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Measuring Intertemporal Substitution:

Evidence from a Consumption Tax Rate Increase in Japan*

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Abstract

The intertemporal elasticity of substitution (IES) is estimated using the 1997 Consumption Tax rate increase in Japan, which represented an exogenous change in the real interest rate. Since the Japanese Consumption Tax is highly comprehensive and the tax rate increase was announced prior to implementation, it is an ideal natural experiment for estimating the IES. A Japanese monthly household survey is exploited to accurately categorize "non-durables" and to address intra-temporal substitution bias. We find that the IES is 0.21 and not significantly different from zero, but it is significantly less than one. Our results suggest that the impact of policies that affect the real interest rate will be small.

Key words: Intertemporal Substitution, Japanese Consumption Tax, Value Added Tax

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1. Introduction

In this paper, we estimate the intertemporal elasticity of substitution (IES) using a rate increase in the Japanese Consumption Tax as a natural experiment. The Consumption Tax, which is a Value Added Tax (VAT), increased from three to five percent in April 1997. Unlike VAT in many other countries, Japan has a single flat rate with a relatively small number of exemptions. Due to the government's effort, the tax burden was borne fully by consumers in the form of higher prices. Since nominal interest rates and the inflation rate were constant around the implementation of the tax rate increase, it can be treated as an exogenous and predictable change in the real interest rate, which provides us with an ideal situation to estimate the IES.

Previous research on this topic (e.g. Hall, 1988; Attanasio and Weber, 1993, 1995; Ogaki and Reinhart, 1998) has relied on an instrumental variables approach to address the critical econometric problem that the real interest rate is endogenous in the standard log-linearized Euler equation for consumption. However, as Yogo (2004) notes, asset returns are notoriously difficult to predict, and as a result, the available instruments are weak. Weak instruments can lead to biased estimators and finite-sample distributions of test statistics that depart greatly from their limiting distributions. This paper avoids the problem of weak instruments by exploiting the natural experiment presented by the Consumption Tax rate increase.

In addition to the novel research design, our dataset plays an important role in estimating the IES. We use the Japanese Family Income and Expenditure Survey (JFIES), which is a monthly household-level panel dataset. Given our use of micro-data, our results are free from the aggregation bias discussed in Attanasio and Weber (1993, 1995). Its high frequency (monthly) panel structure allows us to adopt the conventional Euler equation approach, and to observe consumption expenditure immediately before and after implementation of the tax rate increase.

Moreover, since the JFIES is highly disaggregated by item-type, we can define "non-durables" appropriately. The definition of non-durables in previous studies included goods and services that exhibit some degree of storability and/or durability. For example, as Mankiw (1985) points out, footwear and clothing are usually considered to be non-durables, but they should be classified as durables. Attanasio and Weber (1993, 1995), which is the first to address this issue, exclude durables and semi-durables, but pay little attention to storability. Storable goods can be stockpiled during low price periods for consumption in high price periods. Failing to account for this behavior will bias the estimate of the IES upwards. To avoid these biases, we separate non-storable non-durable goods and services (e.g. eating out) from storable non-durable (e.g. laundry detergent) and durable (e.g. automobiles) goods and services.

With multiple goods, we explicitly consider the intratemporal substitution between non-durables, storables and durables by constructing a model of consumer choice. As Ogaki and Reinhart (1998) demonstrate, failing to account for intratemporal substitution can induce a biased estimate of the IES when preferences over non-durables and durables are non-separable. In general, the service flow from durables becomes higher prior to a tax rate increase since the user cost of durables falls. With non-separable preferences, households substitute away from non-durables and towards durables. If we do not control for this, the estimate of the IES would be biased, where the sign of the bias depends on the structure of intratemporal preferences. The empirical specification derived below, which is consistent with our model, is robust to the possibility of intratemporal substitution.

Exploiting these advantages, our point estimate of the IES is 0.21, which is significantly less than one, but not significantly different from zero. While the baseline regression uses the sample period between April 1992 and March 2002, the choice of sample period has little impact on our results. In addition, the results are robust to sample selection criteria. Point estimates from those robustness checks range between 0.17 and 0.36, which are comparable to those in previous studies using macro-data such as Hall (1988), Ogaki and Reinhart (1998), and Yogo (2004), but less than those using micro-data such as Attanasio and Weber (1993; 1995) and Engelhardt and Kumar (2009). We employ additional tests to check whether liquidity constraints or data quality are responsible for the small IES, but find no evidence to support these assertions.

The results here suggest monetary and/or fiscal policies that aim to dampen business cycle volatility through changes in the real interest rate will not be effective. For the same reason, the deadweight loss from a pre-announced increase in a VAT and the taxation of interest income is small. In addition, since we find a slight positive impact at the announcement of the tax increase, the planned increase in Japan's Consumption Tax rate from five to ten percent will have a relatively small impact on the economy.

The remainder of the paper is organized as follows. Section 2 provides background on Japan's April 1997 Consumption Tax rate increase and evidence for our assertion that the tax rate increase represented an exogenous change in the real interest rate. Section 3 introduces a representative agent model of household consumption to make predictions about household consumption in the months following announcement of a consumption tax rate increase. We then present an empirical specification consistent with the model, and discuss identification of the IES. The data used in estimation and our results are presented in Section 4. Section 5 concludes.

