.045 ***	0.004 ***	0.020 ***	-0.017 ***	0.084 ***	-0.001	0.296 ***	-0.008 *	-0.006	0.000	-0.006	0.195 ***	
Age of household head	0.000 ***	-0.001 ***	0.000 ***	0.000 ***	0.000 ***	-0.002 **	0.000	-0.031 ***	-0.008 *	0.000	0.000	0.000	-0.075 ***	
Age of head of household (squared)								0.000 **	0.000 **	0.000	0.000	0.000	0.001 ***	
Number of household members dummies (base: two-person)														
Single-person household	-0.161 ***	-0.124 ***	-0.110 ***	-0.112 ***	-0.119 ***	-0.248 ***	-0.248 ***	-0.119 ***	-0.008	-0.152 ***	-0.008	-0.152 ***	-0.152 ***	
Three-person household	0.165 ***	0.022 ***	0.069 ***	0.041 ***	0.069 ***	0.060 ***	0.060 ***	0.069 ***	0.065 **	0.028	0.065 **	0.028	0.065 **	
Four or more person household	0.262 ***	0.033 ***	0.068 ***	0.055 **	0.093 ***	0.058 **	0.058 **	0.093 ***	0.169 ***	-0.026	0.169 ***	-0.026	0.169 ***	
Number of household members (persons)														
Individual sales	-0.158 ***	-0.211 ***	-0.118 ***	-0.168 ***	-0.023	0.026 **	-0.075 **	-0.088 ***	-0.033 *	-0.076 ***	0.008	-0.076 ***	0.093	
Unemployed & part-time dummies (base: employees)	-0.107 ***	-0.127 ***	0.111 ***	0.079 **	0.014	0.030 ***	-0.016	-0.010	0.008	-0.066 *	0.008	-0.066 *	0.095	
Elementary, junior and senior high school student dummy	-0.048 ***	0.050 ***	-0.030 ***	-0.021 ***	-0.084 ***	-0.067 ***	-0.049 **	-0.237 ***	0.035 **	0.215 ***	0.035 **	0.215 ***	-0.102	
Infant dummy													0.021	
Consumption expenditure excl. relevant goods (log-JPY)	0.560 ***	0.439 ***	0.722 ***	0.487 ***	0.197 ***	0.178 ***	-0.141 ***	0.047	0.027	-0.054	0.027	-0.054	-0.046	
FY2005	0.079 **	0.077 **	0.128 ***	0.057 **	0.030 ***	0.030 ***	0.030	0.030 ***	0.046 *	0.023	0.046 *	0.023	0.023	
FY2006	0.162 **	0.145 **	0.233 ***	0.103 **	0.087 ***	0.087 ***	0.084 **	-0.098	0.008	-0.033	0.008	-0.033	0.200 *	
FY2007	0.258 **	0.240 **	0.281 ***	0.214 **	0.135 ***	0.135 ***	0.135 ***	-0.244 **	-0.004	-0.025	-0.004	-0.025	0.190 **	
FY2008	0.318 **	0.300 **	0.405 ***	0.259 **	0.166 ***	0.166 ***	0.166 ***	-0.056	0.002	-0.048	0.002	-0.048	0.365 ***	
FY2009	0.384 **	0.361 **	0.506 ***	0.290 **	0.205 **	0.205 **	0.205 **	-0.230 **	0.002	0.020	0.002	0.020	0.071	
FY2010	0.431 **	0.381 **	0.557 ***	0.380 **	0.238 **	0.238 **	0.238 **	-0.152	0.002	0.185 *	0.002	0.185 *	0.120	
FY2011	0.479 **	0.413 **	0.627 ***	0.425 **	0.225 **	0.225 **	0.225 **	0.185 *	0.002	0.185 *	0.002	0.185 *	-0.016	
FY2012	0.487 **	0.433 **	0.637 ***	0.464 **	0.178 ***	0.178 ***	0.178 ***	0.150	0.002	0.054	0.002	0.054	0.200 *	
FY2013	0.560 ***	0.439 ***	0.722 ***	0.487 ***	0.197 ***	0.197 ***	0.197 ***	0.047	0.023	-0.046	0.023	-0.046	0.311 ***	
Month dummies (base: March)														
April	-0.021 **	-0.039 ***	-0.038 ***	-0.049 ***	-0.026 ***	-0.026 ***	-0.041	0.134	-0.087 ***	-0.130 ***	-0.087 ***	-0.130 ***	0.075	
May	-0.008	-0.002	-0.047 ***	-0.030 ***	-0.021 **	-0.021 **	-0.102	0.099	-0.145 ***	-0.250 ***	-0.145 ***	-0.250 ***	0.269 **	
June	-0.027 ***	-0.029 ***	-0.038 ***	-0.031 ***	-0.026 ***	-0.026 ***	-0.138 ***	0.284 **	-0.140 ***	-0.283 ***	-0.140 ***	-0.283 ***	0.288 **	
July	-0.035 **	-0.025 **	-0.044 ***	-0.044 ***	-0.021 **	-0.021 **	-0.089 ***	0.166	-0.158 ***	-0.229 ***	-0.158 ***	-0.229 ***	0.213 *	
August	-0.021 **	-0.006	-0.023 **	-0.043 ***	-0.026 **	-0.026 **	-0.200 ***	0.253 **	-0.203 ***	-0.253 ***	-0.203 ***	-0.253 ***	0.248 *	
September	-0.009	-0.011	-0.025 **	-0.034 ***	-0.022 **	-0.022 **	-0.071	0.303 **	-0.177 ***	-0.260 ***	-0.177 ***	-0.260 ***	0.254 **	
October	0.008	0.011	-0.004	-0.015	-0.025 ***	-0.025 ***	-0.070	0.307 **	-0.089 ***	-0.257 ***	-0.089 ***	-0.257 ***	0.342 ***	
November	-0.001	0.012	-0.010	-0.018	-0.029 ***	-0.029 ***	-0.127 **	0.077	-0.206 ***	-0.265 ***	-0.206 ***	-0.265 ***	0.471 ***	
December	-0.053 ***	-0.109 ***	-0.020 ***	-0.045 ***	-0.030 ***	-0.030 ***	-0.031	-0.028	-0.089 ***	-0.232 ***	-0.089 ***	-0.232 ***	0.223 *	
January	0.043 ***	0.066 ***	-0.007	0.006	0.004	0.004	0.006	0.213 **	-0.156 ***	0.178	-0.156 ***	0.178	0.178	
February	0.038 ***	0.047 **	-0.003	-0.007	-0.011	-0.011	-0.003	0.359 ***	-0.157 ***	-0.197 ***	-0.157 ***	-0.197 ***	0.334 ***	
Constant	1.185 ***	-0.446 ***	-0.073 **	-0.776 **	6.493 ***	6.493 ***	-2.658 ***	1.788 *	-2.407 ***	-2.651 ***	-2.407 ***	-2.651 ***	5.230 ***	
Pseudo R ²	0.164	0.098	0.132	0.098	0.021	0.028	0.024	0.138	0.014	0.030	0.014	0.030	0.114	
R ²	1.313.030	981.174	1.313.030	981.174	456.916	456.916	981.174	2.296	1.313.030	981.174	1.313.030	981.174	2.113	
Sample size														

Notes: *, **, and *** indicate significance at the 10%, 5%, and 1% levels, respectively.

Appendix F. (continued)

	2004.4-2013.12		2004.4-2014.3		2004.4-2013.12		2004.4-2013.12		2004.4-2013.12		2004.4-2014.3	
	(i) Probit estimation: SHE	(ii) WLS estimation: FIES										
Urban area dummy	-0.013	-0.051 ***	0.039 **	0.043	0.016	0.018	0.008	0.205 **	-0.021	0.185 **	-0.021	0.185 **
Owner-occupied dummy	0.002	-0.003	0.038 **	0.045	0.025	0.008	0.094 **	0.447 ***	0.034	0.342 ***	0.034	0.342 ***
Household annual income	-0.152 ***	-0.072 **	-0.193 ***	-0.188 **	-0.077 **	-0.307 ***	-0.247 ***	-0.243 ***	-0.243 ***	-0.143 ***	-0.243 ***	-0.143 ***
- 2 million yen	0.049 ***	0.077 ***	0.092 ***	0.104 ***	0.051 ***	0.120 ***	0.084 ***	0.200 ***	0.143 ***	0.200 ***	0.143 ***	0.200 ***
5-9.99 million yen	0.115 ***	0.135 ***	0.170 ***	0.182 ***	0.120 ***	0.203 ***	0.200 ***	0.203 ***	0.200 ***	0.200 ***	0.200 ***	0.200 ***
10 million yen -												
Household annual income (log, JPY)	0.014 ***	0.020 ***	-0.013 ***	0.003	-0.004	0.005	-0.010 **	0.050	-0.013 **	-0.003	-0.013 **	-0.003
Age of household head	0.000 ***	0.000 ***	0.000 ***	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Age of head of household (squared)	-0.055 **	-0.208 ***	-0.140 ***	-0.042	0.063	-0.148 **	-0.081	0.050	-0.139 ***	0.386 ***	-0.139 ***	0.386 ***
Number of household members dummies	0.046 ***	0.065 ***	0.008	-0.013	0.032 **	0.002	-0.011	0.016	-0.064 ***	-0.003	-0.064 ***	-0.003
Single person household	0.063 ***	0.082 ***	0.056 ***	0.020	-0.004	-0.030	-0.045 **	0.000	-0.104 ***	0.000	-0.104 ***	0.000
Three-person household												
Four or more person household												
Number of household members (persons)	-0.024 **	-0.059 ***	0.043 **	-0.010	0.009	-0.048	0.008	0.053	-0.134 ***	0.059	-0.134 ***	0.059
Household head occupation dummies (base: employers)	-0.009	-0.017	0.029	0.067	0.007	-0.012	0.016	0.087	-0.054	0.382 ***	-0.054	0.382 ***
Individual sales												
Unemployed & part-time												
Elementary, junior and senior high school student dummy	-0.073 ***	-0.044 ***	0.159 ***	0.274 ***	-0.119 ***	-0.089 **	0.014	-0.102	-0.008	-0.258 ***	-0.008	-0.258 ***
Infant dummy												
Consumption expenditure excl. relevant goods (log, JPY)	0.044 ***	0.004	0.046 **	-0.019	0.106 ***	-0.040	-0.010	0.166	0.031	0.053	0.031	0.053
FY2005	0.051 ***	0.015	0.086 **	-0.028	0.038	-0.036	0.009	0.060	0.019	0.373 **	0.019	0.373 **
FY2006	0.015	-0.009	0.042 *	0.007	0.007	-0.013	-0.019	0.059	0.075	0.044	0.075	0.044
FY2007	0.018	-0.007	0.012	0.042	0.019	-0.062	0.035	0.214	-0.021	-0.043	-0.021	-0.043
FY2008	0.016	0.007	0.030	0.050	0.020	-0.040	0.030	0.136	0.086 **	0.161	0.086 **	0.161
FY2009	0.039 **	0.037 *	-0.006	-0.037	0.023	-0.052	-0.010	-0.053	0.008	0.158	0.008	0.158
FY2010	0.079 ***	0.023	0.033	-0.021	-0.016	-0.091 *	0.008	0.112	0.072	0.087	0.072	0.087
FY2011	0.058 ***	0.020	-0.053	-0.053	0.000	-0.075	-0.038	-0.185	0.078 *	-0.153	0.078 *	-0.153
FY2012	0.078 ***	0.016	0.022	0.019	-0.014	-0.018	0.044	0.260 ***	0.128 ***	0.150	0.128 ***	0.150
FY2013												
April	-0.092 ***	-0.090 ***	-0.083 ***	-0.131 ***	-0.068 **	0.020	-0.032	0.111	-0.055	0.080	-0.055	0.080
May	-0.097 ***	-0.038 *	-0.158 ***	-0.254 ***	-0.070 **	-0.041	-0.007	0.576 ***	-0.014	0.320 **	-0.014	0.320 **
June	-0.041 *	-0.002	-0.536 ***	-0.391 ***	-0.085 **	0.051	-0.016	0.354 *	-0.004	0.450 ***	-0.004	0.450 ***
July	-0.057 ***	0.030	-0.642 ***	-0.293 ***	-0.037	-0.017	0.007	0.138	0.045	0.203	0.045	0.203
August	-0.127 ***	-0.097 ***	-0.484 ***	-0.377 ***	-0.025	-0.030	0.043	0.379 **	0.089	0.340 **	0.089	0.340 **
September	-0.087 ***	-0.098 ***	-0.083	-0.336 ***	-0.090 ***	-0.018	0.043	0.468 **	0.096	0.102	0.096	0.102
October	0.130 ***	0.145 ***	-0.392 ***	-0.392 ***	-0.096 ***	-0.027	0.068 *	0.400	0.070	0.007	0.070	0.007
November	0.179 ***	0.091 ***	-0.203 ***	-0.220 ***	-0.054	-0.040	0.022	0.245	-0.032	0.258	-0.032	0.258
December	0.267 ***	0.173 ***	-0.105 ***	-0.087 *	0.026	0.021	0.122 ***	0.024	-0.033	0.124	-0.033	0.124
January	0.073 ***	-0.017	0.139 ***	0.034	-0.082 **	-0.057	-0.033	0.336 *	-0.041	0.211	-0.041	0.211
February	-0.073 ***	-0.104 ***	-0.040	0.011	-0.126 ***	0.024	-0.121 ***	0.318	0.007	0.150	0.007	0.150
Constant	-2.508 ***	-2.786 ***	-2.091 ***	-2.438 ***	-2.492 ***	-3.104 ***	-2.469 ***	5.117 ***	-2.488 ***	-1.362	-2.488 ***	-1.362
Pseudo R ²	0.019	0.019	0.019	0.053	0.007	0.017	0.015	0.112	0.022	0.228	0.022	0.228
R ²	1.313.030	981.174	1.313.030	981.174	1.313.030	981.174	1.313.030	1.057	981.174	1.852	981.174	1.852
Sample size												

