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Abstract

We test the Life Cycle/Permanent Income Hypothesis (LCPIH) using Japan's 2014 value-added tax (VAT) rate increase as a natural experiment. The VAT rate increase represents an unanticipated and proportional reduction in lifetime resources for several reasons: few goods and services are exempt from the VAT; the tax rate increase was uncompensated; it was fully passed on to households in the form of higher prices; and the VAT increase was not anticipated prior to Prime Minister Shinzo Abe's October 2013 announcement. Contrary to the excess smoothness literature, we find that consumption fell in proportion to the income shock upon announcement, implying that we cannot reject the LCPIH.

Keywords: Consumption tax, Income effects, Excess smoothness, Household consumption
JEL classification: H24; H31; D12

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1 Introduction

In this study, we estimate the consumption response to a permanent negative income shock. In April 2014, Japan's Consumption Tax, which is a Value-Added Tax (VAT), increased from five to eight percent. The Japanese government also scheduled a subsequent tax rate increase from eight to ten percent to take effect in October 2015. These executed and planned Consumption Tax rate increases present a strong natural experiment to test the Life-Cycle/Permanent Income Hypothesis (LCPIH), one of the most important theoretical frameworks for analyzing household decision-making.[1]

In the LCPIH literature, most studies have found that the consumption response to an unanticipated permanent income shock is relatively small. Campbell and Deaton (1989), the seminal paper in this literature, presents the "excess smoothness" concept, defined as consumption being too smooth in the sense that it does not respond sufficiently to an innovation to the permanent component of income. In other words, a household responds to an unanticipated and permanent one percent reduction in lifetime resources by reducing consumption less than one percent. Several other studies have attempted to test for evidence of excess smoothness using macro-data (see West, 1988; Gali, 1991; Hansen, Roberds and Sargent, 1991; Flavin, 1993).

However, few studies test for evidence of excess smoothness using micro-data. One exception is Attanasio and Pavoni (2011), which shows that observed excess smoothness is consistent with households possessing more insurance than they would in the standard single asset model. While Attanasio and Pavoni (2011) use what Jappelli and Pistaferri (2010) refer to as a statistical decomposition of income shocks, we employ a quasi-experimental approach. To fulfill a test of the LCPIH using a quasi-experimental approach, the primary methodological challenges are, in general, identifying an income change that is permanent and the time at which households recognize the shock. Since expected income process is quite private and idiosyncratic information, much less information is available with public data that they have (See Flavin, 1983; Pistaferri, 2001). However, exploiting the 2014 Consumption Tax rate increase episode, we can identify a permanent and unanticipated shock.

Unlike VAT in many other countries, Japan's Consumption Tax has a single rate with relatively few exemptions. The government has encouraged the burden of the Consumption Tax rate increases to be borne fully by consumers, implying that a higher tax rate

[1] For recent survey for the LCPIH literature, see Attanasio and Weber (2010) and Jappelli and Pistaferri (2010).

leads to a proportional increase in consumer prices. Consequently, under the assumption that the Consumption Tax rate increases did not affect nominal income expectations, a VAT rate increase in Japan induced a proportional decrease in lifetime resources.

In addition, although the legislative process for the Consumption Tax rate increases concluded in 2012 under outgoing Prime Minister Yoshihiko Noda, it was not at all clear whether incoming Prime Minister Shinzo Abe would confirm their implementation, as the Consumption Tax rate increases were at odds with his economic stimulus program, known as "Abenomics". As such, Abe's October 1, 2013 confirmation that the tax rate increases would be implemented as originally planned were not predictable prior to his announcement. It is, therefore, reasonable to assume that all Japanese households faced the same negative shock at the same time.

Beyond the primary methodological challenges, there exist additional issues that we must address in order to identify the consumption response to the negative income shock. Unlike a pure innovation to income such as an unexpected and permanent salary increase, the announcement of a VAT rate increase prior to its implementation incentivizes households to engage in substitution of consumption over time (intertemporal), substitution between goods (intratemporal), and stockpiling behavior. Building on Cashin and Unayama (2016), our theoretical model and resulting empirical specification distinguish between the income, intratemporal substitution, and intertemporal substitution effects associated with the Consumption Tax rate increase. A testable implication of the model is that, upon announcement of the Consumption Tax rate increase in October 2013, household consumption should fall one-to-one with the reduction in lifetime resources once we appropriately control for substitution effects.

Our main result is that we cannot reject that household consumption fell in proportion to the reduction in lifetime resources. In other words, our result is consistent with households that consume according to the LCPIH, but is inconsistent with excess smoothness. Our baseline regression estimate shows that after controlling for substitution effects, household consumption declined by 5.19 percent following Prime Minister Abe's October 2013 announcement, or 1.1 times the reduction in lifetime resources.

A potential concern with our approach is that while our model and the empirical specification that we derive from it assume that households can respond to permanent and unanticipated changes in future real income income, in reality not all households can. In particular, we would not expect hand-to-mouth (HtM) households to respond to announcement of the Consumption Tax rate increase according to the LCPIH. If a

sudden drop in household consumption for HtM households upon announcement of the Consumption Tax rate increase was at least partially responsible for the proportionate fall in consumption observed for the whole sample, we may erroneously conclude that household consumption is consistent with the LCPIH. In addition, a sudden drop in consumption for HtM households upon announcement may be indicative of a confounding factor unrelated to the Consumption Tax rate increase that biases our results.

As such, we separate HtM and non-HtM households according to Kaplan, Violante, and Weidner (2014) and Hara, Unayama, and Weidner (2015), and compare the consumption responses following announcement of the Consumption Tax rate increase. Further reinforcing our baseline result, we find that upon announcement, HtM household consumption remained stable, while we cannot reject that non-HtM consumption fell in proportion to the reduction in lifetime resources. Furthermore, after controlling for substitution effects, we show that non-HtM consumption was significantly lower in the year following implementation of the Consumption Tax rate increase than it was beforehand, while HtM consumption grew roughly in proportion to income.

Coupled with the small announcement effect estimates for the compensated April 1997 VAT rate increase discussed in Cashin and Unayama (2016), the main result of this paper - that household consumption responds to a VAT rate change in a manner consistent with the LCPIH - has an important implication for future changes in VAT rates. In the absence of significant offsetting compensation to households, governments should expect to observe a decline in household consumption that is proportional to the VAT rate increase. On the contrary, our HtM results suggest that the decline in household consumption may not be as acute for countries such as the United States that possess a higher proportion of HtM households than Japan.

The remainder of the paper is organized as follows. Section 2 discusses why Japan's 2014 Consumption Tax rate increase presents a strong natural experiment to estimate the impact of a permanent shock to income. Section 3 lays out our identification assumptions, methods for separately identifying income and substitution effects, empirical specification, and the data. We present the results in Section 4. Section 5 concludes.

2 Consumption Tax Rate Increase as a Permanent Shock

In this section, we discuss the features and history of Japan's Consumption Tax, as well as the reasons why the 2014 and (planned) 2015 Consumption Tax rate increases represented a proportional decrease in households' lifetime resources. The Japanese government introduced the Consumption Tax in 1989 at a rate of three percent, and in 1997, increased the rate to five percent. In April 2014, the government increased the tax rate from five to eight percent, with an additional increase to ten percent planned for October 2015. However, in December 2014 the government postponed the planned Consumption Tax rate increase until April 2017.

Due to the legal and institutional features of Japan's Consumption Tax, we can treat the most recent tax rate increase as a permanent income shock that is roughly proportional to the percentage increase in the tax rate. First, unlike VAT in many other countries, the Consumption Tax has a single flat rate with relatively few exemptions. Based on the weights for the Consumer Price Index (CPI), more than 80 percent of household expenditure is taxable, with "pre-committed" expenditures such as "Rent for housing" and "School tuition" comprising the major tax-exempt items.[2]

Second, as documented by Ishi (2001), the Japanese government has repeatedly made it clear that it expects the burden of the Consumption Tax to be borne fully by consumers, and this is in fact what has been observed. Each time the government increases the Consumption Tax rate, it carries out an extensive advertising campaign to ensure that consumers bear the full burden of the tax rate increase in the form of higher prices (See Cashin and Unayama, 2016). Due to the efforts of the government, prices increased by roughly the same percentage as the tax rate upon implementation. In April 1989, prices on goods and services not previously subject to tax increased by approximately three percent. Likewise, in April 1997, prices on goods subject to the Consumption Tax increased by about two percent. It is thus reasonable to believe that households expected to bear the full burden of the 2014 and 2015 Consumption Tax increases, and in turn

[2]Exemptions include transfer or lease of land, transfer of securities, transfer of means of payment, interest on loans and insurance premiums, transfer of postal and revenue stamps, fees for government services, international postal money orders, foreign exchange, medical care under the Medical Insurance Law, social welfare services specified by the Social Welfare Services Law, midwifery service, burial and crematory service, transfer or lease of goods for physically handicapped persons, tuition, entrance fees, facilities fees, and examinations fees of schools designated by the Articles of the School Education Law, transfer of school textbooks, and the lease of housing units.

experience a proportional loss in lifetime resources.

In fact, we observe a similar pattern in prices. Figure 1 shows the CPI for total consumption, non-storable non-durable goods and services, and tax-exempt goods and services before and after the 2014 Consumption Tax rate increase. The overall CPI is very stable throughout the sample period except for April 2014 when the government implemented the tax rate increase. We observe that the CPI for non-storable non-durable goods and services, our dependent variable in this study, jumped by nearly three percent between March and May 2014. As was the case in 1989 and 1997, the price jump is quite similar to the percentage increase in the Consumption Tax rate (2.85). On the contrary, the CPI for tax-exempt goods and services is roughly constant throughout the sample period, suggesting that the price changes observed around implementation were due solely to the tax rate increase.