2. 1997 Consumption Tax Rate Increase in Japan[1]

2.1. The Political Process of Japan's Consumption Tax Rate Increase

Japan's consumption tax was first imposed on April 1, 1989. It was introduced as part of an effort by the government to shift away from direct taxation towards indirect taxation, which was deemed necessary for an aging society with an unfunded pension system. Unlike consumption taxes in many other countries, Japan has a single flat rate with relatively few exemptions.[2] The initial rate was three percent and remained at that level until April 1, 1997, when the rate was increased to five percent.

Although the government recognized that the shift from direct to indirect taxation was necessary for the nation's long-term fiscal health, achieving such reform proved politically difficult because of Japan's prolonged recession from 1991 to 1993, which followed the bursting of the economic bubble. However, the government finally succeeded in late 1994 with a tax reform package that coupled a future increase in the consumption tax rate with immediate cuts in income tax rates. Although the Murayama Tax Reform set a target date of April 1997 for the consumption tax rate increase, the legislation also stated that the rate increase would be imposed only if the economy had sufficiently recovered.

Having judged the economy to have sufficiently recovered, the ruling Liberal Democratic Party moved quickly in June 1996 to pass the consumption tax rate increase, a move driven by a political motivation to avoid letting the consumption tax become an issue in Fall 1996 elections to the Lower House of the Diet. Legislation passed through the Upper House on June 25, 1996, and the rate increase was scheduled to become effective on April 1, 1997. However, the government stated that they would revisit the issue of the rate increase when they submitted the fiscal year 1997 budget. On December 26, 1996, the government submitted the fiscal year 1997 budget, and decided to increase the consumption tax rate to five percent as planned.

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[1] The information of this Section comes primarily from Ishi (2001) and Takahashi (1999).

[2] Exemptions included transfer of lease or land, transfer of securities and 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.

2.2. Awareness of the Consumption Tax Rate Increase

The Life Cycle Permanent Income Hypothesis (LCPIH) predicts that households change their consumption at the time of announcement of the rate increase. However, the events described above suggest that it is difficult to pinpoint what constituted announcement. The Murayama reform package was intended to be revenue-neutral over the long-run, but given the staggered nature of the reforms and uncertainty associated with the future consumption tax rate increase, it is not clear whether households perceived it in this manner.

To elucidate these issues, we examine the number of articles mentioning the consumption tax in the Nihon Keizai Shimbun, Japan's leading business newspaper with a circulation of over three million (in 2010), and the Yomiuri Shimbun, a leading non-business newspaper with a circulation of over 10 million (in 2010). Figure 1 reports the number of articles that mention the phrase "Consumption Tax".[3] Coverage initially peaked in September 1994, which coincided with the passage of the Murayama reform package, suggesting that households may have been aware of the package's goal of revenue-neutrality. Following a decline in coverage in 1995, there was a steady upward trend that began just prior to the initial passage in June 1996; and a spike in coverage in October 1996, which coincided with elections to the Lower House of the Diet. Overall coverage was consistently high in the months following the election but prior to the tax change, with nearly 300 articles in the Nihon Keizai Shimbun mentioning the Consumption Tax in March 1997. Since news coverage of the Consumption Tax rate increase was consistently high beginning in October 1996, but the rate increase did not become a certainty until December, our working assumption throughout the remainder of the paper, which will be reflected in the empirical specification, is that announcement of the Consumption Tax rate increase occurred in the fourth quarter of 1996.

2.3. Price Expectations

Awareness of the consumption tax rate increase prior to its implementation is not sufficient to induce intertemporal substitution effects. It must also be the case that households anticipated an increase in price levels as a result of the tax change. Furthermore, households should not have expected any changes in nominal interest rates by the central bank that would offset the intertemporal substitution incentives. While we do not have direct evidence of consumer price or interest rate expectations before the rate increase, we believe consumers expected a price increase

[3] Circulation numbers come from Japan's Audit Bureau of Circulations.

from March to April 1997 of about two percent on non-storable non-durable goods and services that were subject to the consumption tax, and that nominal interest rates would remain constant.

As documented by Ishi (2001), the Japanese government's official stance was that the burden of the consumption tax should be borne fully by consumers at the time of the rate increase.[4] We also find it likely that the smooth transition to the consumption tax in 1989, in which prices on goods and services subject to the new tax increased by just less three percent in the month the three percent tax was introduced, should have allayed fears of excessive hikes in pre-tax prices when the rate increase took effect. Furthermore, Carroll et al. (forthcoming) find that full forward shifting at the time of a consumption tax rate increase is the norm across most countries.

As shown in Figure 2, seasonally-adjusted prices on non-storable non-durable goods and services subject to the consumption tax rose by just over two percent between March and April 1997, which implies that households did bear the full burden of the tax rate increase in the form of higher prices. It is also important to note that notwithstanding the increase in the price level resulting from the consumption tax rate increase, inflation was negligible during the mid to late 1990s. Since there was little to no change in pre-tax price levels, we can rule out the influence of an additional factor that affects the real interest rate.

Because this study takes seriously the possibility of intratemporal substitution between goods, we also examine relative prices around the time of the consumption tax rate increase. As shown in Figure 3, there was little change in the ratio of seasonally-adjusted durable and storable non-durable prices to non-storable non-durable prices in the months prior to and following the tax rate increase. As a result, we can rule out intratemporal substitution between storables and non-storables, and can safely assume that the price of durables relative to non-storable non-durables was constant. However, we must still concern ourselves with intratemporal substitution between durables and non-durables, since the user cost of durables is a function of the real interest rate, which fell prior to the consumption tax rate increase.