Notes: *, **, and *** indicate significance at the 10%, 5%, and 1% levels, respectively.

Appendix F. (continued)

	2004.4-2013.12		2004.4-2014.3		2004.4-2013.12		2004.4-2014.3		2004.4-2013.12		2004.4-2014.3	
	(i) Probit estimation: SHE	(ii) WLS estimation: FIES										
Urban area dummy	0.055 ***	0.070 ***	-0.236 ***	-0.117 ***	-0.085 ***	-0.125 ***	0.158 *	0.188 *	-0.252 ***	-0.254 ***	0.120 ***	0.099 ***
Owner-occupied dummy	0.010	0.018	0.104 ***	0.083 ***	0.052 **	0.072 *	0.188 *	0.188 *	0.117 **	0.080 ***	0.099 ***	0.099 ***
Household annual income dummies	-0.223 ***	-0.325 ***	-0.156 ***	-0.154	-0.104 **	0.101	-0.104 **	0.011	-0.221 ***	-0.342 ***	0.111 ***	0.198 ***
5-9.99 million yen (base: 2-4.99 million)	0.489 ***	0.520 ***	0.115 **	0.240 ***	0.048 **	0.079	0.047 **	0.079	0.077 ***	0.108 ***	0.198 ***	0.198 ***
Household annual income (log, JPY)	-0.005 *	-0.010 ***	0.065 ***	0.316 ***	0.008 **	0.005	0.005	0.005	0.021 ***	0.018 ***	-0.033 *	0.005
Age of household head	0.000	0.000	0.000 **	0.000 **	0.000 **	0.000 **	0.000 **	0.000 **	0.000 **	0.000 **	0.000 **	0.000
Age of head of household (squared)	0.043	-0.014	0.068 *	-0.159 ***	0.147 ***	-0.034	0.068 *	0.068 *	-0.060 ***	-0.060 ***	0.014 **	-0.005
Number of household members dummies	0.041 ***	0.001	0.083 ***	0.025	0.083 ***	0.025	0.083 ***	0.025	0.038 ***	0.014 **	0.014 **	0.010
(base: two-person)	0.094 ***	0.015	0.183 ***	0.043 **	0.183 ***	0.043 **	0.183 ***	0.043 **	0.091 ***	-0.005	0.091 ***	0.091 ***
Number of household members (persons)	-0.097 ***	-0.051 ***	-0.140 ***	-0.101 ***	-0.148 ***	-0.113 ***	-0.002	-0.045	-0.074 ***	-0.036 ***	-0.083 ***	0.061 **
Household head occupation dummies (base: employed)	-0.065 ***	-0.150 ***	0.117 ***	-0.162 ***	0.042 *	-0.036	-0.110	-0.110	0.033 ***	-0.209 ***	0.026	0.010
Unemployed & part-time	-0.134 ***	-0.258 ***	-0.066 *	-0.057	-0.061 **	-0.107	-0.146	-0.146	-0.030 ***	-0.004	0.010	0.010
Elementary, junior and senior high school student dummy	-0.097 ***	-0.051 ***	-0.140 ***	-0.101 ***	-0.148 ***	-0.113 ***	-0.002	-0.045	-0.074 ***	-0.036 ***	-0.083 ***	0.061 **
Infant dummy	-0.097 ***	-0.051 ***	-0.140 ***	-0.101 ***	-0.148 ***	-0.113 ***	-0.002	-0.045	-0.074 ***	-0.036 ***	-0.083 ***	0.061 **
Consumption expenditure excl. relevant goods (log, JPY)	-0.115 ***	-0.086 ***	-0.121 ***	-0.063 *	-0.089 **	0.025	0.458 ***	0.458 ***	0.097 ***	0.103 ***	0.405 ***	0.405 ***
FY2005	0.005	0.022	0.025	-0.014	0.046	0.060	0.174	0.174	0.042 ***	0.022 *	-0.033	-0.033
FY2006	0.015	0.007	0.011	-0.073 **	0.060 **	-0.183 ***	0.174	0.174	0.073 ***	0.034 ***	0.021	0.021
FY2007	-0.008	-0.027	0.000	-0.027	0.023	0.000	-0.229	-0.229	0.090 ***	0.018	0.003	0.003
FY2008	-0.049 ***	-0.034	-0.039	-0.077 ***	0.005	-0.082	0.050	0.050	0.054 ***	0.043 ***	-0.005	-0.005
FY2009	-0.079 ***	-0.046 **	0.006	0.048	0.006	-0.066	0.337 *	0.337 *	0.094 ***	0.070 ***	0.040	0.040
FY2010	-0.068 ***	-0.059 **	-0.036 *	-0.021	-0.112 ***	-0.128 *	-0.024	-0.024	0.103 ***	0.070 ***	-0.015	-0.015
FY2011	-0.082 ***	-0.117 ***	-0.029	-0.023	-0.076 **	-0.021	0.159	0.159	0.133 ***	0.064 ***	-0.004	-0.004
FY2012	-0.103 ***	-0.128 ***	-0.011	0.054 *	-0.107 ***	-0.036	0.185	0.185	0.131 ***	0.118 ***	-0.012	-0.012
FY2013	-0.115 ***	-0.086 ***	-0.020	0.063 *	-0.089 **	0.025	0.458 ***	0.458 ***	0.097 ***	0.103 ***	-0.035	-0.035
April	-0.093 ***	-0.196 ***	-0.067	-0.090 ***	0.041	-0.063	-0.117	-0.117	-0.067 ***	-0.011	-0.262 ***	-0.262 ***
May	-0.105 ***	-0.184 ***	-0.199 ***	-0.224 ***	-0.105	-0.095	0.013	0.013	-0.102 ***	-0.171 ***	0.048	0.048
June	-0.107 ***	-0.132 ***	0.003	-0.175 ***	-0.032	-0.032	-0.123	-0.123	-0.112 ***	-0.206 ***	0.277 ***	0.277 ***
July	-0.197 ***	-0.219 ***	-0.053	-0.131 ***	-0.038	0.086	-0.043	-0.043	-0.082 ***	-0.160 ***	0.268 ***	0.268 ***
August	-0.338 ***	-0.366 ***	-0.068	-0.146 ***	0.006	-0.066	-0.066	-0.066	-0.124 ***	-0.215 ***	0.172 ***	0.172 ***
September	-0.275 ***	-0.313 ***	0.033	-0.139 ***	0.013	-0.066	-0.260	-0.260	-0.087 ***	-0.193 ***	0.251 ***	0.251 ***
October	-0.122 ***	-0.159 ***	-0.039	-0.122 ***	0.009	-0.156 *	-0.075	-0.075	-0.103 ***	-0.194 ***	0.203 ***	0.203 ***
November	-0.071 ***	-0.159 ***	-0.071	-0.170 ***	-0.085 **	-0.161	0.056	0.056	-0.075 ***	-0.175 ***	-0.175 ***	-0.175 ***
December	-0.051 ***	-0.133 ***	0.030	-0.146 ***	-0.027	-0.180	-0.007	-0.007	-0.020	0.072 ***	-0.362 ***	-0.362 ***
January	-0.094 ***	-0.125 ***	-0.058	-0.224 ***	0.085	-0.099	-0.365	-0.365	-0.136 ***	-0.220 ***	-0.017	-0.017
February	-0.207 ***	-0.213 ***	0.029	-0.140 ***	-0.140 ***	-0.126 ***	0.052	0.052	-0.107 ***	-0.203 ***	0.286 ***	0.286 ***
Constant	-1.773 ***	-1.784 ***	-2.341 ***	-2.573 ***	-2.964 ***	-2.440 ***	8.145 ***	8.145 ***	-1.957 ***	-1.857 ***	4.467 ***	4.467 ***
Pseudo R ²	0.046	0.061	0.027	0.028	0.018	0.022	0.157	0.157	0.024	0.031	0.064	0.064
R ²	1.313:030	981:174	1.313:030	981:174	1.313:030	981:174	599	599	1.313:030	981:174	592:38	592:38
Sample size												

Notes: *, **, and *** indicate significance at the 10%, 5%, and 1% levels, respectively.