While prices jumped in proportion to the Consumption Tax rate increase upon implementation, other factors affecting households' budget sets, such as nominal income expectations and interest rates, were stable. In addition, given the well-documented financial strains on the Japanese "pay-as-you-go" public pension system, there was no reason to believe that the government would reduce the Consumption Tax rate in the future.

Finally, unlike the 1989 and 1997 Consumption Tax rate implementation and increase, households received little to no offsetting compensation in 2014. Households who are not subject to the income tax because of low income and who receive the earnings-tested child benefit were eligible to receive a cash rebate from the Japanese government to offset the additional burden imposed by the Consumption Tax rate increase. However, the rebate was only worth 10,000 yen (roughly 100 US dollar) per eligible individual, with total expenditures on the rebate equaling only 180 billion yen, or about 3 percent of the revenue increase per year resulting from the Consumption Tax rate increase. On the contrary, the 1989 implementation and 1997 tax rate increases were a part of tax system reform and intended to be revenue-neutral changes. For these reasons, we can treat the most recent Consumption Tax rate increase as a permanent income shock for which the income path permanently shifted down.

3 Theoretical Framework and Empirical Specification

3.1 The Model

As we have seen above, a VAT rate change in Japan represents a permanent negative shock to lifetime resources. Once an income shock is known to occur, consumption would change immediately through the "income effects" regardless of whether income itself has changed. Accordingly, we should look at the consumption changes at the timing of the announcement to evaluate the long-run impacts of the 2014 VAT rate increase.

However, the announcement of a VAT rate would affect consumption through other channels. Since,unlike a pure income shock, the future VAT rate increase incentivizes households to engage in substitution of consumption over time. Households have an incentive to increase consumption prior to a VAT rate increase when prices are relatively low even if all goods and services are non-storable and non-durable, which is referred as "intertemporal substitution effects". In addition, they have an even stronger incentive to increase spending, not necessarily consumption, on durable (e.g. televisions) and storable (e.g. toilet paper) goods and services, which can be purchased at a relatively low price prior to the tax rate hike and consumed later. Barrell and Weale (2009) refer to such behavior as an "arbitrage effect". The arbitrage effect makes the short-run impacts more complicated because purchases of durables may cause a substitution between goods and services referred as "intratemporal substitution effects". For example, a purchase of a television may increase electricity bill.

To address these short-run disturbances, Cashin and Unayama (2016) restrict their analysis to non-storable non-durable goods and services because the timing of consumption for these goods and services, which is unobservable, roughly coincides with the timing of expenditure, which the econometrician observes. In addition, Cashin and Unayama (2016) propose a regression specification to control the intratemporal substitutions. However, the model do not explicitly consider how an announcement of a VAT rate change affects consumption.

Although Cashin and Unayama (2016) empirically confirmed significant impacts of the short-run effects, we firstly construct a model in which non-storable non-durable consumption is separable from durable and storable consumptions, and thereby, ignore effects of storability and durability at this stage.

Firstly, let the utility maximization problem of a household be as follows:

$$\max_{\{c_s|s=t+1\cdots\infty\}} U_t = u(c_t) + E_t\left[\sum(\frac{1}{1+\delta})^{s-t}u(c_s)\right], \quad (1)$$

$$s.t. \qquad A_t + y_t + E_t\left[\sum \frac{y_t}{(1+r)^{s-t}}\right] = c_t + E_t\left[\sum \frac{p_s c_s}{(1+r)^{s-t}}\right]. \quad (2)$$

where c_s is consumption of non-storable non-durable goods and services (N); δ is the subjective discount rate; r is interest rate, which is assumed to be constant; A_t is non-human capital wealth; y_s is income, which is a random variable; p_s is the price of N.

Suppose a $100(\tau_1+\tau_2)$ percent stepwise VAT tax rate increase is planed at time S_1 and S_2, respectively. However, households are not confident of the implementation of tax rate increase and subjective probability of the implementation at time t is ρ_t. Also suppose the tax rate increase is the only source of price change; and so, $p_s = 1$ for $S_1 > s$; $= 1+\tau_1$ for $S_2 > s \geq S_1$; and $= 1+\tau_1+\tau_2$ for $s \geq S_2$;.

Using the first order conditions and the law of the iterated expectations, the followings hold:

$$u'(c_t) = \left(\frac{1+\delta}{1+r}\right)^{T-t} E_t\left[\frac{p_t}{p_T}u'(c_T)\right], \quad (3)$$

where period T is sufficiently after the planned second implementation (that is, $T > S_2$). In the specific case of isoelastic utility, $u(c) = c^{1-\varepsilon}/(1-\varepsilon)$,

$$c_t = \left(\frac{1+\delta}{1+r}\right)^{-\frac{T-t}{\varepsilon}} E_t\left[\frac{p_t}{p_T}c_T^{-\varepsilon}\right]^{-1/\varepsilon}. \quad (4)$$

Taking the log and difference between t and $t-1$ yeilds

$$\log c_t - \log c_{t-1} = -\frac{1}{\varepsilon}\left(\log\left(\frac{1+\delta}{1+r}\right) + \log E_t\left[\frac{p_t}{p_T}c_T^{-\varepsilon}\right] - \log E_{t-1}\left[\frac{p_{t-1}}{p_T}c_T^{-\varepsilon}\right]\right). \quad (5)$$

Here, we assume that a VAT rate increase does not affect the income process. Then, the expectation can be decomposed as below.

$$\log E_t\left[\frac{p_t}{p_T}c_T^{-\varepsilon}\right] = \log\left(\frac{\rho_t}{1+\tau_1 I_t^1 + \tau_2 I_t^2}E_t\left[c_T^{-\varepsilon}|\Omega=1\right] + (1-\rho_t)E_t\left[c_T^{-\varepsilon}|\Omega=0\right]\right) \quad (6)$$

where I_t^1 and I_t^2 are indicator functions, $I_t^k = 1$ if $S_k > t$ and $= 0$ afterwards; $\Omega = 1$ represents the situation in which the VAT is actually increased; and $\Omega = 0$ does in which not. Since T is the period after the implementation, the price is expected to be lower

only if $\Omega = 1$.

Under the two assumptions 1) the income process is not affected by a VAT rate increase, 2) the utility function is additively separable across periods with the isoelastic instantaneous utility function, a permanent price increase is a synonym of a reduction of lifetime resources and induces a proportional consumption drop through income effects. Accordingly, given the wealth holding, consumption at peirod T, sufficiently after the planned implementation, should be proportionally lower if the VAT rate would be increased, or $\Omega = 1$.

Additionally, since households would spend more due to the intertemporal substitution effects, the non-human-capital wealth should be lower, or $E_t[A_T|\omega = 0] > E_t[A_T|\omega = 1]$. Consumption would thereby be lower than the proportional level.

However, if the period between the announcement and the implementation is not so long, the impacts of the intertemporal substitution effects, $E_t[A_T|\omega = 0] - E_t[A_T|\omega = 1]$ are negligiblely small compare to the total lifetime resources including human capital wealth. The following relationship, therefore, should be true:

$$\frac{E_t\left[c_T^{-\varepsilon}|\Omega = 1\right]}{E_t\left[c_T^{-\varepsilon}|\Omega = 0\right]} \sim (1 + \tau_1 + \tau_2)^{-\varepsilon}. \tag{7}$$

Putting this into (6) yeilds

$$\begin{aligned}
\log E_t\left[\frac{p_t}{p_T}c_T^{-\varepsilon}\right] &= \log E_t\left[c_T^{-\varepsilon}|\Omega = 0\right] \\
&\quad + \log\left(1 + \rho_t\left(\frac{1}{1 + \tau_1 I_t^1 + \tau_2 I_t^2}\frac{E_t\left[c_T^{-\varepsilon}|\Omega = 1\right]}{E_t\left[c_T^{-\varepsilon}|\Omega = 0\right]} - 1\right)\right) \\
&= \log E_t\left[c_T^{-\varepsilon}|\Omega = 0\right] \\
&\quad + \log\left(1 + \rho_t((1 + \tau_1 I_t^1 + \tau_2 I_t^2)^{-1}(1 + \tau_1 + \tau_2)^{-\varepsilon - 1} - 1)\right)
\end{aligned} \tag{8}$$

Using the first order approximation and and rearranging terms, the consumption change between period t and $t - 1$ can be written as

$$\begin{aligned}
\log c_t - \log c_{t-1} &= -\frac{1}{\varepsilon}\left(r - \delta - \left(\rho_t I_t^1 - \rho_{t-1} I_{t-1}^1\right)\tau_1 - \left(\rho_t I_t^2 - \rho_{t-1} I_{t-1}^2\right)\tau_2\right) \\
&\quad - \left(\rho_t - \rho_{t-1}\right)\left(\tau_1 + \tau_2\right) + \eta_t
\end{aligned} \tag{9}$$

where $\eta_t = \log E_t\left[c_T^{-\varepsilon}|\Omega = 0\right] - \log E_{t-1}\left[c_T^{-\varepsilon}|\Omega = 0\right]$, which represents the evolution of

expectations on the income process.

The term $-(\rho_t - \rho_{t-1})(\tau_1 + \tau_2)$ captures the income effects. That is, the more a household become confident the VAT rate increase, the lower the consumption becomes. In a case in which people firstly know the increase without doubt at time t, consumption should be lower by the same rate as the tax rate increase.