The price of current consumption relative to future consumption is also affected by expectations of nominal interest rates. In particular, expectations of an increase in the nominal interest rate that coincides with the consumption tax rate increase would mitigate intertemporal

[4] When Consumption Tax was introduced in 1989, the government took several steps to ensure this outcome. First, a Special Council on the Transition was formed to promote enforcement of the consumption tax across agencies. Second, the government carried out an extensive advertising campaign to allay the public's fear of price hikes and to restrain overcharging by traders. A telephone service was also set up so consumers could report complaints about prices. Finally, the Economic Planning Agency increased the budget for the price monitoring system. The situation was nearly identical in 1997.

substitution incentives, and vice versa. Figure 4 presents the average contracted interest rates on short-term loans and discounts. These are the average interest rates applied to a contract of less than one year between a commercial bank and lender. As the figure makes clear, the average interest rate fell precipitously throughout 1995, but remained relatively constant thereafter. For this reason, it seems safe to conclude that households did not expect to observe a significant change in nominal interest rates in the months following announcement of the consumption tax rate increase.

As a summary, since the consumption tax rate increase was pre-announced, awareness was high, households expected to bear the full burden of the rate increase in the form of higher price levels, and pre-tax price levels and nominal interest rates were stable, we argue that the April 1997 consumption tax rate increase represented an exogenous change in the real interest rate.

3. A consumption tax rate increase and the intertemporal elasticity of substitution

3.1. The Model

In this section, we construct a model to demonstrate the impact of a consumption tax rate increase on both household consumption and expenditure. A household consumes three types of goods and services: non-storable non-durables (N), storable non-durables (S), and durables (D). Household *i* maximizes its lifetime utility function, *U*, which is the discounted sum of the instantaneous utility, *u*. Suppose the utility function at time *s* is as follows:

$$U_s = \sum_{t=s}^{\infty} \beta^{t-s} \left(\frac{\sigma}{\sigma-1}\right) \left[u_t^{\frac{\sigma-1}{\sigma}} - 1\right],$$

where β is the subjective discount factor; σ is the IES; and u_t is the instantaneous utility. Unlike previous studies, we use a deterministic setting since we focus on short-run dynamics around the time of the Consumption Tax rate increase.

Following Ogaki and Reinhart (1998), the intratemporal utility function is assumed to have the CES form for N, S, and D:[5]

$$u_t = u(C_t^N, C_t^S, D_t) = \left[a C_t^{N\frac{\epsilon-1}{\epsilon}} + b C_t^{S\frac{\epsilon-1}{\epsilon}} + D_t^{\frac{\epsilon-1}{\epsilon}}\right]^{\frac{\epsilon}{\epsilon-1}}$$

[5] Pakos (2004) points out that preferences are in fact non-homothetic. In particular, durables are luxuries, while non-durables are necessities. However, given that we are focused on a short time period and a modest rate increase, it is plausible to assume that preferences over durables and non-durables are homothetic.

where C_t^N and C_t^S are consumption of N and S, respectively; D_t is the stock of D held at the end of period *t*; ϵ is the intratemporal elasticity of substitution; and a and b are some positive numbers that determine the weights attached to N and S.[6] It is worth noting that the utility function becomes additively separable in N, S, and D if $\sigma = \epsilon$.

In maximizing its lifetime utility, the household faces three constraints: the intertemporal budget constraint and laws of motion for the stock of S and D. The intertemporal budget constraint is given by

$$A_t = (1 + R_t - \pi_t)A_{t-1} + Y_t - C_t^N - p_t^S X_t^S - p_t^D\{X_t^D + \varphi(X_t^D)\} - \theta(S_t) \quad \text{for } t = s \cdots \infty,$$

where A_t is financial wealth held at the end of period *t*; R_t is the nominal interest rate; π_t is the inflation rate in terms of N; Y_t is income; p_t^S and p_t^D are the prices of S and D in relation to N, respectively; X_t^S and X_t^D are gross expenditures on S and D, respectively; and S_t is the stock of S held at the end of period *t*. The functions θ and φ represent costs associated with the storage of S and purchase of D, which we discuss below. Finally, we take $A_{s-1},\ D_{s-1},\ S_{s-1}$ as given.

As discussed in the previous section, it was expected that the Consumption Tax rate increase would be fully passed onto consumers in the form of higher prices at the time of implementation (hereafter, period *T*). In addition, the price of S and D relative to N were constant before and after the rate increase. Moreover, nominal interest rates and the pre-tax price level were stable around the implementation. As a result, we can safely make the following two simplifications to the intertemporal budget constraint:

$$1)\ p_t^S = p^S \quad \text{and} \quad p_t^D = p^D$$

$$2)\ R_t - \pi_t \equiv r_t = \begin{cases} r - \tau & \text{in period } T-1 \\ r & \text{in other periods.} \end{cases}$$

where τ is the inflation rate due to the rate increase. In our case, τ =0.0239 since the CPI for N was increased by 2.39 percent from March to April 1997.

The function θ accounts for the cost of holding a level of stock, *S*.[7] This consists of costs from stock shortages as well as storage costs. For example, if a household runs out of storable non-

[6] Since we are focusing on short-run dynamics, our model ignores the labor/leisure choice, effectively assuming that labor supply is fixed during the period of interest. Crossley and Wakefield (2009), which investigates a VAT rate change in the UK, also ignored the labor supply decision.