Appendix F. (continued)

	2004.4-2013.12		2004.4-2013.12		2004.4-2013.12		2004.4-2013.12		2004.4-2013.12		2004.4-2013.12		2004.4-2013.12		2004.4-2013.12	
	(i) Probit estimation	(ii) WLS estimation														
Urban area dummy	-0.079 **	-0.074 ***	-0.074 ***	-0.074 ***	-0.021	0.039	-0.026 *	0.039	-0.003	0.001	-0.003	0.032	-0.003	0.001	-0.003	-0.016
Owner-occupied dummy	0.604 **	0.586 ***	0.586 ***	0.586 ***	0.068 **	0.209 ***	0.030 **	0.209 ***	0.173 ***	0.173 ***	0.173 ***	0.201 **	0.173 ***	0.173 ***	0.149 **	0.149 **
Household annual income	-0.139 ***	-0.214 ***	-0.214 ***	-0.214 ***	-0.102 **	-0.066 ***	-0.048 *	-0.066 ***	-0.157 ***	-0.157 ***	-0.157 ***	-0.086 **	-0.157 ***	-0.157 ***	-0.127 ***	-0.127 ***
5-9.99 million yen	0.105 **	0.116 ***	0.116 ***	0.116 ***	0.098 **	0.084 ***	0.084 ***	0.084 ***	0.100 ***	0.100 ***	0.100 ***	0.084 ***	0.100 ***	0.100 ***	0.127 ***	0.127 ***
10 million yen -	0.260 **	0.267 ***	0.267 ***	0.267 ***	0.198 **	0.198 **	0.198 **	0.198 **	0.170 ***	0.170 ***	0.170 ***	0.148 ***	0.170 ***	0.170 ***	0.211 **	0.211 **
Household annual income (log, JPY)	0.012 **	0.013 ***	0.013 ***	0.013 ***	0.018 ***	0.009	0.018 ***	0.009	0.002	0.002	0.002	0.177 ***	0.002	0.007 *	0.120 ***	0.120 ***
Age of household head	0.000	0.000	0.000	0.000	0.000 **	0.000	0.000 **	0.000	0.000	0.000	0.000	-0.012 *	0.000	0.000	-0.003	-0.003
Age of head of household (squared)	0.018	0.049 ***	0.049 ***	0.049 ***	-0.039	-0.042	-0.039	-0.042	-0.117 ***	-0.117 ***	-0.117 ***	0.000	-0.117 ***	-0.090 ***	0.000	0.000
Number of household members dummies	-0.025 **	-0.018 **	-0.018 **	-0.018 **	0.039 **	0.023 *	0.039 **	0.023 *	0.062 ***	0.062 ***	0.062 ***	0.034 **	0.027 **	0.011	0.011	0.011
Single person household	-0.047 ***	-0.050 ***	-0.050 ***	-0.050 ***	0.075 ***	0.052 **	0.075 ***	0.052 **	0.157 ***	0.157 ***	0.157 ***	0.020	0.058 ***	0.040 **	0.040 **	0.040 **
Three-person household																
Four or more person household																
Number of household members (persons)																
Household head occupation dummies (base: employees)	0.009	-0.104 ***	-0.104 ***	-0.104 ***	-0.061 ***	-0.016	-0.061 ***	-0.016	-0.013	-0.013	-0.013	-0.077 *	-0.001	-0.118 ***	-0.040	-0.040
Unemployed & part-time	0.055 ***	0.099 ***	0.099 ***	0.099 ***	-0.017	0.010	-0.017	0.010	-0.037 **	-0.037 **	-0.037 **	-0.022	0.005	0.057 ***	0.029	0.029
Elementary, junior and senior high school student dummy	-0.028 **	-0.068 ***	-0.068 ***	-0.068 ***	-0.012	-0.012	-0.012	-0.012	-0.019	-0.019	-0.019	0.061 ***	-0.038 ***	-0.045 **	-0.008	-0.008
Infant dummy																
Consumption expenditure excl. relevant goods (log, JPY)																
FY2005	0.002	-0.028 **	-0.028 **	-0.028 **	0.019	-0.006	0.019	-0.006	0.037 *	0.037 *	0.037 *	0.068 **	0.002	0.018	0.018	0.018
FY2006	0.037 **	-0.064 ***	-0.064 ***	-0.064 ***	-0.011	-0.040	-0.011	-0.040	0.065 ***	0.065 ***	0.065 ***	0.031	-0.002	-0.007	-0.007	-0.010
FY2007	-0.013	-0.069 ***	-0.069 ***	-0.069 ***	0.013	0.013	0.013	0.013	0.042 *	0.042 *	0.042 *	0.012	-0.035 *	-0.065 **	0.061	0.061
FY2008	-0.027 ***	-0.074 ***	-0.074 ***	-0.074 ***	-0.023	-0.023	-0.023	-0.023	-0.016	-0.016	-0.016	0.070 **	-0.001	0.011	0.065	0.065
FY2009	-0.012	-0.085 ***	-0.085 ***	-0.085 ***	-0.013	-0.013	-0.013	-0.013	0.000	0.000	0.000	0.046	-0.031	0.023	0.032	0.032
FY2010	-0.040 ***	-0.040 ***	-0.040 ***	-0.040 ***	0.045	0.045	0.045	0.045	0.037	0.037	0.037	0.080 **	0.107 ***	0.153 ***	0.001	0.001
FY2011	-0.023 **	-0.059 ***	-0.059 ***	-0.059 ***	-0.025	-0.025	-0.025	-0.025	-0.029	-0.029	-0.029	0.203 ***	0.031	0.037	0.061	0.061
FY2012	-0.048 ***	-0.056 ***	-0.056 ***	-0.056 ***	-0.031	-0.031	-0.031	-0.031	-0.008	-0.008	-0.008	0.043	0.054 ***	0.073 **	0.098 **	0.098 **
FY2013	-0.043 ***	-0.064 ***	-0.064 ***	-0.064 ***	-0.059	-0.059	-0.059	-0.059	-0.043	-0.043	-0.043	0.225 ***	0.059 **	0.106 ***	0.083 **	0.083 **
April	0.125 **	0.040 **	0.040 **	0.040 **	-0.088 ***	0.080	-0.088 ***	0.080	-0.119 ***	-0.119 ***	-0.119 ***	0.157 *	-0.035	0.012	-0.139	-0.139
May	0.176 ***	0.085 ***	0.085 ***	0.085 ***	-0.120 ***	0.105 **	-0.120 ***	0.105 **	-0.138 ***	-0.138 ***	-0.138 ***	0.359 ***	0.187 ***	0.203 **	-0.286 **	-0.286 **
June	0.134 **	0.158 ***	0.158 ***	0.158 ***	-0.054 **	0.056 **	-0.054 **	0.056 **	-0.103 ***	-0.103 ***	-0.103 ***	0.405 ***	0.537 ***	0.537 ***	0.228 **	0.228 **
July	0.163 **	0.184 ***	0.184 ***	0.184 ***	0.114 **	0.100 **	0.114 **	0.100 **	-0.039 *	-0.039 *	-0.039 *	0.413 **	0.783 ***	0.783 ***	-0.350 **	-0.350 **
August	0.129 **	0.135 **	0.135 **	0.135 **	0.116 **	0.130 **	0.116 **	0.130 **	-0.074 ***	-0.074 ***	-0.074 ***	0.406 **	0.570 ***	0.611 **	-0.248 **	-0.248 **
September	0.111 **	0.098 **	0.098 **	0.098 **	0.000	0.128 **	0.000	0.128 **	-0.086 ***	-0.086 ***	-0.086 ***	0.438 **	0.190 **	0.239 **	-0.156	-0.156
October	0.161 **	0.146 **	0.146 **	0.146 **	-0.100 ***	0.249 **	-0.100 ***	0.249 **	-0.170 ***	-0.170 ***	-0.170 ***	0.390 **	0.004	0.038	-0.158	-0.158
November	0.188 **	0.177 **	0.177 **	0.177 **	-0.117 **	0.210 **	-0.117 **	0.210 **	-0.120 ***	-0.120 ***	-0.120 ***	0.451 **	0.154 **	0.093	-0.113	-0.113
December	0.234 **	0.278 **	0.278 **	0.278 **	-0.093 **	0.220 **	-0.093 **	0.220 **	-0.055 **	-0.055 **	-0.055 **	0.435 **	0.204 **	0.137 **	-0.204 **	-0.204 **
January	-0.039 **	0.014	0.014	0.014	-0.218 **	-0.167 **	-0.218 **	-0.167 **	-0.119 **	-0.119 **	-0.119 **	0.320 **	0.036	0.054	-0.285 **	-0.285 **
February	-0.049 **	-0.024	-0.024	-0.024	-0.250 **	-0.084	-0.250 **	-0.084	-0.133 ***	-0.133 ***	-0.133 ***	0.432 **	-0.024	-0.114 *	-0.157	-0.157
Constant	-2.779 ***	-3.064 ***	-3.064 ***	-3.064 ***	-3.051 ***	3.055 **	-3.051 ***	3.055 **	-2.702 ***	-2.702 ***	-2.702 ***	-3.304 ***	-3.027 ***	-3.435 ***	8.311 **	8.311 **
Pseudo R ²	0.064	0.077	0.077	0.077	0.015	0.021	0.015	0.021	0.010	0.010	0.010	0.017	0.064	0.077	0.077	0.077
R ²	1.313,030	981,174	981,174	981,174	1,313,030	46,952	1,313,030	46,952	1,313,030	1,313,030	1,313,030	981,174	1,313,030	981,174	5,063	5,063
Sample size																

Notes: *, **, and *** indicate significance at the 10%, 5%, and 1% levels, respectively.

Appendix F. (continued)