On the other hand, the terms $(\rho_t I_t^k - \rho_{t-1} I_{t-1}^k)\tau_k/\varepsilon$ for $k = 1, 2$ represent the intertemporal substitution effects. Once households know the tax would be increase, they start engaging in arbitrage behavior and consumption would be higher than the long-run level in which the income effect is already taken into consideration. The size of the intertemporal subsitution effect should depend on the form of the instantaneous utitlity function, or ε. In addition, this clearly shows that consumption would drop at the time of implementation, or period S. Suppose households becomes hundred percent sure just before the implementation, $\rho_{S_k-1} = \rho_{S_k} = 1$, consumption drops by $100\tau_k/\varepsilon$ percent at period S_k because $I_{S_k}^k = 0$ and $I_{S_k-1}^k = 1$.

3.2 Announcement of the Consumption Tax Rate Increase

The model above shows that households would change their consumption when the new information arrives, while it is, in general, quite difficult to identify what is the information set of each household especially when the information set varies across households. However, this difficulty can be overcome in our case by looking at the political timeline.

Since its inception, Japan's Consumption Tax has been a major political issue. This is especially true following the every-five-year actuarial review of pension schemes, as the government relies heavily on Consumption Tax revenue to finance the social security system of a rapidly aging society. This means we can think the tax rate should be a part of the information set of households.

Figure 2 reports the number of articles between 2010 and 2015 that mention the phrase "Consumption Tax" in the Yomiuri and Asahi newspapers, which are two leading non-business newspapers with a circulation of over 10 million (in 2010). During this period, the Consumption Tax received significant attention on several occasions along with the political timeline. With this figure, Japanese households would be well informed and share similar information about the tax increase.

Following the 2009 actuarial review, the government discussed a Consumption Tax rate increase, and the subsequent FY2009 Tax Reform Law required the government to

take legislative action to increase the Consumption Tax rate by 2011. Based on the Tax Reform Law, the Democratic Party of Japan (DPJ), which is defeated Liberal Democratic Party (LDP) in 2009 election, decided details about the Consumption Tax rate increase.

Prime Minister (PM) Yoshihiko Noda of DPJ submitted the bill with which the tax rate is increased stepwise. It set a target date of April 1, 2014, to increase the Consumption Tax rate from five to eight percent, and another two percent increase was scheduled on October 1, 2015. The Japanese Diet passed the Consumption Tax bill on August 10, 2012, which was the first official announcement of the tax rate increase.

In terms of words of the model we have constucted above, sizes of the first and the second increases, τ_1 and τ_2 are 0.03 and 0.02, respectively. Their planned date to take effect, S_1 and S_2 are April 1, 2014 and October 1, 2015, respectively.

However, despite passage of the legislation, it quickly became unclear whether the government would implement the Consumption Tax rate increase as planned. In late 2012, the LDP defeated the DPJ, and Shinzo Abe replaced Yoshihiko Noda as PM. PM Abe immediately reopened discussion of the Consumption Tax rate increase since he regarded the tax rate increase as a serious obstacle to "Abenomics", his cabinet's policy package intended to help the Japanese economy emerge from its long period of stagnation.

Since PM Abe repeatedly claimed that he reserved a right to postpone of the increase and "postpone" politically meant "stop", households became skeptical of feasibility of the rate increase. In fact, Figure 2 mentioned above shows that articles that contained words "Consumption Tax" and "postpone" was increased soon after his appointment. This suggests that people realistically believe the possibility that the increase would not be done; or in the model term, ρ_t became zero.

Debate over the proposed Consumption Tax rate increase culminated in the "Intensive Review Meetings", which began in late August 2013. During these meetings, PM Abe met with "specialists" including economists, company managers, and NPO representatives who advised him on the expected short- and long-run impacts of the Consumption Tax rate increase. The aftermath, on October 1, 2013, confirming that the majority of the meeting participants supported the increase, PM Abe finally declared that the government would increase the Consumption Tax rate as planned.

Reflecting the uncertainty about the decision, this announcement caused some surprises. Figure 3 shows indexes for stock prices, Nikkei 225 and TOPIX. It shows that stock prices sharply dropped right after the announcement in spite of up-ward trend just before and after the announcement. Although we cannot tell the true reason for the

price change, this suggests that there would be"new information". In addition, Figure 2 mentioned above shows that the number of articles including the word "Consumption Tax" hiked. That is, majority of households would recognize the decision; or in the model term, ρ_t would become one.

Using these political timeline of events from 2009 through 2015, simultaneous news coverage on the Consumption Tax and stock price movements around the announcement, we argue that the permanent income shock was revealed to all Japanese households in October 2013. In that sense, the 2014 VAT rate increase is a good natural experiment in which households face a negative income shock; the size and timing of the shock is known; and households know happening of the shock at the same time.

In addition to the main episode, it is worth while emphasizing that, in our 2014 episodes, there was another announcement. While the Consumption Tax Law initially scheduled the second increase in October 2015, discussions to postpone the second increase began as economic conditions had deteriorated beyond the government's expectations after the first increase took effect in April 2014.

Politically, the legislation allowed the government to reconsider the tax rate increase if it felt the increase was likely to cause serious harm to the economy. In fact, Figure 2 shows that postponement received a great deal of attention in the fourth quarter of 2014.

While a deadline to decide on the additional tax rate increase was set for March 31, 2015, PM Abe decided to postpone the further increase and dissolved the Diet in an effort to get the voting public to judge his decision in November 18, 2014. The LDP won the election on December 2014, and legislation that set a new date of April 1, 2017 for the increase passed the Diet on March 31, 2015.

The postponing the further increase is theoretically equivalent to an unexpected temporary income increase for the period between the planned (October 1, 2015) and the postponed (April 1, 2017) date. In that sense, the postponing of the further increase is equivalent to a temporal VAT tax cut like 2009 VAT cut in UK, and we should expect small consumption increase at the time of announcement.

With this episode, however, the timing of the announcement is relatively unclear. The fate of the postpone depend on the results of election, but it is true that the LDP was widely expected to win the December 2014 election. Moreover, the opposition parties, including the DPJ, largely agreed with postponement. Accordingly, we assume that the time of announcement of the postponing the further increase was sometime between late November 2014 and January 2015 in analysis below.

3.3 Empirical Specification

Here is discussed how the theoretical model presented above is applied to regression analysis. Before discussing the regression specification, we should firstly specify the time horizon. Since we use monthly data, a period is equal to one month. Since the the second increase has not implemented yet, we cannot evaluate the impacts of it.

Based on the derived relation by the model (9), the basic regression equation would be

$$\Delta \log c_t = const + \frac{1}{\varepsilon}(\tau_1 + \tau_2)D_{Oct,2013} - \frac{1}{\varepsilon}\tau_1 D_{Apr,2014} - (\tau_1 + \tau_2)D_{Oct,2013} + \eta_t \quad (10)$$

where $D_{Oct,2013}$ and $D_{Apr,2014}$ are month dummies for October, 2013 and April, 2014, respectively, since $\rho_t I_t^1 - \rho_{t-1} I_{t-1}^1 = 1$ and $\rho_t I_t^2 - \rho_{t-1} I_{t-1}^2 = 1$ in October, 2014, $\rho_t I_t^1 - \rho_{t-1} I_{t-1}^1 = -1$ in April, 2014, and $\rho_t - \rho_{t-1} = 1$ in October, 2013.

Since the dummy for October, 2013 appears twice, the regression equation of reduced form should be

$$\Delta \log c_t = const + \alpha D_{Oct,2013} + \gamma D_{Apr,2014} + \eta_t. \quad (11)$$

where α and γ corresponds $(-1 + 1/\varepsilon) * (\tau_1 + \tau_2)$ and $(-1/\varepsilon) * \tau_1$, respectively.

Our main interest is whether the arrival of news about a permanent income shock proportionally decrease the consumption. In other words, the LCPIH can explain the consumption responses associated with the VAT rate increase. With this specification, although we cannot observe the consumption change at the second implementation, we can get a testable implication of the LCPIH using the sum of the coefficients

$$-\frac{\alpha}{(\tau_1 + \tau_2)} + \frac{\gamma}{\tau_1} = 1. \quad (12)$$

Since τ_1 and τ_2 , the sizes of planned tax increases, are the size of negative permanent shock, the left hand side represents the marginal propensity to consume (MPC) out of the permanent shock. The equation (12) means that, as is true in the basic LCPIH mode, the MPC should be one, while excess smoothness literature shows smaller responses in consumption to a permanent shock; in our case, the MPC < 1.

Cashin and Unayama (2016) find the intertemporal elastisity of substitute (IES), or γ/τ_1 here, is around 0.2 looking at the consumption changes at the implementation of 1997 VAT rate increase. However, since the timing of announcement is unclear for the 1997 episode, they cannot evaluate the impact of the announce or α; and therefore, cannot test the impacts of the permanet income shock.

Until here, we have ignored the storability and durability of consumption goods, although Cashin and Unayama (2016) explicitly control the arbitrage effect and associated intra-temporal subistitution effects. In fact, it is evident that expenditures on D rose immediately after announcement. Figure 4 shows the average percentage deviation in household expenditures on D and N relative to September 2013 (the month prior to announcement) after controlling for seasonality, time-varying aggregate factors (e.g. number of holidays in a month), household fixed effects, and time-varying household characteristics. This suggests that intratemporal substitution may have been present as early as October 2013.

On the other hand, we expect that any intratemporal substitution between D and N should have ceased by September 2014. The same figure shows that expenditures on D remained elevated prior to the consumption tax rate increase, fell precipitously once the tax rate increase took effect, and then recovered by the third quarter of 2014.

Based on these durable expenditure patterns, Cashin and Unayama (2016) suggests to add the first difference of month dummies for the period in which the short-run impacts (that is, the arbitrage and intra-temporal substitution effects) presents.

Also, as we showed in the previous subsection, the postponing of the second increase would have positive impacts on consumption. Unlike announcement of the April 2014 consumption tax rate increase, however, the postponement announcement occurred in the middle of December 2014.To address this, we add the month dummies for December, 2014 and January, 2015.