[7] Previous studies have shown empirically that demand is affected by the storability of a good (e.g. Hendel and Nevo, 2004 & 2006). In particular, households weigh the benefits of purchasing storable goods at a lower price against the cost of holding additional inventory.

durable goods such as toothpaste, there is a time cost associated with making a trip to the store to purchase an additional tube. Alternatively, stockpiling S requires the use of storage space that could be used for other purposes. These scenarios suggest that there exists a bliss point for the stock of *S*, S^*, which means that $\theta'(S_{i,t}) \leq 0$ if $S_{i,t} \leq S^*$ and $\theta'(S_{i,t}) > 0$ if $S_{i,t} > S^*$.

φ accounts for costs associated with the purchase of *D*. The purchase of a durable good is an infrequent event, and more effort is required than for a non-durable purchase. This may include collecting catalogues, identifying key specs, and shopping around to get a better price. Assuming that the opportunity cost of a household's time spent shopping is increasing, convex, and proportional to the amount spent on durable goods, it follows that φ_i is increasing and convex in its argument. That is, $\varphi' > 0$ and $\varphi'' > 0$.

Finally, the evolution of the stocks of *S* and *D* are given by

$$S_t = (1 - \delta^s)S_{t-1} - C_t^S + X_t^S \qquad \text{for } t = s \cdots \infty,$$

and

$$D_t = (1 - \delta^D)D_{t-1} + X_t^D \qquad \text{for } t = s \cdots \infty$$

where $\delta^S$and δ^D are the depreciation rates of *S* and *D*, respectively.[8]

3.2. Optimal consumption path and the intertemporal elasticity of substitution

Solving the household's optimization problem, we obtain the following first order conditions:

$$\frac{\partial u/\partial C_{t+1}^N}{\partial u/\partial C_t^N} = \left(\frac{F_{t+1}}{F_t}\right)^{\frac{\sigma-\epsilon}{\sigma(\epsilon-1)}} \left(\frac{C_{t+1}^N}{C_t^N}\right)^{\frac{-1}{\sigma}} = \frac{1}{\beta(1+r_t)} \qquad (1)$$

$$C_t^S = C_t^N \left(\left(\frac{a}{b}\right)p^S\right)^{-\epsilon} \qquad (2)$$

$$\theta_i'(S_t) = \theta_i'\left((1-\delta^S)S_{t-1} - C_t^S + X_t^S\right) = -p^S\left\{\frac{r_t + \delta^S}{1+r_t}\right\} \qquad (3)$$

$$D_t = C_t^N \left(ap^D\left[\left(\frac{r_t+\delta^D}{1+r_t}\right) + \left\{\varphi'(X_t^D) - \frac{1-\delta^D}{1+r_t}\varphi'(X_{t+1}^D)\right\}\right]\right)^{-\epsilon} \qquad (4)$$

[8] In the case that δ^S and δ^D are equal to one, S and D effectively become nondurables.

where

$$F_t = 1 + \left(\frac{b}{a}\right)\left(\frac{C_t^S}{C_t^N}\right)^{\frac{\epsilon-1}{\epsilon}} + \left(\frac{1}{a}\right)\left(\frac{D_t}{C_t^N}\right)^{\frac{\epsilon-1}{\epsilon}}.$$

Equation (1) gives the standard Euler equation, which can be rewritten as

$$\frac{C_{t+1}^N}{C_t^N} = \beta^\sigma (1+r_t)^\sigma \left(\frac{F_{t+1}}{F_t}\right)^{\frac{-(\sigma-\epsilon)}{(\epsilon-1)}}.$$

Then, taking the logarithm of both sides and using the general approximation $\ln(1+\mathrm{x}) \cong \mathrm{x}$ for small x, the consumption changes can be denoted as

$$\Delta \ln C_t^N = \sigma \ln \beta + \sigma \ln r_t - \frac{\sigma-\epsilon}{\epsilon-1}\Delta \ln F_t = \begin{cases} \kappa - \sigma\tau - \left(\frac{\sigma-\epsilon}{\epsilon-1}\right)(\ln F_t - \ln F_{t-1}) & \mathrm{t} = T \\ \kappa \quad\quad - \left(\frac{\sigma-\epsilon}{\epsilon-1}\right)(\ln F_t - \ln F_{t-1}) & \mathrm{t} \neq T \end{cases}$$

where $\Delta \ln C_t^N = \ln C_{t+1}^N - \ln C_t^N$ and $\kappa = -\sigma\{\ln\beta + r\}$.

This shows that we can estimate the IES, σ, using the Japanese consumption tax rate increase as an experiment once we assume that preferences over N, S, and D are additively separable (i.e. $\sigma = \epsilon$).[9] Since the third term becomes zero, we simply divide the change in log-consumption growth of N at the time of implementation by the size of the tax rate increase, τ, in order to get the IES.

However, as Ogaki and Reinhart (1998) point out, this approach could yield a biased estimator if preferences over N, S, and D are in fact non-separable. With non-separable preferences, F_t varies across periods since the term F_t reflects intratemporal substitution between N and D. Moreover, F_t is an increasing function of τ if $\epsilon > 0$ because the user cost of durables, given by the term in parenthesis on the right hand side of Equation (4), becomes lower to make D_t/C_t^N larger. Accordingly, the change in consumption growth at implementation would be associated not only with inter- but also intra- temporal substitution effects. That said, it is difficult to obtain a closed-form solution since F_t is a non-linear function of τ. To address this issue, we will add terms to allow for non-separable preference in the estimation procedure described below.

[9] In a closely related study, Cashin (2012) cannot reject that preferences over durables and non-durables are additively separable.