	2004.4-2013.12		2004.4-2014.3		2006.4-2013.12		2006.4-2014.3		2010.4-2013.12		2010.4-2014.3		2004.4-2013.12		2004.4-2014.3	
	(i) Probit estimation: SHE	(ii) WLS estimation: FIES	(i) Probit estimation: SHE	(ii) WLS estimation: FIES	(i) Probit estimation: SHE	(ii) WLS estimation: FIES	(i) Probit estimation: SHE	(ii) WLS estimation: FIES	(i) Probit estimation: SHE	(ii) WLS estimation: FIES	(i) Probit estimation: SHE	(ii) WLS estimation: FIES	(i) Probit estimation: SHE	(ii) WLS estimation: FIES	(i) Probit estimation: SHE	(ii) WLS estimation: FIES
Urban area dummy	-0.024 **	-0.017	-0.013	-0.172 ***	0.014	0.078	0.033 **	0.018	0.009	0.039 **	0.015	0.039 **	0.015	0.039 **	0.015	0.039 **
Owner-occupied dummy	0.073 ***	0.064 ***	-0.013	-0.172 ***	-0.013	0.281 ***	-0.013	0.053	0.064 ***	0.084 ***	-0.042	0.084 ***	-0.042	0.084 ***	-0.042	0.084 ***
Household annual income dummies (base: 2-4.99 million)	-0.101 ***	0.111 ***	-0.135 ***	0.138 ***	-0.105	-0.187 ***	-0.167 ***	-0.183 ***	-0.183 ***	0.155 ***	0.169 ***	-0.183 ***	0.155 ***	0.169 ***	-0.183 ***	0.155 ***
Household annual income (log: JPY)	0.105 ***	0.202 ***	0.108 ***	0.226 ***	0.108	0.081	0.140 ***	0.067 *	0.262 ***	0.317 ***	0.208 ***	0.262 ***	0.317 ***	0.208 ***	0.262 ***	0.317 ***
Age of household head	0.022 ***	0.010 ***	0.003	0.000	0.003	0.014	-0.043 ***	-0.035 ***	0.000	-0.010 **	0.000	-0.043 ***	-0.035 ***	-0.010 **	0.000	0.000
Age of head of household (squared)	0.000 ***	0.000 ***	0.000 ***	0.000	0.000 ***	0.000	0.000 ***	0.000 ***	0.000 ***	0.000	0.000	0.000 ***	0.000 ***	0.000	0.000	0.000
Number of household members dummies (base: two-person)	0.032	-0.050 **	-0.075 **	-0.046 **	-0.011	-0.075 **	-0.240 ***	0.049	-0.042	0.051 *	0.051 *	-0.240 ***	0.049	-0.042	0.051 *	0.051 *
Number of household members (persons)	0.038 ***	0.026 **	0.050 ***	0.046 **	0.046 **	0.023	-0.158 ***	-0.023	0.017	-0.065 ***	0.017	-0.158 ***	-0.023	0.017	-0.065 ***	0.017
Household head occupation dummies (base: employees)	0.096 ***	0.019	0.073 ***	0.044 **	0.044 **	0.044 **	0.114 ***	0.114 ***	0.025 **	-0.092 ***	0.025 **	0.114 ***	0.114 ***	0.025 **	-0.092 ***	0.025 **
Individual sales	-0.002	-0.065 ***	-0.014	-0.044	-0.044	-0.076	-0.060 ***	0.003	-0.013	-0.051 **	-0.059	-0.060 ***	0.003	-0.013	-0.051 **	-0.059
Unemployed & part-time	-0.006	0.051 **	-0.023	0.002	0.002	-0.090	0.018	-0.133 *	0.003	0.046 *	0.024	0.018	-0.133 *	0.003	0.046 *	0.024
Elementary, junior and senior high school student dummy	-0.049 ***	-0.041 ***	0.012	-0.047 **	-0.047 **	-0.027	0.439 ***	0.563 ***	-0.023 **	0.021	-0.042	0.439 ***	0.563 ***	-0.023 **	0.021	-0.042
Infant dummy	-0.096 ***	-0.173 ***	-0.300 ***	-0.191 ***	-0.191 ***	0.073	-0.069 ***	-0.036	-0.096 ***	0.002	-0.455 ***	-0.069 ***	-0.036	-0.096 ***	0.002	-0.455 ***
Consumption expenditure excl. relevant goods (log: JPY)	-0.194 ***	-0.201 ***	-0.135 ***	-0.114 ***	-0.114 ***	0.407 ***	-0.093 ***	-0.070 ***	-0.086 ***	0.020	-0.239 **	-0.093 ***	-0.070 ***	-0.086 ***	0.020	-0.239 **
FY2005	0.035 **	-0.018	0.336 **	0.472 ***	0.472 ***	0.134	0.013	0.033	0.018	0.017	0.090	0.013	0.033	0.018	0.017	0.090
FY2006	0.027	0.006	0.684 ***	0.684 ***	0.684 ***	0.102	-0.105	-0.008	-0.034	0.055 *	0.105	-0.105	-0.008	-0.034	0.055 *	0.105
FY2007	0.061 ***	0.035	0.685 ***	-0.027	-0.014	0.290 ***	-0.088 **	-0.088 **	-0.091 ***	0.072 **	-0.003	-0.088 **	-0.088 **	-0.091 ***	0.072 **	-0.003
FY2008	0.123 ***	0.082 ***	0.265 ***	0.631 ***	0.631 ***	0.533 ***	0.036	0.053	-0.069 ***	0.027	-0.179 ***	0.036	0.053	-0.069 ***	0.027	-0.179 ***
FY2009	0.300 ***	0.265 ***	0.365 ***	0.375 ***	0.375 ***	0.375 ***	-0.047	0.104 ***	-0.064 ***	0.016	0.069 **	-0.047	0.104 ***	-0.064 ***	0.016	0.069 **
FY2010	0.500 ***	0.427 ***	0.116 ***	0.116 ***	0.116 ***	0.187 **	0.023	0.073 *	0.004	0.086 ***	-0.282 ***	0.023	0.073 *	0.004	0.086 ***	-0.282 ***
FY2011	0.304 ***	0.228 ***	-0.041	0.106 ***	0.106 ***	0.187 **	-0.097 ***	-0.069 ***	-0.017	0.094 ***	-0.455 ***	-0.097 ***	-0.069 ***	-0.017	0.094 ***	-0.455 ***
FY2012	-0.096 ***	-0.173 ***	-0.300 ***	-0.136 ***	-0.136 ***	-0.226 *	-0.069 ***	-0.029	-0.096 ***	0.002	-0.411 ***	-0.069 ***	-0.029	-0.096 ***	0.002	-0.411 ***
FY2013	-0.194 ***	-0.201 ***	-0.135 ***	-0.114 ***	-0.114 ***	0.407 ***	-0.093 ***	-0.070 ***	-0.086 ***	0.020	-0.239 **	-0.093 ***	-0.070 ***	-0.086 ***	0.020	-0.239 **
April	-0.160 ***	-0.252 ***	0.175 ***	-0.112 **	-0.112 **	0.134	0.013	0.033	0.018	-0.058	-0.039	0.013	0.033	0.018	-0.058	-0.039
May	-0.214 ***	-0.218 ***	0.192 ***	-0.138 ***	-0.138 ***	0.058	-0.105	-0.008	-0.034	0.045	0.045	-0.105	-0.008	-0.034	0.045	0.045
June	-0.099 ***	-0.198 ***	0.285 ***	-0.112 **	-0.112 **	0.043	-0.088 **	-0.088 **	-0.091 ***	0.123	0.123	-0.088 **	-0.088 **	-0.091 ***	0.123	0.123
July	0.025	-0.067 ***	0.273 ***	-0.023	-0.023	0.134	-0.036	0.053	-0.069 ***	0.029	0.029	-0.036	0.053	-0.069 ***	0.029	0.029
August	-0.097 ***	-0.177 ***	0.309 ***	-0.097 **	-0.097 **	0.068	-0.047	0.104 ***	-0.064 ***	0.088	0.088	-0.047	0.104 ***	-0.064 ***	0.088	0.088
September	-0.113 ***	-0.191 ***	0.218 ***	-0.083 *	-0.083 *	-0.011	0.023	0.073 *	0.004	0.102	0.102	0.023	0.073 *	0.004	0.102	0.102
October	-0.099 ***	-0.178 ***	0.256 ***	-0.085 *	-0.085 *	0.108	-0.034	0.031	-0.027	0.034	0.034	-0.034	0.031	-0.027	0.034	0.034
November	0.023	-0.057 ***	0.212 ***	-0.063	-0.063	0.026	-0.022	0.093 **	-0.069 ***	0.029	0.029	-0.022	0.093 **	-0.069 ***	0.029	0.029
December	0.068 ***	0.005	0.176 ***	0.171 **	0.171 **	0.181 *	0.065 **	0.568 ***	0.008	0.051	0.051	0.065 **	0.568 ***	0.008	0.051	0.051
January	-0.119 ***	-0.150 ***	0.134 ***	0.070 ***	0.070 ***	0.023	0.106 **	0.143 ***	-0.063 ***	0.049	0.049	0.106 **	0.143 ***	-0.063 ***	0.049	0.049
February	-0.190 ***	-0.256 ***	0.099 **	-0.122 ***	-0.122 ***	-0.061	-0.040	-0.041	-0.104 ***	-0.182 ***	-0.182 ***	-0.040	-0.041	-0.104 ***	-0.182 ***	-0.182 ***
Constant	-2.939 ***	-2.743 ***	6.133 ***	-2.522 ***	-2.522 ***	3.406 ***	-0.586 ***	-0.783 ***	-2.302 ***	-2.254 ***	5.637 ***	-0.586 ***	-0.783 ***	-2.302 ***	-2.254 ***	5.637 ***
Pseudo R ²	0.038	0.037	0.017	0.021	0.021	0.121	0.124	0.130	0.019	0.024	0.024	0.124	0.130	0.019	0.024	0.024
R ²	1.313.030	981.174	1.036.028	777.471	777.471	4.113	527.553	374.744	1.313.030	981.174	5.705	527.553	374.744	1.313.030	981.174	5.705
Sample size																

Notes: *, **, and *** indicate significance at the 10%, 5%, and 1% levels, respectively.

Appendix F. (continued)