Considering all of these as well as demographics and other controls, the specification below would be robust to the exsistence of the short-run impacts:

$$\begin{aligned}\Delta \log c_t &= const + \Delta X\beta + \phi(D_{Dec,2014} + D_{Jan,2015}) \\ &\quad + \sum_{t=Oct,2013}^{Sep,2014} \omega_t \Delta D_t + \alpha D_{Oct,2013} + \gamma D_{Apr,2014} + \eta_t, \qquad (13)\end{aligned}$$

where ΔX is a vector of (potentially) time-varying household-specific characteristics,

which includes the number of household members; the number of working household members; the number of household members under age 18; the number of household members above age 65; whether a household received a child benefit or pension payment; and interview dummies, which control for "survey fatigue", the tendency of households to report lower expenditure in later interviews (See Stephens and Unayama, 2011). It is worth noting that household-specific fixed effects are already controlled for by taking the first difference. To address the possibility of correlation among information updating, η, standard errors are clustered by household, and are thus robust to serial correlation within households. The coefficient ϕ captures the postponement effects.

With this specification, an identification problem arises since the combination of $D_{Oct,2013}$, $D_{Oct,2014}$, and $\Delta D_{Oct,2013}$ should be underidentified due to perfect collinearity. Specifically, we would be unable to identify our main interests, α and γ. To address this issue, we impose a restriction, $\omega_{Oct,2013} = 0$, that implies intratemporal substitution between D and N was not present in October 2013.

If our assumption is incorrect, α and γ might include $\omega_{Oct,2013}$ and the resulting estimates will be biased. Of the two possibilities, we believe it is much more likely that $\omega_{Oct,2013} > 0$ because expenditures on D jumped in October 2013 and we observe a positive and highly significant correlation between monthly changes in expenditures on D and N throughout our sample period and following announcement of the consumption tax rate increase. A positive $\omega_{Oct,2013}$ makes α and γ under- and over- estimated, respectively in absolute value.

4 Empirical Results

4.1 Data

We use data from the Japanese Family Income and Expenditure Survey (JFIES) to estimate the income effect.[3] The JFIES is a rotating panel survey in which households are interviewed for six consecutive months and approximately 8,000 households are interviewed each month.[4]

Our estimates make use of JFIES data from the period between October 2008 and

[3] See Stephens and Unayama (2011, 2012) for more information regarding the JFIES design and content.

[4] Until 2002, single-person and agricultural households were excluded from the JFIES. As of the 2009 JFIES, single-person households comprised 11.8 percent of the population and were responsible for 18.1 percent of expenditures, while agricultural households accounted for 2 percent of the population, and 2.1 percent of expenditures.

September 2015. We choose to exclude the period before the "Great Recession" years because trends in household expenditures were changed with large fluctuations. Our sample period ends due to the data availability. We use exact eight years so every month has eight observations for controlling the seasonality.

Following Cashin and Unayama (2016), we limit the sample to households: who are non-agricultural; who are male headed; whose head does not change his job. In addition, we restrict the sample to those who report the asset and debt information. Since more than 80 percent of households reports their wealth, we believe the restriction affects little. These sample restrictions leave us with 447,072 observations from 80,102 households.

Table 1 presents summary statistics for our sample as well as those reported in Table 2 of Cashin and Unayama (2016). Age of head is much older and number of working members is smaller in our sample than that in Cashin and Unayama (2016) reflecting rapid aging in Japan.

Also following Cashin and Unayama (2016), the JFIES expenditure data is divided into four groups: non-storable nondurables (N); durables (D); storables (S); and the tax exempted (E). As shown in Table 1, expenditure on taxed items comprised almost 80 percent of total expenditure, while most tax-exempt expenditure consists of rent for housing and education (e.g. tuition for school). Among taxable items, 60 percent is N, which is of our main interest, while expenditure on S and D are similar. We deflate monthly expenditures on N, S, and D using tax-inclusive consumer price indices specific to our categories.

To show the long-run impact, Table 1 also reports average expenditures for each category for one year before the announcement and after the announcement. All categories are decreased after the implementation by 3-7 percent. This observation is consistent with the prediction of the model in which the VAT increase is regarded as a permanent negative shock to the lifetime resources.

To show the short-run evolution of expenditures around the VAT increase, we displays plots of seasonally-adjusted real monthly household expenditure on N, S, D, and E in Panel B of Figure 4. More exactly saying, 1) we run a regression for each category in which month dummies as well as the compound factors we discuss below, 2) calculate the residuals and average them to make the "seasonally-adjusted" data. In Panel A of Figure 4, we also show the same figure for 1997 episodes from Cashin and Unayama (2016) as well.

Note that once expenditures on N are seasonally adjusted, as is the case in our empir-

ical specification presented in Section 3.3, there appears to be relatively little variation in N before and after implementation of the VAT increase, while expenditures on S and D exhibit a large spike in March 2014, followed by somewhat lower expenditure after the tax increase.

4.2 Regression Results: Pooled Results

Column 2 of Table 2 presents our baseline regression result. Upon announcement of the Consumption Tax rate increase in October 2013, household consumption fell by 2.79 percent (α), which is significant at the one percent level. This result implies that the negative income effect associated with the tax rate increase dominated the positive intertemporal substitution effect. We also find that once we properly control for intratemporal substitution effects, consumption fell by 1.51 percent (γ) upon implementation of the Consumption Tax rate increase in April 2014.

Given the 2.85 percent increase in the price level, we can infer that the IES is 0.53, which is larger than the corresponding estimate in Cashin and Unayama (2016). As we discussed above, if our identifying assumption that the intratemporal substitution effect was not present in October 2013 is incorrect, our IES estimate may be biassed upward.

As in Cashin and Unayama (2016), the intratemporal substitution effects, given by the coefficient estimates for the first differenced month dummies, are in general positive prior to the VAT rate increase, when durable arbitrage effects were present. The coefficient estimate for March 2014, when durable arbitrage peaked, is statistically significant at the one percent level. That is, non-durable consumption rose when the relative price of durables was lowest. Following the VAT rate increase, the coefficient estimates are generally negative, when durable expenditures dipped. Together, the estimates corroborate previous estimates showing that durables and non-durables are strong complements (see Pakos, 2011; Cashin and Unayama, 2016; and Cashin, 2016)[5].

Column 1 of Table 2 confirms the finding in Cashin and Unayama (2016) that failing to control for intratemporal substitution induces an estimate of the IES that is biased upwards. To test the robustness of the coefficients of interest to the choice of the period over which we allow for intratemporal substitution, we include additional first difference dummies for August and September 2014. The results appear in Columns 3 and 4 of

[5] As further evidence of the strong complementarities between durables and non-durables, we find a positive and highly significant correlation between monthly changes in household durable and non-storable non-durable expenditures during the period in which we allow for intratemporal substitution effects. From November 2013 to August 2014, the correlation is 0.08 with a p-value of 0.00.

Table 2. While the addition of the August 2014 dummy has a negligible impacts on our baseline results, inclusion of the September 2014 dummy reduces the IES estimate. Unlike the IES, the the announcement effect estimate is robust to the choice of the time horizon for which we allow intratemporal substitution effects.

Applying the estimates of α and γ to the left hand side of (12), we estimate the MPC out of the permanent shock. For our baseline specification presented in column 2, the estimated MPC is 1.11, which is not significantly different from 1. In other words, we cannot reject the hypothesis that the LCPIH can explain the decrease in consumption in response to the Consumption Tax rate increase. Inclusion of the first difference dummies for August and September 2014 does not affect our baseline result. Even when the September 2014 dummy is included, the estimated MPC is 0.66, and we cannot reject the LCPIH.

We also examine the impact of postponement of the October 2015 Consumption Tax rate increase to April 2017. In Column 2 of Table 2, we observe that household consumption jumped by 1.21 percent following the postponement, which is significant at the five percent level. The size of impacts are almost consistent with the evidence provided by Barrell and Weale (2009) and Crossley, Low and Wakefield (2009), in which they show the 2.5 percent temporal VAT cut in 2009 in UK would increase consumption by 1.2 percent. However, we should care more about difference between temporal cut and postponing of rate increase. This is for future research.

4.3 Heterogeneity between Non-HtM and HtM

Our baseline result is derived under an implicit assumption that all households can consume according to the LCPIH if they choose to do so; that is, we assume that the Euler equation derived from the LCPIH holds for all households. However, previous studies have shown that some households exhibit hand-to-mouth (HtM) behavior, in which a household consumes an amount equal to their current rather than permanent income. Testing whether households exhibit HtM behavior is also known as the excess sensitivity test, and several studies find the LCPIH is rejected by the test.[6]

If these households experienced a significant decline in current income in October 2013, we may erroneously conclude that household consumption behavior is consistent with the LCPIH due to a decline in consumption for households that by definition do not

[6]For example, see Parker (1999), Souleles (1999), Johnson, Parker, and Souleles (2006), Stephens and Unayama (2011), Parker, Souleles, Johnson, and McClelland (2013) for the micro-evidence.

consume according to the LCPIH. Furthermore, should we observe a significant reduction in the consumption of HtM households in October 2013, it may indicate a confounding factor affecting consumption unrelated to the Consumption Tax rate increase.

To determine whether HtM consumption behavior biases our results, we separate our sample into HtM and non-HtM households using the methodology of Kaplan, Violante and Weidner (2014).[7] We define a household as HtM if its liquid wealth balance is: 1) positive and less than or equal to half of its earnings per pay-period; or 2) negative and within half of its per pay-period income from its borrowing limit, where we set the borrowing limit to one month's income following the baseline case in the previous studies.[8] We find that HtM households comprise about 10 percent of our sample, which is similar to the proportion found in Hara, Unayama, and Weidner (2016).