3.3. Empirical Specification

To estimate the IES, we use an empirical specification that is consistent with the model and is able to separately identify the IES from intra-temporal substitution effects. According to the model presented above, the intra-temporal substitution effects, or changes in $\ln F_t$, will appear symmetrically in the months prior to and following implementation. On the other hand, the intertemporal substitution effect is present only at the time of implementation. This is key to identifying the IES.

With this in mind, the following specification can identify the IES:

$$\Delta \ln C^N_{i,y,m} = (\text{constant}) + \gamma_{\text{Apr}} D_{\text{Apr}} + \sum_{(y,m)\in I} \alpha^N_i \Delta D_{y,m}$$

where $\Delta \ln C^N_{i,y,m}$ is the log-difference of consumption of N for household type i in year y and month m; D_{Apr} is a dummy for April 1997; and $\Delta D_{y,m}$ is the first difference of month dummies for the period I, during which the intra-temporal substitution effects are present. In the absence of durable adjustment costs (i.e. φ is always zero), the changes in $\ln F_t$ will be limited to the month prior to and the month of implementation. That is, the set I consists of one element, March 1997. With this specification, our main interest is γ_{Apr}, which is divided by τ to obtain the IES. On the other hand, the α^N_i's correspond to $\frac{\sigma-\epsilon}{\epsilon-1}\Delta \ln F_{y,m}$ for each month m.

Importantly, the inclusion of a first-differenced month dummy will also capture any arbitrage that households may have engaged in. Although we define N more strictly than previous studies do, goods and services with some degree of durability or storability are included in N. Thus, it is quite plausible that households purchased, say, fresh fruit the day prior to the tax rate increase, but consumed it after implementation. If we did not include a first-differenced dummy for March 1997 in the presence of arbitrage, then our estimate of the IES would be biased upwards.

In the actual estimation, we consider some additional factors affecting consumption that were excluded from the theoretical model, such as seasonality and demographics. The regression equation is:

$$\Delta \ln C^N_{i,y,m} = (\text{constant}) + \Delta \boldsymbol{Z_m} \delta^j_{i,m} + \Delta \boldsymbol{X_{i,y,m}} \phi^{\text{j}}_i +$$

$$+(\gamma_{\text{Oct}} D_{\text{Oct}} + \gamma_{\text{Nov}} D_{\text{Nov}} + \gamma_{\text{Dec}} D_{\text{Dec}}) + \gamma_{\text{Apr}} D_{\text{Apr}} + \textstyle\sum_{(y,m)=(1997,1)}^{(1997,12)} \alpha^j_i \Delta D_{y,m} \qquad (5)$$

where $\Delta \boldsymbol{Z_m}$ is the first difference of a vector of month dummies. Consequently, $\delta_{i,m}^{\mathrm{j}}$ represents the seasonal effects. $\Delta \boldsymbol{X_{i,y,m}}$ 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; and interview dummies, which control for "survey fatigue", the tendency of households to report lower expenditure in later interviews. It is worth noting that household-specific fixed effects (or non-time-varying characteristics) are already controlled for by taking the first difference.

The dummies for October, November, and December 1996 (D_{Oct}, D_{Nov}, and D_{Dec}, respectively) are included to capture the announcement effect of the rate increase. The effect is the sum of the income effect and the intertemporal substitution effect. As we discussed in Section 2, the announcement of the tax rate increase occurred sometime between October and December 1996; thus, it is preferable to include not a single month but all three month dummies. The sign of the coefficients associated with each dummy are, however, ambiguous. The income effect should be negative since the rate increase represents a negative income shock, while the intertemporal substitution effect should be positive, reflecting households' incentive to increase their consumption during the periods between announcement and implementation, when the price level was relatively low. As a result, the sign of the coefficients depends on which effect dominated the other.[10]

Figure 5 provides a graphical depiction of our identification strategy. In the top figure, the blue circles represent monthly expenditure on N in the absence of intra- and inter- temporal substitution effects. The red X's represent expenditure on N in the absence of intra-temporal substitution effects. And finally, the orange doughnuts represent observed expenditure on N. In this example, we assume that announcement occurs in October 1996; the announcement effects appear immediately upon announcement; the income effect dominates the positive intertemporal substitution effects; and intra-temporal substitution between durables and non-durables is confined to March and April 1997. When we take the first difference of expenditure on N, the coefficient associated with the dummy variable for October 1996 will capture the sum of the income (I) and positive intertemporal substitution effect (S_+), γ_{Oct}; the coefficient associated with the first-differenced March 1997 dummy variable will capture the intra-temporal substitution effect, α_{Mar}; and the coefficient associated with the April 1997 dummy variable will properly capture the intertemporal substitution effect, γ_{Apr}, since we are able to control for the intra-temporal substitution effect in that month.

[10] There is also a literature that suggests that the income effect associated with a tax change is absent until the tax change is implemented. See, for example, Watanabe et al. (2001) and Mertens and Ravn (2010). If this were the case, our estimate of the IES would be biased upwards, since the decline in expenditure from March to April would capture not only intertemporal substitution, but also the negative income effect..

4. Empirical Evidence

4.1. Data

We use data from the Japanese Family Income and Expenditure Survey (JFIES) to estimate the IES.[11] 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.[12]

Our estimates make use of JFIES data from the period between April 1992 and March 2002. We use a symmetric five year window around the April 1997 rate increase. We choose to exclude the "bubble" years before April 1992 because household expenditures prior to 1992 grew at a much faster pace than they did after the bursting of the economic "bubble" in 1991, while they remained more or less flat after that. Our sample period ends in March 2002, which coincided with the beginning of another boom.