	2004.4-2013.12		2004.4-2013.12		2004.4-2013.12		2004.4-2013.12		2004.4-2013.12		2004.4-2013.12		2004.4-2013.12		2004.4-2013.12	
	(i) Probit estimation: SHE	(ii) WLS estimation: FIES														
Urban area dummy	0.053 **	0.091 **	0.139 **	0.079 **	-0.072 **	0.152 *	0.084 **	-0.010	0.088 **	0.121 **	0.030	0.088 **	0.121 **	0.030	0.088 **	0.121 **
Owner-occupied dummy	0.056 **	0.128 **	0.079 **	0.027	0.022	0.113	-0.104 **	-0.009	0.191 **	0.205 **	0.039	0.191 **	0.205 **	0.039	0.191 **	0.205 **
Household annual income - 2 million yen	-0.084 **	-0.403 **	-0.022	-0.022	-0.186 **	-0.319 **	-0.460 **	-0.319 **	-0.328 **	-0.484 **	0.250 **	-0.328 **	-0.484 **	0.250 **	-0.328 **	-0.484 **
dummies	0.213 **	0.283 **	0.037	0.079 **	0.174 **	0.113	0.289 **	0.289 **	0.298 **	0.298 **	0.298 **	0.298 **	0.298 **	0.298 **	0.298 **	0.298 **
(base: 2-4.99 million)	0.400 **	0.509 **	0.112 **	0.112 **	0.174 **	0.113	0.666 **	0.666 **	0.595 **	0.614 **	0.614 **	0.595 **	0.614 **	0.614 **	0.595 **	0.614 **
Household annual income (log, JPY)	0.059 **	0.126 **	0.087 **	0.087 **	-0.001	0.252 **	0.004	0.004	0.024 **	-0.003	0.004	0.024 **	-0.003	0.004	0.024 **	-0.003
Age of household head	-0.001 **	-0.001 **	-0.001 **	-0.001 **	0.000 **	-0.001 **	0.000 **	0.000 **	0.000 **	0.000 **	0.000	0.000 **	0.000 **	0.000	0.000 **	0.000
Age of head of household (squared)	-1.541 **	-0.656 **	0.036	0.036	-0.008	0.088 **	0.230 **	0.159 **	0.211 **	0.105 **	0.245 **	0.211 **	0.105 **	0.245 **	0.211 **	0.105 **
Number of household members dummies	0.249 **	0.072 **	0.110 **	0.110 **	-0.027	0.052	-0.061 **	-0.102 **	-0.128 **	-0.138 **	0.004	-0.128 **	-0.138 **	0.004	-0.128 **	-0.138 **
(base: two-person)	0.401 **	0.166 **	0.387 **	0.387 **	0.111 **	-0.172	-0.159 **	-0.238 **	-0.171 **	-0.258 **	0.000	-0.171 **	-0.258 **	0.000	-0.171 **	-0.258 **
Number of household members (persons)			0.035 **	0.035 **		0.088 **		0.026 **			0.013			0.013		
Household head occupation dummies (base: employers)	-0.060 **	-0.101 **	0.045 **	0.045 **	-0.060 **	0.052	-0.053 **	-0.050 **	-0.022 *	0.024	0.151 **	-0.022 *	0.024	0.151 **	-0.022 *	0.024
Unemployed & part-time	-0.014	-0.223 **	-0.023	-0.023	0.001	-0.172	0.074 **	-0.003	0.152 **	0.205 **	0.248 **	0.152 **	0.205 **	0.248 **	0.152 **	0.205 **
Elementary, junior and senior high school student dummy	1.547 **	2.279 **	0.010	0.010	0.280 **	0.313 **	-0.112 **	-0.104 **	-0.253 **	-0.230 **	0.034	-0.253 **	-0.230 **	0.034	-0.253 **	-0.230 **
Infant dummy			-0.457 **	-0.457 **		-0.489 **		0.020			-0.074			-0.074		
Consumption expenditure excl. relevant goods (log, JPY)			0.103 **	0.103 **		0.151 **		0.120 **			0.082 *			0.082 *		
Fiscal year dummies (base: FY2004)	0.004	-0.009	-0.031 *	-0.031 *	-0.011	-0.266	-0.013	-0.021	0.009	-0.016	-0.148 *	0.009	-0.016	-0.148 *	0.009	-0.016
FY2005	0.018 *	-0.005	0.037 **	0.037 **	-0.095 **	-0.046 *	0.046 *	-0.047	-0.005	0.017	-0.091	-0.005	0.017	-0.091	-0.005	0.017
FY2006	0.001	-0.050 **	0.046 **	0.046 **	-0.035	-0.294 *	0.004	-0.009	-0.028	-0.042	0.075	-0.028	-0.042	0.075	-0.028	-0.042
FY2007	0.048 **	-0.032 **	0.042 **	0.042 **	-0.040	-0.068	0.004	-0.026	-0.078 **	-0.031	0.037	-0.078 **	-0.031	0.037	-0.078 **	-0.031
FY2008	0.075 **	-0.013	0.078 **	0.078 **	0.008	-0.201	-0.031	-0.073 **	-0.049 **	-0.050 *	-0.096	-0.049 **	-0.050 *	-0.096	-0.049 **	-0.050 *
FY2009	0.123 **	-0.012	0.031 *	0.031 *	0.066 *	-0.220	-0.031	-0.049	-0.051 **	-0.016	-0.067	-0.051 **	-0.016	-0.067	-0.051 **	-0.016
FY2010	0.076 **	-0.011	0.101 **	0.101 **	0.006	-0.155	-0.025	-0.073 **	-0.024	0.021	-0.245 **	-0.024	0.021	-0.245 **	-0.024	0.021
FY2011	0.123 **	-0.026 **	0.100 **	0.100 **	-0.014	0.055	-0.048 **	-0.030	-0.051 **	0.019	-0.079	-0.051 **	0.019	-0.079	-0.051 **	0.019
FY2012	0.143 **	-0.019	0.085 **	0.085 **	-0.047 *	-0.196	-0.004	-0.017	-0.084 **	-0.023	-0.054	-0.084 **	-0.023	-0.054	-0.084 **	-0.023
FY2013	-0.011	0.029 *	-0.057 **	-0.057 **	-0.089 **	0.163	-0.052 **	-0.001	-0.064 **	-0.028	0.091	-0.064 **	-0.028	0.091	-0.064 **	-0.028
April	-0.038 **	-0.004	-0.204 **	-0.204 **	-0.136 **	0.388 **	0.000	-0.002	-0.046 *	-0.021	0.050	-0.046 *	-0.021	0.050	-0.046 *	-0.021
May	-0.019	0.031 **	-0.200 **	-0.200 **	-0.169 **	0.074	-0.058 **	-0.078 **	-0.006	-0.005	0.352 **	-0.006	-0.005	0.352 **	-0.006	-0.005
June	-0.003	-0.071 **	-0.076 **	-0.076 **	-0.092 **	0.346 **	0.029	0.020	-0.046 **	0.014	0.250 **	-0.046 **	0.014	0.250 **	-0.046 **	0.014
July	-0.026 *	-0.026 *	-0.111 **	-0.111 **	-0.102 **	0.570 **	0.080 **	0.089 **	-0.005	0.021	0.256 **	-0.005	0.021	0.256 **	-0.005	0.021
August	0.006	0.047 **	-0.172 **	-0.172 **	-0.160 **	0.129	-0.001	-0.031	0.005	0.052	0.115	0.005	0.052	0.115	0.005	0.052
September	0.017	0.039 **	-0.216 **	-0.216 **	-0.152 **	0.223	-0.013	-0.023	-0.025	0.011	0.026	-0.025	0.011	0.026	-0.025	0.011
October	0.015	0.040 **	-0.186 **	-0.186 **	-0.142 **	0.155	-0.002	-0.031	-0.048 **	-0.004	0.004	-0.048 **	-0.004	0.004	-0.048 **	-0.004
November	0.011	0.038 **	-0.104 **	-0.104 **	-0.047	0.455 **	-0.005	-0.018	-0.088 **	-0.042	0.213 **	-0.088 **	-0.042	0.213 **	-0.088 **	-0.042
December	0.020	0.022	-0.173 **	-0.173 **	-0.039	0.707 **	-0.097 **	-0.134 **	-0.051 *	0.021	0.021	-0.051 *	0.021	0.021	-0.051 *	0.021
January	-0.008	-0.037 **	-0.197 **	-0.197 **	0.006	0.652 **	-0.076 **	-0.104 **	-0.014	-0.047	0.067	-0.014	-0.047	0.067	-0.014	-0.047
February																
Constant	-3.714 **	-6.436 **	1.178 **	1.178 **	-2.484 **	3.869 **	-2.130 **	-2.137 **	-3.199 **	-2.623 **	6.519 **	-3.199 **	-2.623 **	6.519 **	-3.199 **	-2.623 **
Pseudo R ²	0.366	0.431	0.026	0.026	0.033	0.291	0.042	0.050	0.051	0.048	0.044	0.051	0.048	0.044	0.051	0.048
R ²	1.313,030	981,174	1.313,030	1.313,030	981,174	3,059	1,313,030	981,174	1,313,030	981,174	5,612	1,313,030	981,174	5,612	1,313,030	981,174
Sample size			80,694	80,694												

Notes: *, **, and *** indicate significance at the 10%, 5%, and 1% levels, respectively.

Appendix F. (continued)

	2004.4-2013.12		2004.4-2013.12		2004.4-2014.3	
	Video camera					
	(i) Probit estimation: SHE	(ii) Probit estimation: FIES	(iii) WLS estimation: FIES	(iv) Probit estimation: FIES	(v) WLS estimation: FIES	(vi) Probit estimation: FIES
Urban area dummy	0.002	-0.052 *	0.032	0.002	-0.052 *	0.032
Owner-occupied dummy	0.006	-0.019	0.121 ***	0.006	-0.019	0.121 ***
Household annual income dummies						
- 2 million yen	-0.172 ***	-0.361 ***		-0.172 ***	-0.361 ***	
5-9.99 million yen	0.083 ***	0.130 ***		0.083 ***	0.130 ***	
(base: 2-4.99 million)	0.158 ***	0.265 ***		0.158 ***	0.265 ***	
Household annual income (log, JPY)			-0.010			-0.010
Age of household head	-0.031 **	-0.037 ***	-0.009	-0.031 **	-0.037 ***	-0.009
Age of head of household (squared)	0.000 ***	0.000 ***	0.000	0.000 ***	0.000 ***	0.000
Number of household members: dummies						
Single-person household	-0.331 ***	-0.263 ***		-0.331 ***	-0.263 ***	
Three-person household	0.090 **	0.033		0.090 **	0.033	
(base: two-person)	0.135 ***	0.080 **		0.135 ***	0.080 **	
Number of household members: (persons)			0.004			0.004
Household head occupation dummies (base: employers)						
Individual sales	-0.001	-0.134 ***	-0.100	-0.001	-0.134 ***	-0.100
Unemployed & part-time	-0.035	-0.034	-0.023	-0.035	-0.034	-0.023
Elementary, junior and senior high school student dummy	0.087 ***	0.075 **	-0.067	0.087 ***	0.075 **	-0.067
Infant dummy			0.001			0.001
Consumption expenditure excl. relevant goods (log, JPY)			0.208 ***			0.208 ***
Fiscal year dummies (base: FY2004)						
FY2005	-0.027	-0.027	0.016	-0.027	-0.027	0.016
FY2006	-0.066 **	-0.052	0.016	-0.066 **	-0.052	0.016
FY2007	-0.071 **	0.016	-0.142	-0.071 **	0.016	-0.142
FY2008	-0.079 ***	-0.003	0.080	-0.079 ***	-0.003	0.080
FY2009	-0.096 ***	-0.058	-0.170 **	-0.096 ***	-0.058	-0.170 **
FY2010	-0.079 **	-0.038	-0.377 ***	-0.079 **	-0.038	-0.377 ***
FY2011	0.036	0.069	-0.702 ***	0.036	0.069	-0.702 ***
FY2012	-0.049	0.032	-0.703 ***	-0.049	0.032	-0.703 ***
FY2013	-0.117 ***	-0.069	-0.611 **	-0.117 ***	-0.069	-0.611 **
April	-0.073	-0.060	0.257 **	-0.073	-0.060	0.257 **
May	-0.117 ***	-0.006	0.176	-0.117 ***	-0.006	0.176
June	-0.116 ***	-0.151 **	0.297 ***	-0.116 ***	-0.151 **	0.297 ***
July	-0.116 ***	-0.105 *	0.132	-0.116 ***	-0.105 *	0.132
August	-0.114 ***	-0.023	0.192 *	-0.114 ***	-0.023	0.192 *
September	0.067 **	0.118 **	0.236 **	0.067 **	0.118 **	0.236 **
October	-0.021	0.015	0.018	-0.021	0.015	0.018
November	-0.161 ***	-0.100	-0.003	-0.161 ***	-0.100	-0.003
December	-0.125 ***	-0.040	0.133	-0.125 ***	-0.040	0.133
January	-0.095 **	-0.057	0.034	-0.095 **	-0.057	0.034
February	-0.108 ***	0.021	0.113	-0.108 ***	0.021	0.113
Constant	-1.768 ***	-1.971 ***	8.879 ***	-1.768 ***	-1.971 ***	8.879 ***
Pseudo R ²	0.043	0.057		0.043	0.057	
R ²			0.336			0.336
Sample size	1,313,030	981,174	1,044	1,313,030	981,174	1,044

Notes: *, **, and *** indicate significance at the 10%, 5%, and 1% levels, respectively.