Table 3 reports the results of a difference of means test for consumption in the year prior to announcement and the year following implementation, when both the negative income and intratemporal substitution effects should be evident.[9] Specifically, we report the mean of the log deviation from average adjusted real monthly income and non-storable non-durable consumption. The adjusted values account for seasonality and other control variables used in the regression analysis. Consistent with our baseline result, consumption fell significantly for non-HtM households, while HtM consumption increased significantly by an amount that was roughly in line with income growth over the period.

Column 4 of Table 4 displays the regression estimates for a pooled analysis in which the announcement, implementation, and postponement responses for HtM and non-HtM households are allowed to differ. Note that while consumption for non-HtM households fell by a highly significant 4.13 percent upon announcement, it actually increased, albeit insignificantly, for HtM households. Furthermore, in Columns 2 and 4, we see that the exclusion of HtM households from our test of the LCPIH does not alter our baseline result. Based on the results presented in Tables 3 and 4, we conclude that our baseline income effect estimate is not biased by the consumption behavior of HtM households. In addition, the fact that non-HtM consumption did not fall upon announcement makes it

[7] Hara, Unayama, and Weidner (2016) applies the same methodology as that used in Kaplan, Violante and Weidner (2014) to Japan's National Survey of Family Income and Expenditure. Because the JFIES has all of the variables required to define a household as HtM or non-HtM, we use the same definition and criteria as Hara, Unayama, and Weidner (2016).

[8] Kaplan, Violante, and Weidner (2014) further categorizes HtM households based on the household's illiquid wealth balance. If the household has a positive illiquid wealth balance, then they are considered as wealthy HtM; otherwise, poor HtM.

[9] We ignore the period between announcement and implementation of the Consumption Tax rate increase because of the positive intratemporal substitution effects observed during that time frame.

less likely that a confounding factor unrelated to the Consumption Tax rate increase was primarily responsible for the significant drop observed for non-HtM households.

Yet another method to test the robustness of our baseline result is a comparison of the share of households whose consumption decreased upon announcement and implementation relative to corresponding months in other years covered in our sample. If the shares are similar, it would suggest that the negative income and intertemporal substitution effect estimates from the baseline regression are driven by a few outliers rather than a more general response to the Consumption tax rate increase. Figure 5 plots the share of households whose consumption decreased in April and October for each year in our sample. Note that the share of households recording a consumption decrease reached its peak for the sample as a whole and non-HtM households in October 2013. Similarly, we observe the highest share of households reporting a consumption decrease in April 2014. Interestingly, the share of HtM households reporting a consumption decrease is also quite high relative to other years in the sample period, which is consistent with HtM consumption falling in response to the reduction in current real income that occurred in April 2014. Overall, the results from Figure 5 suggest that the decreases in consumption observed upon announcement and implementation of the Consumption Tax rate increase were not driven by outliers and instead were consistent with a more general decrease in consumption across households.

5 Conclusion

In this paper, we test the LCPIH using Japan's 2014 Consumption Tax rate increase as a natural experiment. Because the Consumption Tax has a single rate with relatively few exemptions and the tax burden is borne fully by consumers, a rate increase induces a proportional price change. Given no change in nominal income expectations, the higher price level causes a proportional decrease in lifetime resources. In addition, we treat this particular Consumption Tax rate increase as an unanticipated shock. While legislation associated with the Consumption Tax rate increase was completed in 2012, the fate of the tax rate increase became highly uncertain following the 2012 election in which Shinzo Abe became Prime Minister (PM). To promote his economic policy package, known as "Abenomics", PM Abe repeatedly mentioned the possibility of postponing or cancelling the tax rate increase altogether. As a result, we assume that households did not anticipate the income shock associated with the Consumption Tax rate increase prior to PM Abe's

October 2013 announcement that the rate increase would be implemented as originally scheduled.

We then construct a model to derive a testable implication of the LCPIH. Under the assumption of an iso-elastic instantaneous utility function, the model predicts that consumption falls by $1 - IES$ times the size of the tax rate increase at the time of announcement. That is, the announcement effect is a combination of a negative income and positive intertemporal substitution effect, where the income effect, or marginal propensity to consume (MPC) out of the income shock, is one. To obtain an estimate of the MPC, we subtract our estimate of the IES from the estimated announcement effect. If the resulting MPC estimate does not differ significantly from 1, then we cannot reject the LCPIH. Using the FIES, we test this implication and find that we cannot reject the LCPIH.

While the standard LCPIH assumes that the Euler equation holds for all households, it is well known that the consumption behavior of HtM households does not correspond to the Euler equation. Following this insight, we divide our sample into HtM and non-HtM households and test the implication of the model separately for each group. We find that consumption changes at the time of announcement and implementation satisfy the predictions of the LCPIH for non-HtM households. For HtM households, consumption did not change at announcement, as the HtM literature predicts. Overall, contrary to the excess smoothness literature, we show that consumption changes around the 2014 VAT rate increase are well explained by the LCPIH.

Coupled with the small announcement effects observed in response to the compensated 1997 Consumption Tax rate increase (see Cashin and Unayama, 2016), the results in this study suggest that in the absence of significant offsetting compensation, a VAT rate increase will induce households to decrease their consumption in proportion to the tax rate increase. Furthermore, the lack of a significant negative consumption response among HtM households suggests that the long-run impact of a VAT rate increase may be mitigated in an economy with a greater share of HtM households.

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TABLE 1. SUMMARY STATISTICS

	Full Sample		Before Announcement (Oct 2012-Sep 2013)		After Implementation (Apr 2014-Mar 2015)		Cashin and Unayama (2016)	
Variable	Mean	Std.	Mean	Std.	Mean	Std.	Mean	Std.
Age of head	57.0	14.8	57.5	14.8	58.4	15.0	51.5	13.7
Number of household members	3.11	1.14	3.10	1.13	3.07	1.12	3.38	1.24
Number of household members under age 18 [a)]	0.63	0.96	0.61	0.95	0.60	0.95	0.68 [a)]	0.98 [a)]
Number of household members aged 65+	0.74	0.90	0.76	0.90	0.81	0.92	0.47	0.75
Number of working members	1.35	0.99	1.35	1.00	1.32	0.99	1.52	0.95
Yearly income (1,000 yen)	6,284	3,943	6,308	3,918	6,089	3,901	7,113	4,652
Total expenditure (1,000 yen)	297	249	299	250	290	254	317	266
Excluding Tax Exempted items (1,000 yen)	230	210	234	214	228	216	221	195
Non-storable non-durables (N) (1,000 yen)	139	98	141	100	136	98	120	78
Storable non-durables (S) (1,000 yen)	45	32	46	34	43	30	52	32
Durables (D) (1,000 yen)	46	163	48	172	46	175	47	138
Tax Exempted items (EXPT) (1,000 yen)	66	109	65	104	63	113	-	-
Number of Observations	447,072		63,331		63,288		646,900	

NOTE: YEARLY HOUSEHOLD INCOME AND MONTHLY HOUSEHOLD EXPENDITURES ARE CPI ADJUSTED BY CORRESPONDING CATEGORIES WITH THE BASE YEAR OF 2010. A) CASHIN AND UNAYAMA (2016) REPORTS NUMBER OF HOUSEHOLD MEMBERS NOT UNDER AGE 18 BUT UNDER AGE 15

TABLE 2. INCOME EFFECTS AND IES: BASELINE RESULTS

	Dependent Variable: Non-storable Nondurables (multiplied by 100)							
	(1)		(2)		(3)		(4)	
	NSND		NSND		NSND		NSND	
	Coef.	Standard error	Coef.	Standard error	Coef.	Standard error	Coef.	Standard error
$\Delta \boldsymbol{D}_{\text{Nov,2013}}$			1.35	(1.02)	1.35	(1.02)	1.34	(1.02)
$\Delta \boldsymbol{D}_{\text{Dec,2013}}$			0.70	(0.97)	0.70	(0.97)	0.65	(0.98)
$\Delta \boldsymbol{D}_{Jan,2014}$			3.79***	(1.15)	3.79***	(1.15)	3.82***	(1.15)
$\Delta \boldsymbol{D}_{\text{Feb,2014}}$			0.85	(1.17)	0.85	(1.17)	0.84	(1.17)
$\Delta \boldsymbol{D}_{\text{Mar,2014}}$			4.65***	(1.27)	4.65***	(1.27)	4.70***	(1.27)
$\Delta \boldsymbol{D}_{\text{Apr,2014}}$			1.69	(1.18)	1.62	(1.27)	0.54	(1.33)
$\Delta \boldsymbol{D}_{\text{May,2014}}$			0.07	(1.09)	0.00	(1.13)	-1.16	(1.24)
$\Delta \boldsymbol{D}_{\text{Jun,2014}}$			0.44	(1.04)	0.38	(1.08)	-0.79	(1.19)
$\Delta \boldsymbol{D}_{\text{Jul,2014}}$			-0.26	(0.97)	-0.33	(1.02)	-1.45	(1.13)
$\Delta \boldsymbol{D}_{\text{Aug,2014}}$					-0.07	(0.95)	-1.17	(1.00)
$\Delta \boldsymbol{D}_{Sep,2014}$							-1.38	(0.99)
$\boldsymbol{D}_{\text{Oct,2013}}$ (a)	-2.32***	(0.87)	-2.79***	(0.92)	-2.78***	(0.92)	-2.61***	(0.93)
$\boldsymbol{D}_{\text{Apr,2014}}$ (b)	-4.28***	(0.94)	-1.51	(1.58)	-1.44	(1.61)	-0.34	(1.67)
$\boldsymbol{D}_{\text{Dec,2014}} + \boldsymbol{D}_{\text{Jan,2015}}$	0.97**	(0.49)	1.21**	(0.49)	1.21**	(0.49)	1.19**	(0.49)
Test for Excess Smoothness A)	-1.98** (0.01)		-1.11 (0.83)		-1.09 (0.87)		-0.66 (0.57)	
IES (upper bound) (=(b)| divided by 2.85)	-1.50***		0.53		0.51		0.12	
Observations	372,947							