We limit the sample to households who complete all six interviews, but nearly all households can be used since the response rate of the JFIES is quite high. Although data for agricultural households is available in the JFIES after 1999, we drop them to maintain consistency over the sample period. Also, we use male headed households and those whose head does not change his job since March is the end of fiscal year in Japan and so we observe a lot of job changes, which may cause systematic changes in consumption. The sample restrictions leave us with 646,900 observations from 129,380 households. Table 1 presents summary statistics for our sample.

The JFIES expenditure data is highly disaggregated by item type, which allows us to accurately categorize goods and services. It is critical for our purpose to distinguish not only between taxable and tax-exempt goods and services, but also between N, S, and D.

To construct expenditure on N, we first exclude expenditures on goods and services that were not subject to the consumption tax. As shown in Table 1, expenditure on taxed items comprised 70% of total expenditure, while most tax-exempt expenditure consists of rent for housing and education (e.g. tuitions for school), which would not respond to a rate increase in the short-run.

As a second step, we divide goods and services that were subject to the tax into three sub-categories: D, S, and N. We define N as goods and services which are neither storable nor durable. That is, they depreciate relatively quickly over time when not in use, and when in use, are fully consumed. For example, fresh fruit, if not eaten, will spoil, and is fully consumed with use. This

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

[12] 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.

category also includes services such as taxi service, which is consumed at the point of purchase. Second, we define S as those goods and services that depreciate slowly over time if not used and fully if used. For example, laundry detergent can be stored for long periods of time with little to no effect on its ability to clean clothing, but once it is put into use, whatever amount was used has been fully consumed. This category also includes rail service, due to the fact that many Japanese households purchase passes which are good for train travel for several months. Thus, one might expect that a household would purchase a pass good for several months during a low price period, and use the pass during a relatively high price period. Finally, we define D as goods and services which depreciate relatively slowly over time if not used and do not depreciate fully with use. This category includes traditional durables such as refrigerators and automobiles, as well as goods such as clothing that are classified as semi-durables in the JFIES. In addition, we include a select group of services such as home repair and tailoring, which consumers derive benefits from long after the service is provided.[13]

We then deflate monthly expenditures on N, S, and D using tax-inclusive consumer price indices specific to our categories.[14] We are left with real monthly expenditures for Japanese households from April 1992 through March 2002. Table 1 shows that more than half of taxable expenditure is on N, while expenditure on S and D are similar.

4.2. Empirical Results

Table 2 presents our estimates for the entire sample based on the specification given in Equation (5). Regression (1) includes only a dummy for April 1997. In effect, it ignores the announcement, intratemporal substitution, and arbitrage effects. We find that expenditure on N fell significantly between March and April 1997. The 2.16 percent decline in expenditure implies that the intertemporal elasticity of substitution is 0.91, which exceeds previous estimates in the intertemporal substitution literature. The estimate of the IES remains unchanged in Regression (2), which allows for announcement effects. However, these estimates ignore intratemporal substitution and arbitrage, and could be biased as a result.

Regression (3), our baseline estimates, adds a first-differenced March 1997 dummy intended to capture intra-temporal substitution and/or arbitrage effects. Inclusion of this dummy reduces the coefficient associated with the April 1997 dummy from -2.16 to -0.51. The implied IES is 0.21,

[13] See Appendix Table A.1 for our complete categorization of N, S, and D.

[14] In particular, we construct Laspeyres price indices for each of our four categories using item-specific price indices and expenditure shares in 1990 for each of these items as the weights.

which is significantly less than one, but not significantly different from zero. The coefficient for the first-differenced March 1997 dummy is significantly different from zero, and therefore should, in fact, be included in the specification. To consider the possibility that the intra-temporal substitution and/or arbitrage effects existed beyond March and April 1997, Regression (4) includes additional first-differenced month dummies. Doing so, the estimate of the IES is slightly larger than in the baseline estimate (0.30), while we cannot reject the null that all first differenced month dummies are zero.

Table 3 presents regression estimates intended to test the robustness of our results. Since seasonal effects may change over time, a longer sample period could yield an incorrect estimate of the IES. While we use the symmetric five year window from 1992 through 2002 in the baseline, Regression (1) uses a four year window (1993-2001) and Regression (2) a three year window (1994-2000). The resulting IES estimates (0.17 and 0.30, respectively) are similar to the baseline estimate. Regression (3) removes all sample selection criteria such as male-headed household, participated all six interviews, etc. The implied IES is the largest of all our regressions (0.36), but still small and significantly less than one.

Our results are comparable to the results in the previous studies using macro-data. Hall (1988) summarizes his results by saying that "the value may even be zero and is probably not above .2" (Hall, 1988; p.350); Ogaki and Reinhart (1998) conclude that the point estimates fall in a "range of 0.32 to 0.45" when allowing for non-separable preference (Ogaki and Reinhart, 1998; p.1095); and moreover, Yogo (2004) reports the 95% confidence intervals [-0.43, 0.56] (the negative sign is added for comparison with our estimates) using Japanese data between 1970 and 1998 (Yogo 2004; Table 3). In contrast, Attanasio and Weber (2010) summarize their results (Attanasio and Weber 1993, 1995) as follows: the lower IES based on the macro-data can be explained by aggregation bias; once this bias is taken into account, the IES estimate increases to approximately 0.8 (Attanasio and Weber 2010, p.710). We believe that our estimates are preferable to previous estimates since we use microdata and a natural experiment approach. The former means that our result is free from aggregation bias, and the latter that we do not rely on the validity of instruments. [15]