Appendix G. Estimated results for seasonal adjustment

Estimated period: 2005.4–2014.3		Estimation method: CLS						
		Food and non-alcoholic beverages/ND	Alcoholic beverages and tobacco/ND	Clothing and footwear/SD	Clothing and footwear/CS	Housing, electricity, gas and water supply/ND	Housing, electricity, gas and water supply/CS	Furnishings, household equipment and household services/CD
Family type dummies (base: married couple with one child)	Single person	-352,024.3 ***	-25,388.1 ***	-98,727.9 ***	-7,662.6 ***	-126,607.1 ***	-83,546.8 ***	-40,385.7 ***
	Married couple only	-62,428.7 ***	422.4	-42,670.1 ***	-2,429.9 ***	-41,326.8 ***	3,453.8	-3,127.4
	Couple with two or more children	69,135.8 ***	-267.5	25,298.2 ***	-487.0 ***	36,933.1 ***	-30,055.2 ***	-7,801.4 ***
	Other households	-91,041.8 ***	-10,672.5 ***	-66,125.0 ***	-5,414.8 ***	-18,344.9 ***	-21,621.0 ***	-17,848.7 ***
Owner-occupied households dummy	-163,122.5 ***	-218.8	-26,674.2 ***	-3,780.9 ***	-61,766.7 ***	421,286.9 ***	-48,800.1 ***	
Fiscal year dummies (base: FY2005)	FY2006	-6,144.6 **	-1,855.1 **	-2,264.3	-116.1	-5,420.7 ***	6,450.3	-5,303.8 *
	FY2007	-2,454.1	-1,587.0 **	-7,574.9 ***	-738.0 ***	4,660.4 ***	4,735.7	-3,899.8
	FY2008	-1,769.0	-1,722.4 **	-16,195.5 ***	-1,065.1 ***	1,988.2 *	2,049.6	-7,705.5 ***
	FY2009	-6,765.8 **	-3,872.9 **	-22,047.4 ***	-2,001.7 ***	-6,927.3 ***	-3,592.1 *	-5,262.1 *
	FY2010	-17,217.9 ***	-4,767.9 ***	-31,318.0 ***	-2,714.7 ***	2,080.5 *	-282.5	-110.4
	FY2011	-15,654.0 ***	-4,940.5 ***	-28,506.1 ***	-2,633.4 ***	2,989.6 ***	2,285.2	-383.3
	FY2012	-21,276.4 ***	-4,828.7 ***	-30,163.7 ***	-3,343.5 ***	6,662.6 ***	6,934.2	-714.6
FY2013	-11,994.2 ***	-5,192.2 ***	-30,839.8 ***	-3,114.1 ***	15,156.0 ***	15,390.4 ***	10,149.6 ***	
Month dummies	April	-10,549.5 ***	349.6	-5,403.6 ***	1,659.8 ***	-20,553.4 ***	3,768.8	-945.2
	May	-1,872.5	1,874.9 ***	-5,614.8 ***	986.5 ***	-30,457.0 ***	7,952.1 **	4,918.8 **
	June	-6,378.5 ***	939.8	-3,657.5 ***	-643.4 ***	-37,104.7 ***	4,738.3	8,651.9 ***
	July	26,391.5 ***	4,180.9 ***	-5,225.8 ***	-978.9 ***	-27,009.1 ***	1,624.5	5,568.1 **
	August	19,266.6 ***	2,103.2 ***	-514.5	-1,061.5 ***	-14,151.8 ***	-71.6	5,939.3 ***
	September	7,661.1 ***	-1,456.2 **	4,015.1 **	-855.6 ***	1,342.8	-6,307.2 *	1,561.0
	October	16,022.9 ***	-41.0	10,365.0 ***	-679.4 ***	17,468.8 ***	7,275.3 **	97.1
	November	14,975.0 ***	1,387.3 **	13,314.6 ***	307.8	29,248.6 ***	-2,159.7	-884.2
	December	7,244.3 ***	-509.6	4,923.3 ***	-406.6 **	33,244.8 ***	-6,955.5 **	-6,321.0 ***
	January	-37,417.0 ***	-4,045.8 ***	377.6	-149.5	35,335.1 ***	-11,088.2 ***	-8,806.3 ***
	February	-21,889.7 ***	-4,031.0 ***	-5,931.3 ***	669.7 ***	17,967.2 ***	-739.7	-6,830.5 ***
	March	-13,454.3 ***	-752.1	-6,648.0 ***	1,151.2 ***	-5,331.4 ***	1,962.9	-2,949.0
Constant	754,054.0 ***	64,052.8 ***	214,242.0 ***	16,428.1 ***	285,577.2 ***	123,952.2 ***	108,318.7 ***	
F statistic	2,619.6	131.3	400.2	143.5	2,836.7	1,259.6	73.6	
Sample size	177,553	177,553	177,553	177,553	177,553	177,553	177,553	

Notes:

1. *, **, and *** indicate significance at the 10%, 5%, and 1% levels, respectively.
2. CD: Durable goods, SD: Semi-durable goods, ND: Non-durable goods, CS: Services.

Appendix G. (continued)

Estimated period: 2005.4–2014.3		Estimation method: CLS						
		Furnishings, household equipment and household services/SD	Furnishings, household equipment and household services/ND	Furnishings, household equipment and household services/CS	Health/CD	Health/ND	Health/CS	Transport/CD
Family type dummies (base: married couple with one child)								
Single person		-25,271.9 ***	-17,476.1 ***	-1,170.0 ***	-5,190.6 ***	-21,438.9 ***	-49,144.1 ***	-88,888.8 ***
Married couple only		-5,285.3 ***	-5,965.5 ***	916.5 ***	-1,602.0 ***	1,140.9 **	13,522.9 ***	-43,453.4 ***
Couple with two or more children		-2,241.7 ***	3,259.7 ***	301.1	2,421.7 ***	-3,505.2 ***	-7,846.2 ***	45,768.9 ***
Other households		-11,728.0 ***	-5,134.8 ***	410.3	-3,814.0 ***	-7,409.8 ***	-9,290.1 ***	-43,936.6 ***
Owner-occupied households dummy								
FY2006		-9,495.7 ***	-2,851.7 ***	-7,877.1 ***	-1,617.6 ***	-11,563.9 ***	-28,583.2 ***	-53,496.3 ***
FY2007		-1,337.6	582.9 ***	-47.1	-588.1 *	-2,308.7 ***	1,378.3	8,640.1
FY2008		-853.7	1,305.2 ***	12.5	-1,043.1 ***	-2,527.0 ***	3,856.4 **	-11,964.9
FY2009		-1,438.3	1,805.6 ***	-61.4	-1,367.6 ***	-718.2	-1,526.1	-27,820.6 ***
FY2010		-3,051.6 ***	2,095.7 ***	521.0 *	-1,138.0 ***	2,792.1 ***	-3,343.6 *	-2,587.7
FY2011		-3,328.6 ***	2,252.2 ***	70.5	-1,740.0 ***	5,480.1 ***	-7,614.0 ***	-30,415.6 ***
FY2012		-1,533.3 *	2,558.7 ***	-265.3	-1,419.3 ***	4,649.7 ***	-7,216.3 ***	-37,513.3 ***
FY2013		-2,116.3 **	3,245.0 ***	-507.8 *	-1,275.6 ***	5,145.4 ***	-7,867.5 ***	-12,024.5
		-1,550.7 *	4,593.4 ***	-787.6 ***	-1,165.1 ***	4,058.4 ***	-10,735.6 ***	-12,493.4
Month dummies								
April		-2,772.3 ***	1,011.0 ***	555.8 **	185.9	-1,049.0 *	814.5	-8,980.4
May		-2,257.4 ***	1,877.1 ***	408.9 *	70.8	-1,131.9 **	-2,005.0	-11,714.6 *
June		595.8	1,484.2 ***	573.6 ***	305.8	-1,279.5 **	-24.6	-4,387.6
July		1,066.6	1,558.7 ***	1,200.8 ***	388.9	320.1	1,887.6	-4,469.4
August		1,018.6	-350.9	179.2	310.3	1,114.0 *	-1,118.5	-15,786.8 **
September		3,135.7 ***	-952.0 ***	-143.9	-170.0	1,160.6 **	2,540.5 *	484.8
October		3,710.9 ***	-1,098.5 ***	-460.0 **	-261.7	129.9	3,650.1 ***	7,915.2
November		2,646.0 ***	-1,411.2 ***	-388.5 *	-206.8	1,033.3 *	1,876.9	4,981.2
December		1,799.0 **	-1,226.6 ***	-862.8 ***	-234.0	890.4	-1,953.6	712.6
January		-3,654.9 ***	-1,764.0 ***	-633.8 ***	-109.6	-684.4	-2,427.2 *	4,966.6
February		-2,736.9 ***	-446.4 ***	-668.4 ***	304.2	-446.9	-744.9	10,052.3
March		-2,551.0 ***	1,318.7 ***	238.9	-583.7 **	-56.5	-2,495.9 *	16,225.9 **
Constant		51,547.0 ***	28,535.6 ***	11,896.6 ***	12,624.6 ***	55,373.7 ***	108,134.7 ***	198,687.2 ***
F statistic		93.1	1,188.9	126.2	54.3	148.7	159.2	34.7
Sample size		177,553	177,553	177,553	177,553	177,553	177,553	177,553

Notes:

1. *, **, and *** indicate significance at the 10%, 5%, and 1% levels, respectively.
2. CD: Durable goods, SD: Semi-durable goods, ND: Non-durable goods, CS: Services.

Appendix G. (continued)

		Estimation method: CLS						
		Transport/SD	Transport/ND	Transport/CS	Communication /CS	Recreation and culture/SD	Recreation and culture/ND	Recreation and culture/CS
Family type dummies (base: married couple with one child)	Single person	-14,637.2 ***	-52,028.8 ***	-58,032.5 ***	-88,432.0 ***	-18,562.2 ***	-27,418.7 ***	-60,887.9 ***
	Married couple only	-4,723.3 ***	-19,215.4 ***	-16,877.5 ***	-46,822.8 ***	-12,260.1 ***	-486.3	-715.9
	Couple with two or more children	2,928.4 ***	16,146.2 ***	2,901.6 **	38,326.3 ***	25,178.7 ***	-916.8 **	42,386.7 ***
	Other households	-9,377.7 ***	-27,414.2 ***	-46,939.8 ***	-36,549.1 ***	-14,653.8 ***	-7,479.5 ***	-58,346.0 ***
Owner-occupied households dummy		842.3 *	310.8	4,025.7 ***	16,135.1 ***	1,835.9 ***	-31,376.5 ***	-61,036.3 ***
	FY2006	-259.3	1,074.7	-3,294.7 **	2,855.4 ***	-555.7	-1,550.8 **	4,241.3
Fiscal year dummies (base: FY2005)	FY2007	1,566.9 *	8,713.3 ***	-3,705.6 **	3,764.4 ***	131.3	-1,789.4 ***	1,122.1
	FY2008	1,721.0 **	1,926.4 **	-10,807.3 ***	4,810.0 ***	-1,849.5 **	-2,855.7 ***	-1,820.7
	FY2009	3,357.6 ***	-2,211.9 ***	-8,323.9 ***	6,971.2 ***	-2,761.5 ***	-3,819.0 ***	-1,412.5
	FY2010	3,121.9 ***	2,378.6 ***	-16,319.0 ***	5,275.3 ***	-5,913.7 ***	-6,936.5 ***	-11,092.3 ***
	FY2011	2,790.4 ***	4,362.7 ***	-16,593.2 ***	4,228.0 ***	-5,655.0 ***	-8,191.8 ***	-13,966.4 ***
	FY2012	4,889.4 ***	4,695.2 ***	-12,589.5 ***	7,418.2 ***	-6,044.9 ***	-9,488.2 ***	-11,467.4 ***
	FY2013	6,754.1 ***	9,950.5 ***	-15,025.7 ***	11,543.1 ***	-6,108.8 ***	-10,168.9 ***	-13,278.8 ***
Month dummies	April	-2,102.0 ***	1,281.8 **	5,647.7 ***	-3,024.2 ***	-2,378.9 ***	1,245.0 **	9,317.4 ***
	May	-2,586.9 ***	379.5	2,527.9 *	-1,386.1 *	-5,466.4 ***	10.2	11,425.5 ***
	June	-1,315.1 **	2,762.1 ***	4,005.8 ***	-1,312.3 *	-5,085.3 ***	-1,789.3 ***	2,341.3
	July	-154.3	875.4	1,156.7	843.8	-2,563.9 ***	927.3 *	-4,966.9 *
	August	213.6	1,399.2 **	970.5	14.8	-1,330.2 **	806.0 *	7,162.4 ***
	September	924.0	2,072.9 ***	-3,312.1 **	4,496.3 ***	467.5	281.5	-4,982.0 *
	October	2,122.4 ***	-1,664.5 ***	-3,603.8 ***	3,925.2 ***	1,882.2 ***	-257.6	-6,789.4 **
	November	2,030.3 ***	-2,893.9 ***	-3,401.2 ***	3,642.8 ***	7,101.7 ***	339.6	-2,499.0
	December	1,887.1 ***	-1,787.6 ***	-5,806.6 ***	37.6	6,238.7 ***	1,982.7 ***	-10,947.9 ***
	January	-618.8	-993.1 *	-1,561.3	-675.5	1,707.3 ***	-3,185.1 ***	-5,867.0 **
	February	-1,165.8 *	-3,440.0 ***	-823.7	-3,535.6 ***	705.3	-1,217.0 **	2,398.3
	March	765.4	2,008.0 ***	4,199.9 ***	-3,026.9 ***	-1,278.0 **	856.6 *	3,407.2
Constant	21,351.8 ***	77,079.5 ***	150,356.5 ***	146,394.9 ***	48,395.7 ***	100,801.3 ***	229,930.5 ***	
F statistic	45.7	683.7	152.7	1,604.0	389.8	645.3	159.9	
Sample size	177,553	177,553	177,553	177,553	177,553	177,553	177,553	

Notes:

1. *, **, and *** indicate significance at the 10%, 5%, and 1% levels, respectively.
2. CD: Durable goods, SD: Semi-durable goods, ND: Non-durable goods, CS: Services.