NOTE: THIS TABLE PRESENTS ESTIMATES FROM A REGRESSION BASED ON EQUATION (13). THE DEPENDENT VARIABLE IS THE FIRST DIFFERENCE OF THE LOGARITHM OF REAL EXPENDITURES ON NON-STORABLE NONDURABLES. STANDARD ERRORS ARE ROBUST TO SERIAL CORRELATION WITHIN HOUSEHOLDS OVER TIME. ALL COLUMNS REPORT OLS REGRESSIONS, WHICH INCLUDE, IN ADDITION TO VARIABLES IN THE TABLE, AGE OF HOUSEHOLD HEAD, THE FIRST DIFFERENCE OF: MONTH DUMMIES; DAY OF THE WEEK CONTROLS; INDICATORS FOR EACH INTERVIEW; THE NUMBER OF HOUSEHOLD MEMBERS; WORKING MEMBERS; MEMBERS UNDER AGE 18; AND MEMBERS OVER THE AGE OF 65; CHILD BENEFIT RECEIPT DUMMY; PUBLIC PENSION RECEIPT DUMMY; EAST JAPAN EARTHQUAKE DUMMIES. *, **, AND *** REPRESENT SIGNIFICANCE AT THE 10, 5, AND 1 PERCENT.

A) Based on the model, the coefficients should satisfy (a)/(5/105)+ (b)/(3/105)=-1.

TABLE 3. CONSUMPTION CHANGES BY HTM STATUS

			Before Announcement (Oct 2012-Sep 2013)	After Implementation (Apr 2014-Mar 2015)	Test for the difference
NHtM	ND	Mean	0.012	-0.015	-0.027***
		Std. Dev.	0.463	0.459	0.002
		Obs.	48,055	48,485	
HtM	ND	Mean	-0.006	0.008	0.014***
		Std. Dev.	0.449	0.449	0.0062
		Obs.	5,275	5,168	
	Total Income	Mean	-0.007	0.014	0.021
		Std. Dev.	0.988	0.889	0.013
		Obs.	4,916	4,845	

NOTE: THIS SHOWS THE DEVIATION FROM THE LOG OF THE AVERAGE ADJUSTED REAL MONTHLY HOUSEHOLD INCOME AND NON-STORABLE NON-DURABLE CONSUMPTION. THE ADJUSTED ONES ARE OBTAINED FROM A REGRESSION OF CORRESPONDING VARIABLES ON MONTH DUMMIES AND OTHER CONTROL VARIABLES USED IN THE REGRESSION ANALYSIS. *, **, AND *** REPRESENT SIGNIFICANCE AT THE 10, 5, AND 1 PERCENT.

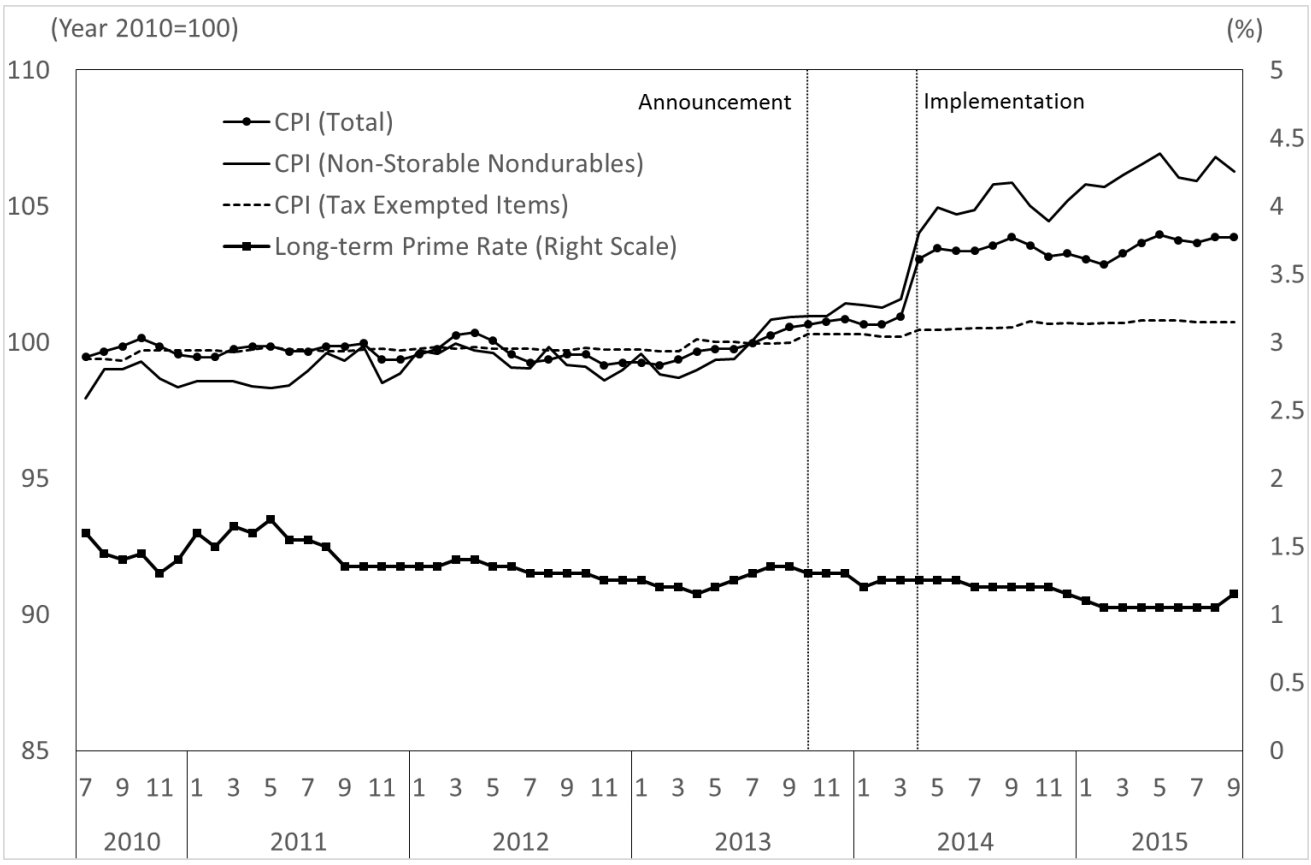
TABLE 4. INCOME EFFECTS AND IES: HAND-TO-MOUTH RESULTS

Dependent Variable: Non-storable Nondurables (multiplied by 100)								
		(1)		(2)		(3)		(4)	
		NSND		NSND		NSND		NSND	
		Coef.	Std. error	Coef.	Std. error	Coef.	Std. error	Coef.	Std. error
$\Delta \boldsymbol{D}_{\text{Nov,2013}}{}^{NHtM}$				2.24	(1.15)			3.05***	(1.11)
$\Delta \boldsymbol{D}_{\text{Dec,2013}}{}^{NHtM}$				1.55	(1.09)			1.53	(1.08)
$\Delta \boldsymbol{D}_{Jan,2014}{}^{NHtM}$				3.97***	(1.27)			3.89***	(1.25)
$\Delta \boldsymbol{D}_{Feb,2014}{}^{NHtM}$				0.97	(1.32)			0.87	(1.30)
$\Delta \boldsymbol{D}_{Mar,2014}{}^{NHtM}$				5.28***	(1.45)			5.44***	(1.42)
$\Delta \boldsymbol{D}_{Apr,2014}{}^{NHtM}$				1.56	(1.48)			0.98	(1.46)
$\Delta \boldsymbol{D}_{May,2014}{}^{NHtM}$				-0.04	(1.32)			-0.21	(1.31)
$\Delta \boldsymbol{D}_{Jun,2014}{}^{NHtM}$				1.59	(1.26)			0.85	(1.24)
$\Delta \boldsymbol{D}_{Jul,2014}{}^{NHtM}$				0.15	(1.19)			-0.31	(1.16)
$\Delta \boldsymbol{D}_{Aug,2014}{}^{NHtM}$				0.34	(1.11)			-0.13	(1.08)
$\boldsymbol{D}_{\text{Oct,2013}}{}^{NHtM}$		-3.37***	(1.00)	-4.09***	(1.06)			-4.13***	(1.03)
$\boldsymbol{D}_{\text{Apr,2014}}{}^{NHtM}$		-4.44***	(1.10)	-1.03	(1.86)			-0.39	(1.84)
$(\text{Postpone})^{NHtM}$		1.80**	(0.54)	1.96**	(0.55)			1.74***	(0.55)
$\boldsymbol{D}_{\text{Oct,2013}}{}^{HtM}$						1.67	(3.35)	2.19	(3.12)
$\boldsymbol{D}_{\text{Apr,2014}}{}^{HtM}$						-1.34	(2.88)	-0.47	(2.51)
$(\text{Postpone})^{HtM}$						-0.98	(1.87)	1.12	(1.73)
Test for Excess Smoothness A) (p-value)	**N-HtM**	-2.26** (0.24)		-1.21 (0.73)				-1.00 (0.99)	
	HtM					-1.07 (0.49)		-0.23 (0.24)	
IES (upper bound) (=(b)| divided by 2.85)	**N-HtM**	-1.55		-0.36				-0.70	
	HtM					-0.47		-0.14	
Sample Selection		Non-Hand-to-Mouth		Non-Hand-to-Mouth		Hand-to-Mouth		Pooled	
Observations		281,821		281,821		30,513		312,334	

NOTE: THIS TABLE PRESENTS ESTIMATES FROM A REGRESSION BASED ON EQUATION (13). THE DEPENDENT VARIABLES NOT LISTED IN THIS TABLE ARE SAME AS THOSE IN TABLE 2. SEE FOOTNOTE OF TABLE 2. DUMMIES. *, **, AND *** REPRESENT SIGNIFICANCE AT THE 10, 5, AND 1 PERCENT.