The smaller IES may be attributable to liquidity constraints. Since liquidity constrained consumers are less able to smooth consumption across periods, the estimated IES could be smaller if many households faced a binding constraint around the time of the consumption tax rate increase. To test for this possibility, we separate the sample into groups that are more likely to be liquidity constrained and groups that are relatively less likely to be constrained. First, we separate working

[15] As in this paper, Engelhardt and Kumar (2009) use micro-data and an approach that exploits a natural experiment to find the IES is 0.74. Unlike others papers (including this one), however, the IES is not derived from the Euler equation, and accordingly, is difficult to compare to our estimates.

and non-working households. While the non-working group includes unemployed households, most are retired.[16] Since retired households can expect little to no income growth, they are much less likely to be liquidity constrained. As Regression (1) and (2) in Table 4 show, the difference in the estimated IES between working and non-working is small. A more conventional method to test for liquidity constraints is to divide households into higher and lower income groups. The results in Regressions (3) and (4) show that the IES is slightly larger for lower income households. Overall, Table 4 suggests that liquidity constraints are not be responsible for our small IES estimate.

Data quality is another possible explanation why consumption of N did not react to the rate increase. If households incorrectly report their expenditures every month, the real changes would be attenuated by measurement error, causing our estimate of the IES to be biased towards zero. To evaluate this, we regress the first difference of the logarithms of S and D on the same set of variables. Expenditures on S and D should change around implementation much more than expenditure on N. This is because S and D are subject not only to intertemporal substitution, but also arbitrage effects. Regressions (2) and (3) in Table 5 show that expenditures on S and D in March 1997 increased significantly. While it is difficult to interpret these coefficients, the results demonstrate that changes in expenditure are accurately reported; and thus, this suggests that data quality issues do not preclude us from finding a response to the Consumption Tax rate increase.

The coefficient on the first-differenced March 1997 dummy in our baseline specification is 1.66, which is significant at the five percent level. This result implies that households engaged in a significant amount of arbitrage prior to implementation of the consumption tax rate increase, and furthermore, that arbitrage dominated any intratemporal substitution that might have occurred between N and D.

Finally, we consider the announcement effects. Specifically, we are interested in their sum. We find that the sum is slightly positive, but does not differ significantly from zero in all regressions presented in Tables 2, 3, and 4. As discussed in subsection 3.3 above, this implies that the positive intertemporal substitution effect cancels out the negative income effect. It follows that we can evaluate the longer-term impact of the Consumption Tax rate increase based on our estimate of the (negative) intertemporal substitution effect only.

[16] More than 90 percent of non-working households are aged 60 or older.

5. Summary and Discussions

This study examines intertemporal substitution using a pre-announced increase in Japan's consumption tax rate from three to five percent. Since the Japanese Consumption Tax is highly comprehensive and the tax rate increase was announced prior to its implementation, it presents an ideal natural experiment for estimating the IES. A Japanese monthly household survey is exploited to accurately categorize "non-durables". Our research design and the use of micro-data allow us to avoid the problems of weak instruments and aggregation bias. Furthermore, our empirical specification is robust to intratemporal substitution between durables and non-durables, as well as arbitrage effects. Given the exogenous change in the real interest rate, our detailed data, and flexible empirical specification, we find that the IES is small. The baseline point estimate is 0.21 and does not differ significantly from zero, but is significantly less than one.

From a policy standpoint, two implications emerge from our result. First, recent work by Correia et al. (2010) demonstrates that when nominal interest rates are at the zero lower bound, a reduction in the VAT can be used to mimic an interest rate cut. However, our result suggests that the stimulus provided by such a policy would be relatively limited.[17]

Second, previous authors (e.g. Kaplow, 2008; Auerbach and Kotlikoff, 1983, 1987) have raised concerns over the efficiency costs of pre-announcement. They posit that the longer the length of time between announcement and implementation of a consumption tax rate increase, the larger will be the welfare losses due to the acceleration of consumption in the period prior to implementation. However, our result suggests that the welfare losses of pre-announcement are small.[18]

Japanese policy makers are currently considering an increase in the Consumption Tax rate from five to ten percent. One concern associated with the proposed tax rate increase is the negative impact it will have on consumption. If we simply apply the estimated IES, 0.21, to the five percent increase, taxable consumption drops by one percent (0.21 * 5 percent). Since the share of taxable goods in total consumption is approximately 70 percent, a 0.7 percent drop in total consumption is expected if we assume that tax-exempt goods and services such as housing and tuition for school are

[17] For a borrowing constrained household, consumption should increase throughout the entire period of the rate decrease. Crossley et al. (2009) point out that the fraction of constrained households likely increases during downturns. If this is true, a rate decrease may provide stimulus not because of the intertemporal substitution effects, but rather income effects for constrained households.

[18] This finding is further reinforced by the results in Cashin (2011), which examines the intertemporal substitution and arbitrage effects of three separate increases in the Goods and Services Tax rate in New Zealand. In all three cases, the length of time between announcement and implementation differed, but in all three cases, the expenditure response was confined to the month prior to implementation, which indicates the response was driven by largely unavoidable arbitrage effects rather than intertemporal substitution.

not affected by the tax rate increase. As such, the direct impact would be roughly 0.42 percent of GDP, since household consumption comprises about 60 percent of GDP. In addition, announcement effects appear to be slightly positive; therefore, the total impact of the tax rate increase on household consumption is expected to be small.