Appendix G. (continued)

Estimated period: 2005.4–2014.3		Estimation method: CLS				
	Restaurants and hotels/CS	Miscellaneous goods and services/CD	Miscellaneous goods and services/SD	Miscellaneous goods and services/ND	Miscellaneous goods and services/CS	
Family type dummies (base: married couple with one child)						
Single person	-38,593.3 ***	-4,593.8 ***	-9,918.7 ***	-23,769.6 ***	-144,736.2 ***	
Married couple only	-7,581.0 ***	-1,342.1 *	-428.1	-6,744.4 ***	-41,829.7 ***	
Couple with two or more children	11,757.2 ***	2,474.4 ***	358.3	602.6	-4,130.7	
Other households	-53,867.0 ***	615.9	-7,228.5 ***	-13,019.3 ***	-73,826.4 ***	
Owner-occupied households dummy	4,034.5 ***	-3,864.2 ***	-5,982.2 ***	-7,302.8 ***	-73,970.1 ***	
FY2006	-265.2	-561.9	428.3	-564.0	4,540.4	
FY2007	-147.0	-538.7	-1,248.4	646.4	5,848.9	
FY2008	-3,661.8 *	563.5	-1,428.6	131.9	4,175.8	
FY2009	-5,028.9 **	-1,357.7	-3,188.0 ***	1,736.9 ***	8,607.3 **	
FY2010	-13,600.5 ***	142.3	-4,439.7 ***	1,563.3 ***	2,544.4	
FY2011	-10,508.1 ***	1,006.7	-3,780.9 ***	1,177.4 **	2,162.1	
FY2012	-10,160.2 ***	2,168.7 *	-3,023.4 ***	2,419.2 ***	8,600.9 **	
FY2013	-5,076.3 **	2,733.0 **	-1,976.3 **	2,958.1 ***	3,500.5	
Month dummies						
April	5,764.4 ***	-1,027.9	144.1	145.8	-34.4	
May	3,730.5 **	-1,812.5 **	-218.8	219.0	-591.9	
June	-1,093.9	1,064.8	-82.8	163.6	-6,412.7 **	
July	4,445.6 ***	1,516.5 *	-1,196.3	1,053.1 **	-5,630.8 *	
August	10,350.2 ***	1,493.7 *	-224.8	1,157.1 ***	-4,460.0	
September	-4,412.7 ***	-523.4	-167.6	460.9	-2,120.1	
October	-6,711.4 ***	-197.9	638.7	379.0	54.4	
November	2,412.5	-1,066.4	-162.5	102.2	4,182.1	
December	-942.8	1,986.7 **	1,705.5 **	-1,004.0 **	4,163.9	
January	-7,169.8 ***	-1,816.2 **	575.8	-1,401.0 ***	2,590.5	
February	-7,836.5 ***	317.7	-98.7	-599.5	3,057.2	
March	1,463.8	64.8	-912.5	-676.1	5,201.9	
Constant	195,321.2 ***	15,377.1 ***	34,802.6 ***	53,457.4 ***	307,774.0 ***	
F statistic	95.3	7.0	22.0	220.0	173.7	
Sample size	177,553	177,553	177,553	177,553	177,553	

Notes:

1. *, **, and *** indicate significance at the 10%, 5%, and 1% levels, respectively.
2. CD: Durable goods, SD: Semi-durable goods, ND: Non-durable goods, CS: Services.

Appendix G. (continued)

	Recreation and culture/CD	Education/CS	Estimation method: CLS
Nuclear family dummy	-14,598.4 ***	-93,376.4 ***	
Owner-occupied households dummy	-15,737.0 ***	-11,122.7 ***	
FY2006	2,109.7	725.7	
FY2007	5,892.1 ***	2,730.4	
FY2008	6,231.6 ***	7,636.6 **	
FY2009	19,845.0 ***	6,018.2	
FY2010	22,266.4 ***	-10,290.1 ***	
FY2011	-12,993.5 ***	-5,265.7	
FY2012	-29,918.0 ***	-7,126.2 *	
FY2013	-24,337.2 ***	-9,179.5 **	
April	-3,710.8 ***	9,555.9 ***	
May	-4,289.7 ***	-9,682.4 ***	
June	1,263.5	-14,456.5 ***	
July	2,263.8 *	-12,311.7 ***	
August	1,045.9	-8,438.2 ***	
September	682.8	5,130.7 *	
October	2,712.9 **	2,527.0	
November	6,974.9 ***	15,827.9 ***	
December	3,192.8 **	-125.2	
January	-3,268.5 ***	10,896.5 ***	
February	-3,362.4 ***	2,628.7	
March	-3,505.3 ***	-1,552.6	
Constant	67,921.6 ***	173,396.8 ***	
F statistic	129.6	130.7	
Sample size	177,553	177,553	

Notes:

1. *, **, and *** indicate significance at the 10%, 5%, and 1% levels, respectively.
2. CD: Durable goods, SD: Semi-durable goods, ND: Non-durable goods, CS: Services.

Appendix H. Estimation results of equivalent income

Estimation method: WLS

Dependant variable: Equivalent income (log)		(i) Employed households	(ii) Individual sales households	(iii) Unemployed households
Male household head dummy		0.148 ***	0.037 **	0.023 ***
Age of household head		0.034 ***	0.016 ***	0.009 **
Age of household head (squared)		0.000 ***	0.000 ***	0.000 **
Pension beneficiary household dummy				-0.022 **
Spouse employment dummy		0.158 ***	0.078 ***	0.152 ***
Equivalent financial assets (log)		0.094 ***	0.114 ***	0.100 ***
Equivalent dwelling area		0.002 ***	0.001 ***	0.002 ***
Regional dummies (base: Special wards of Tokyo and ordinance-designated cities)	Hokkaido, Tohoku, Hokuriku	-0.111 ***	-0.107 ***	-0.061 ***
	Kanto, Koshin	-0.028 ***	-0.040 ***	-0.010
	Tokai, Kinki	-0.083 ***	-0.102 ***	-0.054 ***
	Chugoku, Kyushu, Shikoku	-0.127 ***	-0.120 ***	-0.078 ***
Workplace size dummies (base: <99 employees)	100-999	0.083 ***		
	1,000-	0.172 ***		
	Government office	0.158 ***		
	unknown	0.065 ***		
Employer Industry dummies (base: Services & others)	Mining & construction	0.023 ***	0.000	
	Manufacturing	-0.019 ***	-0.007	
	Utility, transportation & communication	0.016 ***	0.030 *	
	Wholesale & retail trade, restaurants	-0.032 ***	-0.043 ***	
	Finance insurance & real estate	0.031 ***	0.200 ***	
	Public service	-0.031 ***	0.216 **	
	Agriculture, forestry & fishing	-0.068 ***	0.030	
Household head occupation dummies (base: (i) Private sector employees, (ii) Merchants & artisans)	Permanent laborers	-0.190 ***		
	Temporary and day laborers	-0.288 ***		
	Government and municipal employees	0.064 ***		
	Sole proprietors		0.339 **	
	Corporate Owners		0.487 ***	
	Freeholder		0.134 ***	
	Others		0.322 ***	
Family Employee		-0.187 ***		
Fiscal year dummies (base: FY2005)	FY2006	-0.005	0.001	-0.007
	FY2007	-0.010	0.016	-0.009
	FY2008	-0.005	-0.011	-0.018 *
	FY2009	-0.014 **	-0.017	-0.009
	FY2010	-0.022 ***	-0.019	-0.024 **
	FY2011	-0.035 ***	0.007	-0.026 **
	FY2012	-0.042 ***	0.008	-0.044 ***
FY2013	-0.028 ***	0.016	-0.043 ***	
Constant		4.236 ***	4.579 ***	4.573 ***
R ²		0.435	0.327	0.222
Sample size		66,104	19,544	35,675

Notes: *, **, and *** indicate significance at the 10%, 5%, and 1% levels, respectively.

Appendix I. Estimation results of equivalent consumption

		Estimation method: WLS		
Dependant variable: Equivalent consumption (log)				
		(i) Employed households	(ii) Individual sales households	(iii) Unemployed households
Male household head dummy		0.120 ***	0.032 **	0.119 ***
Age of household head		0.020 ***	0.012 ***	0.016 ***
Age of household head (squared)		0.000 ***	0.000 ***	0.000 ***
Pension beneficiary household dummy				0.067 ***
Spouse employment dummy		0.090 ***	0.032 ***	0.037 ***
Equivalent financial assets (log)		0.080 ***	0.103 ***	0.115 ***
Equivalent dwelling area		0.002 ***	0.001 ***	0.002 ***
Regional dummies (base: Special wards of Tokyo and ordinance-designated cities)	Hokkaido, Tohoku, Hokuriku	-0.096 ***	-0.131 ***	-0.104 ***
	Kanto, Koshin	-0.033 ***	-0.060 ***	-0.041 ***
	Tokai, Kinki	-0.075 ***	-0.104 ***	-0.078 ***
	Chugoku, Kyushu, Shikoku	-0.119 ***	-0.154 ***	-0.121 ***
Workplace size dummies (base: -99 employees)	100-999	0.057 ***		
	1,000-	0.100 ***		
	Government office	0.117 ***		
	unknown	0.034 ***		
Employer Industry dummies (base: Services & others)	Mining & construction	-0.014 ***	-0.005	
	Manufacturing	-0.020 ***	0.015	
	Utility, transportation & communication	-0.008	0.048 ***	
	Wholesale & retail trade, restaurants	-0.041 ***	-0.035 ***	
	Finance insurance & real estate	-0.026 ***	0.169 ***	
	Public service	-0.052 ***	0.087	
	Agriculture, forestry & fishing	-0.032	0.003	
Household head occupation dummies (base: (i) Private sector employees, (ii) Merchants & artisans)	Permanent laborers	-0.125 ***		
	Temporary and day laborers	-0.149 ***		
	Government and municipal employees	0.002		
	Sole proprietors		0.157 ***	
	Corporate Owners		0.263 ***	
	Freeholder		0.117 ***	
	Others		0.149 ***	
Family Employee	**	-0.121 ***		
Fiscal year dummies (base: FY2005)	FY2006	-0.016 **	-0.005	0.011
	FY2007	0.002	0.027 **	0.024 **
	FY2008	0.003	-0.004	0.018 *
	FY2009	0.001	0.002	0.034 ***
	FY2010	-0.009	0.007	0.018 *
	FY2011	-0.020 ***	0.004	0.013
	FY2012	-0.014 **	0.020	0.031 ***
FY2013	0.003	0.009	0.057 ***	
Constant		13.375 ***	13.512 ***	13.151 ***
R ²		0.280	0.266	0.270
Sample size		66,104	19,544	35,675

Notes: *, **, and *** indicate significance at the 10%, 5%, and 1% levels, respectively.