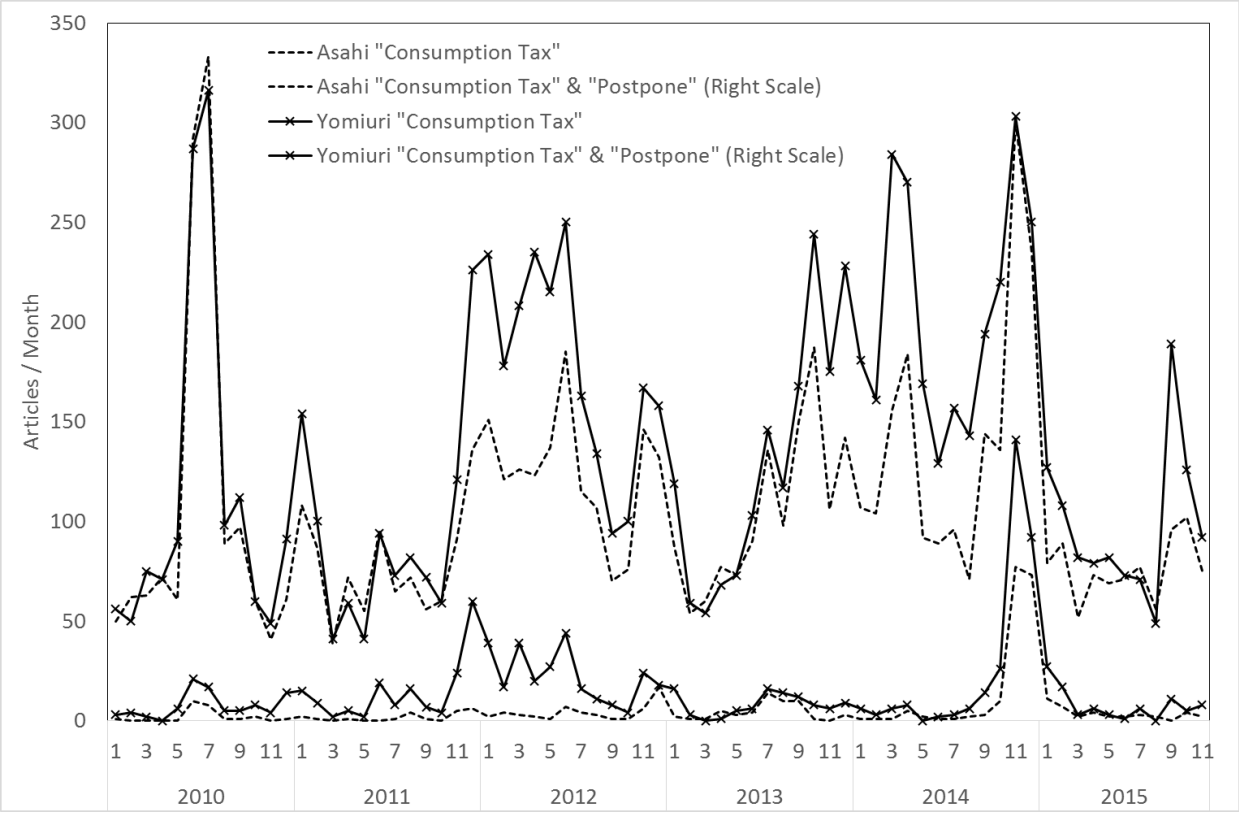
A) BASED ON THE MODEL, THE COEFFICIENTS SHOULD SATISFY (A)/(5/105)+ (B)/(3/105)=-1.

FIGURE 1. CONSUMER PRICE INDEX AND INTEREST RATE AROUND IMPLEMENTATION



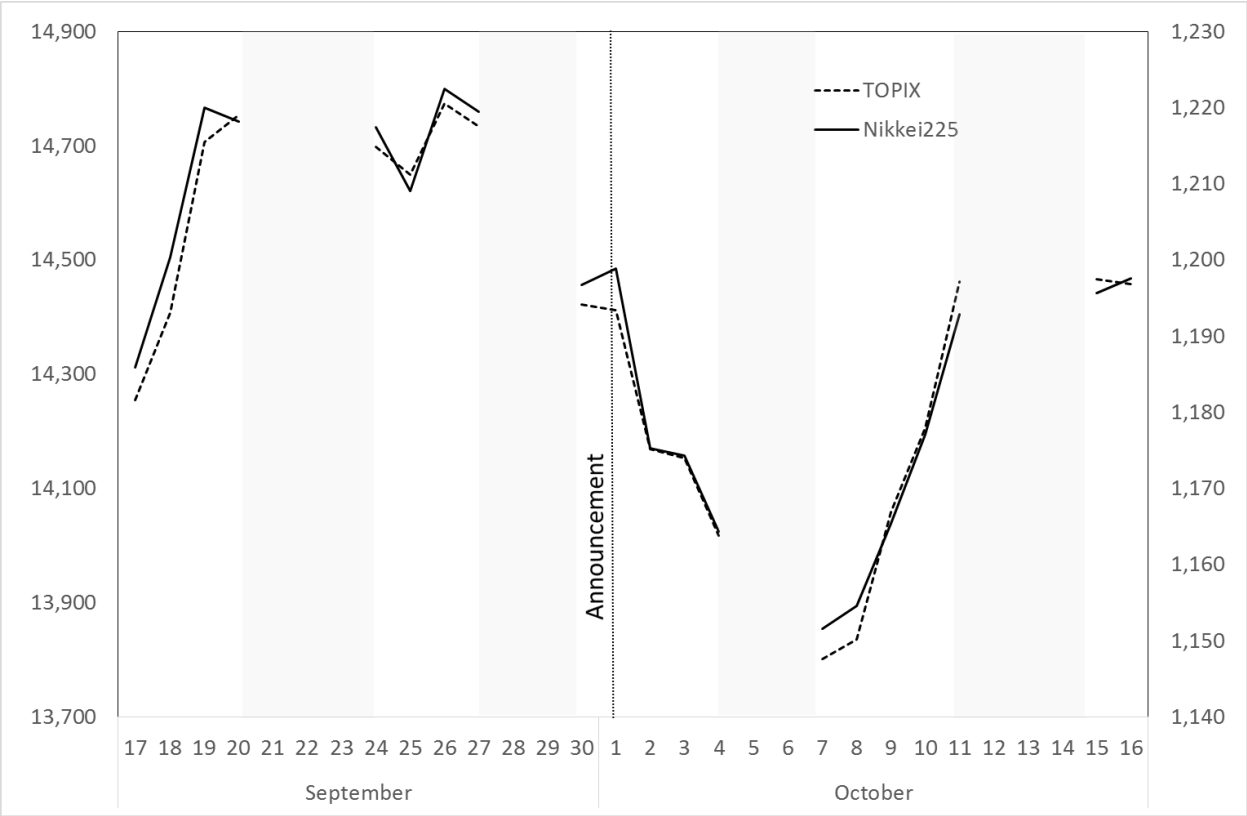
SOURCE: STATISTICAL BUREAU OF JAPAN FOR CPI AND BANK OF JAPAN FOR PRIME RATE.

FIGURE 2. NUMBER OF ARTICLES MENTIONING THE CONSUMPTION TAX



SOURCE: KIKUZO II VISUAL FOR ASAHI NEWSPAPER AND YOMIDAS REKISIKAN FOR YOMIURI NEWSPAPER.