Appendix J. Estimation results of the rent function

		Estimation method: WLS	
Estimation period		FY2004–2013	
Dependant variable: Rent per unit area for “Private rental housing (facilities only) and private rental housing (facilities shared)” (log, JPY)			
Structure dummies (base: wooden)	Fireproof wooden construction	0.126 ***	Hokkaido -0.606 ***
	Reinforced concrete	0.236 ***	Aomori -0.598 ***
	Block and others	0.188 ***	Iwate -0.447 ***
Total floor area dummies (base: 70-200 m ²)	—40m ²	0.920 ***	Miyagi -0.539 ***
	40—70m ²	0.440 ***	Akita -0.541 ***
	70—100m ²	-0.131 ***	Yamagata -0.462 ***
	100—130m ²	-0.131 ***	Fukushima -0.553 ***
	130—160m ²	-0.131 ***	Ibaraki -0.433 ***
Special wards & ordinance-designated cities dummy		0.097 ***	Tochigi -0.433 ***
Rural area dummy		-0.084 ***	Gunma -0.445 ***
			Saitama -0.187 ***
Household annual income dummies (base: 4-6 million yen)	—2 million yen	-0.201 ***	Chiba -0.236 ***
	2—4 million yen	-0.074 ***	Kanagawa -0.194 ***
	4—6 million yen	0.042 ***	Niigata -0.448 ***
	6—8 million yen	0.137 ***	Toyama -0.537 ***
	8—12 million yen	0.178 ***	Ishikawa -0.475 ***
	12 million yen ~	0.178 ***	Fukui -0.428 ***
Household head age dummies (base: 40s)	20s	0.050 ***	Yamanashi -0.436 ***
	30s	0.021	Nagano -0.476 ***
	40s	-0.060 ***	Gifu -0.512 ***
	50s	-0.040 ***	Shizuoka -0.395 ***
	60s	-0.086 ***	Aichi -0.461 ***
Fiscal year dummies (base: FY2004)			Mie -0.525 ***
			Shiga -0.372 ***
			Kyoto -0.398 ***
			Osaka -0.355 ***
			Hyogo -0.342 ***
			Nara -0.371 ***
			Wakayama -0.543 ***
			Tottori -0.496 ***
			Shimane -0.470 ***
			Okayama -0.488 ***
			Hiroshima -0.452 ***
			Yamaguchi -0.613 ***
			Tokushima -0.493 ***
		Kagawa -0.473 ***	
		Ehime -0.528 ***	
		Kochi -0.456 ***	
		Fukuoka -0.532 ***	
		Saga -0.568 ***	
		Nagasaki -0.527 ***	
		Kumamoto -0.586 ***	
		Oita -0.582 ***	
		Miyazaki -0.541 ***	
		Kagoshima -0.463 ***	
		Okinawa -0.639 ***	
Constant		9.359 ***	
R ²		0.535	
F statistic		130.77	
Sample size		25,556	

Notes: *, **, and *** indicate significance at the 10%, 5%, and 1% levels, respectively.

Appendix K. Figures and standard deviation of the graphs

The p50 figures are the average of the median of the consumption burden tax rate estimated from 1,000 simulations. The figures for p25 and p75 are obtained by the same process for the first and third quartiles. Moreover, the figures for p25 SD -- p75 SD are the standard deviations obtained from 1,000 simulations.

	Deciles	p25	p50	p75	p25 SD	p50 SD	p75 SD
Fig 4.1	1	0.02135	0.02972	0.04059	0.000080	0.000087	0.000135
	2	0.02146	0.02943	0.03966	0.000071	0.000085	0.000116
	3	0.02150	0.02949	0.03944	0.000075	0.000085	0.000115
	4	0.02126	0.02897	0.03886	0.000071	0.000077	0.000120
	5	0.02048	0.02786	0.03761	0.000066	0.000083	0.000137
	6	0.01970	0.02699	0.03638	0.000067	0.000077	0.000118
	7	0.01919	0.02600	0.03478	0.000067	0.000070	0.000113
	8	0.01888	0.02548	0.03404	0.000067	0.000063	0.000119
	9	0.01851	0.02472	0.03290	0.000060	0.000064	0.000111
	10	0.01718	0.02345	0.03145	0.000053	0.000063	0.000110
Fig 4.2	1	0.01981	0.02806	0.03918	0.000066	0.000090	0.000131
	2	0.01986	0.02729	0.03696	0.000064	0.000081	0.000126
	3	0.01978	0.02675	0.03593	0.000059	0.000083	0.000113
	4	0.01941	0.02630	0.03540	0.000063	0.000080	0.000118
	5	0.01946	0.02651	0.03578	0.000068	0.000071	0.000118
	6	0.01985	0.02685	0.03581	0.000063	0.000074	0.000111
	7	0.01973	0.02666	0.03569	0.000070	0.000071	0.000103
	8	0.01999	0.02720	0.03704	0.000067	0.000073	0.000118
	9	0.02031	0.02790	0.03793	0.000063	0.000073	0.000124
	10	0.01963	0.02762	0.03845	0.000069	0.000083	0.000122
Fig 4.3	1	0.02044	0.02867	0.03964	0.000081	0.000097	0.000135
	2	0.02031	0.02809	0.03819	0.000067	0.000078	0.000134
	3	0.01995	0.02764	0.03736	0.000070	0.000079	0.000128
	4	0.02020	0.02760	0.03699	0.000066	0.000086	0.000116
	5	0.02035	0.02763	0.03713	0.000065	0.000072	0.000119
	6	0.02011	0.02741	0.03666	0.000060	0.000071	0.000116
	7	0.02024	0.02704	0.03626	0.000068	0.000072	0.000117
	8	0.01955	0.02644	0.03556	0.000063	0.000071	0.000112
	9	0.01910	0.02572	0.03470	0.000059	0.000072	0.000115
	10	0.01805	0.02482	0.03396	0.000058	0.000063	0.000110
Fig 4.4	1	0.01770	0.02508	0.03495	0.000053	0.000066	0.000115
	2	0.01896	0.02608	0.03561	0.000059	0.000068	0.000112
	3	0.01901	0.02598	0.03512	0.000052	0.000063	0.000101
	4	0.01917	0.02606	0.03527	0.000054	0.000069	0.000110
	5	0.01930	0.02657	0.03574	0.000057	0.000069	0.000109
	6	0.01974	0.02673	0.03592	0.000054	0.000064	0.000102
	7	0.01962	0.02691	0.03637	0.000061	0.000066	0.000107
	8	0.01957	0.02675	0.03628	0.000053	0.000069	0.000109
	9	0.01969	0.02716	0.03702	0.000062	0.000068	0.000119
	10	0.01903	0.02690	0.03742	0.000052	0.000063	0.000112
Fig 4.5	1	0.01307	0.01855	0.02652	0.000044	0.000060	0.000104
	2	0.01578	0.02159	0.02982	0.000047	0.000063	0.000098
	3	0.01733	0.02350	0.03177	0.000048	0.000062	0.000103
	4	0.01863	0.02500	0.03335	0.000049	0.000058	0.000098
	5	0.01964	0.02615	0.03449	0.000052	0.000067	0.000098
	6	0.02057	0.02707	0.03567	0.000050	0.000062	0.000091
	7	0.02163	0.02822	0.03706	0.000052	0.000060	0.000098
	8	0.02244	0.02937	0.03854	0.000057	0.000067	0.000106
	9	0.02351	0.03064	0.04048	0.000060	0.000071	0.000120
	10	0.02574	0.03564	0.05077	0.000079	0.000103	0.000207
Fig 5	1	0.01842	0.02623	0.03645	0.000072	0.000089	0.000125
	2	0.01922	0.02659	0.03648	0.000066	0.000083	0.000125
	3	0.01972	0.02709	0.03652	0.000068	0.000079	0.000113
	4	0.02018	0.02737	0.03688	0.000070	0.000083	0.000110
	5	0.02067	0.02817	0.03742	0.000066	0.000072	0.000129
	6	0.02055	0.02788	0.03743	0.000062	0.000085	0.000116
	7	0.02037	0.02734	0.03699	0.000064	0.000074	0.000125
	8	0.02019	0.02725	0.03672	0.000061	0.000065	0.000120
	9	0.01984	0.02646	0.03571	0.000060	0.000074	0.000114
	10	0.01896	0.02613	0.03606	0.000066	0.000081	0.000126
Fig 6.1	1	0.02013	0.02722	0.03764	0.000166	0.000199	0.000292
	2	0.02029	0.02664	0.03501	0.000175	0.000167	0.000296
	3	0.02026	0.02649	0.03420	0.000150	0.000175	0.000257
	4	0.02039	0.02673	0.03490	0.000145	0.000166	0.000276
	5	0.02056	0.02632	0.03418	0.000132	0.000166	0.000262
	6	0.02022	0.02593	0.03401	0.000161	0.000167	0.000248
	7	0.02058	0.02587	0.03326	0.000138	0.000155	0.000238
	8	0.02067	0.02641	0.03416	0.000163	0.000171	0.000232
	9	0.02024	0.02591	0.03310	0.000152	0.000181	0.000238
	10	0.02018	0.02647	0.03407	0.000160	0.000171	0.000249
Fig 6.2	1	0.01832	0.02578	0.03547	0.000396	0.000372	0.000979
	2	0.01993	0.02686	0.03706	0.000406	0.000422	0.000829
	3	0.01989	0.02828	0.03746	0.000464	0.000357	0.000588
	4	0.02089	0.02909	0.03830	0.000348	0.000403	0.000731
	5	0.02001	0.02801	0.03673	0.000468	0.000590	0.000784
	6	0.02041	0.02778	0.03867	0.000363	0.000534	0.000823
	7	0.02058	0.02822	0.03692	0.000475	0.000386	0.000695
	8	0.02104	0.02813	0.03626	0.000621	0.000408	0.000677
	9	0.01854	0.02646	0.03617	0.000378	0.000514	0.000597
	10	0.01844	0.02352	0.03166	0.000198	0.000309	0.000865
Fig 6.3	1	0.01975	0.02725	0.03537	0.000160	0.000187	0.000253
	2	0.02135	0.02848	0.03737	0.000142	0.000201	0.000297
	3	0.02270	0.03000	0.03828	0.000147	0.000161	0.000231
	4	0.02317	0.03035	0.03940	0.000155	0.000160	0.000257
	5	0.02407	0.03075	0.03883	0.000131	0.000140	0.000248
	6	0.02476	0.03207	0.04130	0.000175	0.000177	0.000291
	7	0.02485	0.03245	0.04247	0.000153	0.000177	0.000287
	8	0.02601	0.03350	0.04425	0.000153	0.000201	0.000367
	9	0.02566	0.03382	0.04571	0.000196	0.000172	0.000322
	10	0.02567	0.03530	0.04765	0.000191	0.000280	0.000389