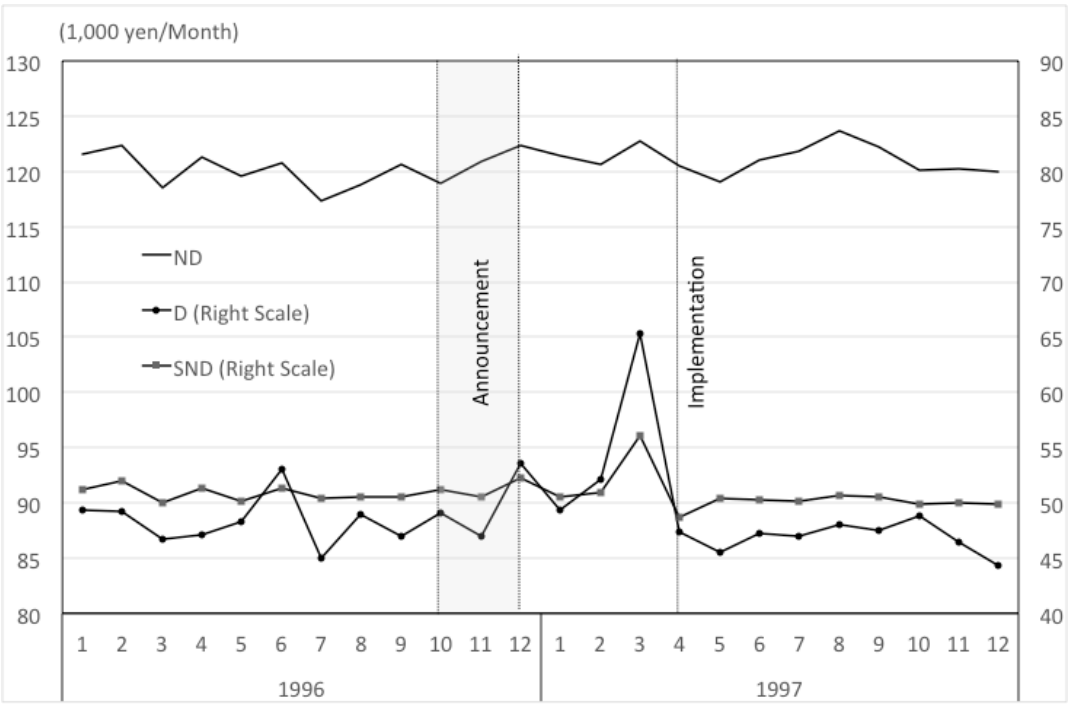
FIGURE 3. STOCK PRICES AROUND ANNOUNCEMENT OF TAX RATE INCREASE



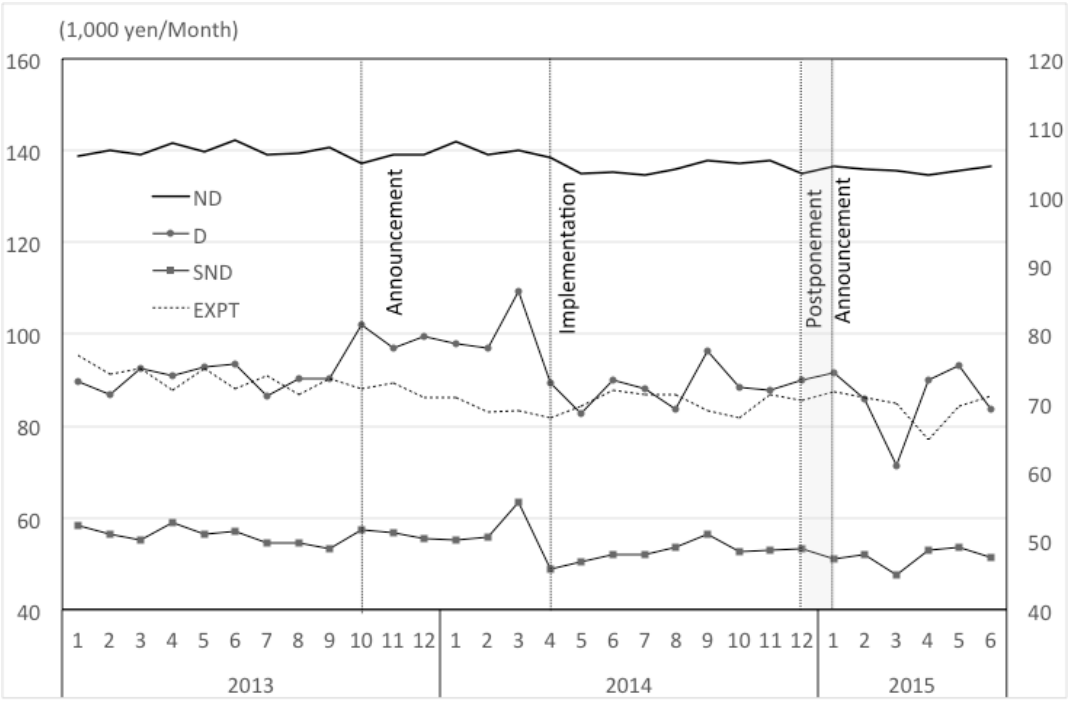
SOURCE: STOCK MARKET DID NOT OPEN IN SHADED DATE DUE TO WEEKENDS OR HOLIDAYS.

FIGURE 4. REAL HOUSEHOLD EXPENDITURE BY CATEGORIES AROUND RATE INCREASE

PANEL A: RATE INCREASE IN 1997



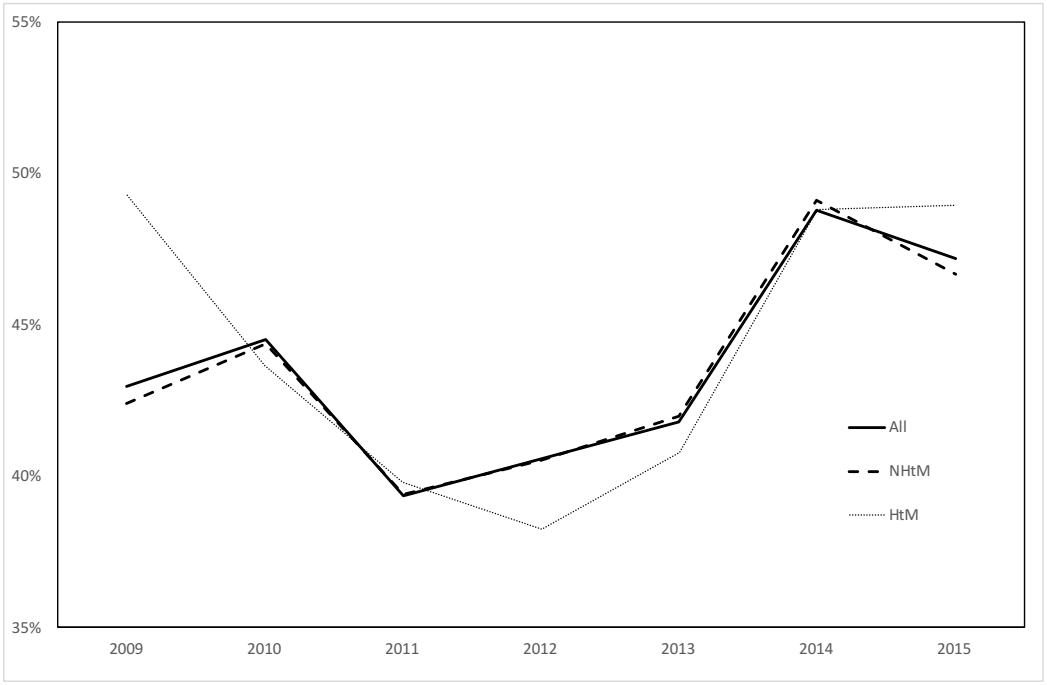
PANEL B: RATE INCREASE IN 2014



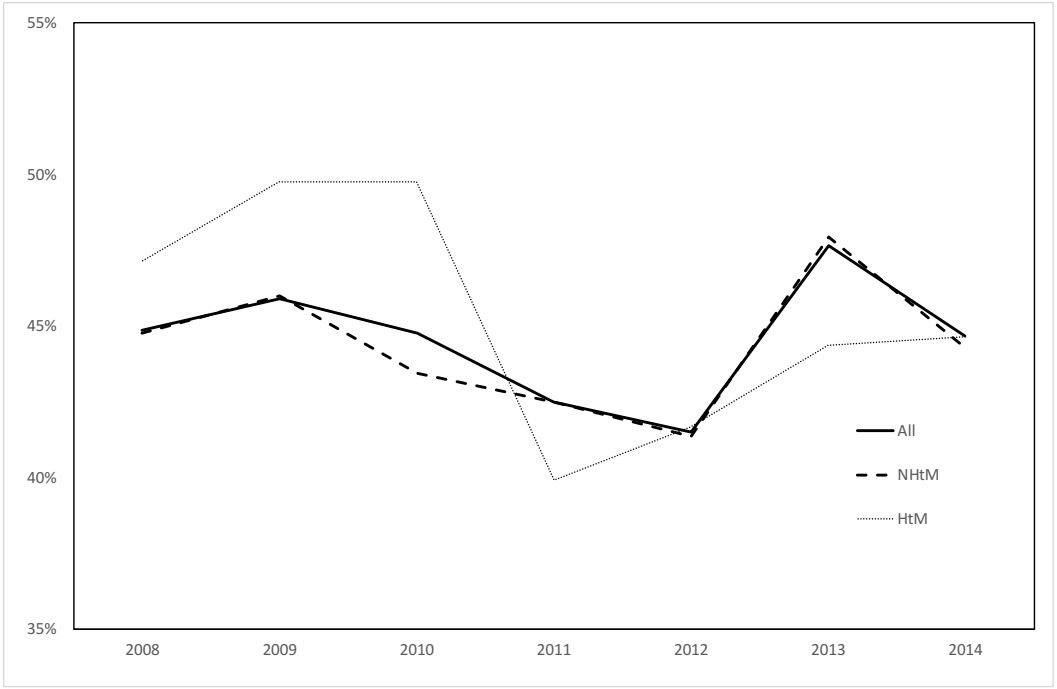
NOTE: THIS SHOWS SEASONALLY-ADJUSTED REAL MONTHLY HOUSEHOLD EXPENDITURES (IN THOUSANDS OF YEN) ON NON-STORABLE NON-DURABLE (N), STORABLE NON-DURABLE (S), DURABLE GOODS (D), AND TAX EXEMPTED ITEMS (EXPT). THE SEASONALLY-ADJUSTED ONES ARE THE RESIDUALS PLUS NON-MONTH SPECIFIC FACTORS FROM A REGRESSION OF REAL MONTHLY HOUSEHOLD EXPENDITURE ON MONTH DUMMIES AND OTHER CONTROL VARIABLES USED IN THE REGRESSION ANALYSIS BELOW. PANEL A IS FROM FIGURE 5 OF CASHIN AND UNAYAMA (2016).

FIGURE 5. SHARE FOR THOSE WHO DECREASE CONSUMPTION

PANEL A: APRIL



PANEL B: OCTOBER



NOTE: THIS SHOWS SHARE FOR THOSE WHO DECREASE THEIR CONSUMPTION RELATIVE TO THAT IN THE PREVIOUS MONRTH. CONSUMPTION MESURE USED HERE IS EXPENDITURE ON NON-STORABLE NON-DURABLE GOODS AND SERVICES DEFLATED BY THE ITEM SPECIFIC CPI.