While we find that *consumption* is insensitive to the real interest rate, the same is not necessarily true for *expenditure*. Durability and storability present arbitrage opportunities that allow households to make purchases during low price periods for consumption during high price periods. Our future work will examine the arbitrage effects associated with Japan's consumption tax rate increase. In so doing, we will be able to fully characterize the consumption and expenditure response to a change in the real interest rate.

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TABLE 1. SUMMARY STATISTICS

Variable	Mean	Std.	Min	Max
Age of head	51.5	13.7	17	99
Number of household members	3.38	1.24	2	11
Number of household members under age 15	0.68	0.98	0	7
Number of household members aged 65+	0.47	0.75	0	4
Number of working members	1.52	0.95	0	7
Yearly income (1,000 yen)	7,113	4,652	0	97,043
Total expenditure (1,000 yen)	317	266	20	14,346
Exculuding Tax Exempted items (1,000 yen)	221	195	15	9,255
Nonstorable non-durables (N) (1,000 yen)	120	78	7	5,523
Storable non-durables (S) (1,000 yen)	52	32	.58	3,790
Durables (D) (1,000 yen)	47	138	0	7,678
Number of Observations	646,900			
Number of Households	129,380			

Note: Yearly household income and monthly household expenditures are listed in thousands of yen, with 2005 serving as the base year.

TABLE 2. INTERTEMPORAL ELASTICITY OF SUBSTITUTION

	Dependent Variable: Non-storable non-durable (multiplied by 100)							
	(1)		(2)		(3)		(4)	
	Coef.	Standard error	Coef.	Standard error	Coef.	Standard error	Coef.	Standard error
First Difference of Month dummies								
$\Delta \boldsymbol{D}_{\text{Feb,1997}}$							-1.10	0.78
$\Delta \boldsymbol{D}_{\text{Mar,1997}}$					1.66**	0.82	0.56	0.91
$\Delta \boldsymbol{D}_{\text{Apr,1997}}$							-0.89	0.94
$\Delta \boldsymbol{D}_{\text{May,1997}}$							-1.54*	0.90
$\Delta \boldsymbol{D}_{\text{Jun,1997}}$							0.06	0.78
p-value for F-test for All $\Delta \boldsymbol{D}$ =0	n.a.		n.a.		0.042**		0.139	
Month Dummies								
$\boldsymbol{D}_{\text{Oct,1996}}$ (a)			-0.93	0.78	-0.93	0.78	-0.93	0.78
$\boldsymbol{D}_{\text{Nov,1996}}$ (b)			1.21	0.76	1.21	0.76	1.21	0.76
$\boldsymbol{D}_{\text{Dec,1996}}$ (c)			-0.05	0.79	-0.05	0.79	-0.05	0.79
$\boldsymbol{D}_{\text{Apr,1997}}$ (d)	-2.16***	0.78	-2.16***	0.78	-0.51	0.84	-0.71	1.15
(a)+(b)+(c) (p-value for F-test)	n.a.		0.23 (0.80)		0.23 (0.80)		0.23 (0.65)	
Implied the IES (=(d) divided by 2.39) [95% Conf. Interval]	-0.91 [-1.55, -0.27]		-0.91 [-1.55, - 0.27]		-0.21 [-0.90, 0.48]		-0.30 [-1.24, 0.65]	
Sample Period	1992-2002							
Sample Restriction	Yes							
Observations	646,900							

Note: This table presents estimates from a regression based on Equation (5). The dependent variable is the first difference of the logarithm of monthly household expenditures. 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, the first difference of month dummies, age of household head the first differences of the following variables: indicators for each interview; the number of household members, working members, members under age 18, and members over the age of 65. *, **, and *** represent significance at the 10, 5, and 1 percent level, respectively.

TABLE 3. ROBUSTNESS CHECK: DIFFERENT SAMPLE

	Dependent Variable: Non-storable non-durable (multiplied by 100)					
	(1)		(2)		(3)	
	Coef.	Standard error	Coef.	Standard error	Coef.	Standard error
First Difference of Month dummies						
$\Delta \boldsymbol{D}_{\text{March,1997}}$	1.75**	0.83	1.54*	0.85	1.79**	0.74
Month Dummies						
$\boldsymbol{D}_{\text{Oct,1996}}$ (a)	-1.03	0.79	-0.38	0.81	-0.94	0.73
$\boldsymbol{D}_{\text{Nov,1996}}$ (b)	1.60**	0.78	1.33*	0.79	1.60**	0.71
$\boldsymbol{D}_{\text{Dec,1996}}$ (c)	0.03	0.80	0.13	0.82	0.10	0.72
$\boldsymbol{D}_{\text{Apr,1997}}$ (d)	-0.41	0.86	-0.71	0.88	-0.86	0.78
(a)+(b)+(c) (p-value for F-test)	0.59 (.407)		1.08 (0.266)		0.42 (.650)	
Implied the IES (=(d) divided by 2.39) [95% Conf. Interval]	-0.17 [-0.87, 0.53]		-0.30 [-1.03, 0.43]		-0.36 [-0.99, 0.27]	
Sample Period	1993-2001		1994-2000		1992-2002	
Sample Restriction	Yes		Yes		No	
Observations	526,612		394,673		764,895	

Note: This table presents estimates from a regression based on Equation (5). The dependent variable is the first difference of the logarithm of monthly household expenditures. 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, the first difference of month dummies, age of household head the first differences of the following variables: indicators for each interview; the number of household members, working members, members under age 18, and members over the age of 65. *, **, and *** represent significance at the 10, 5, and 1 percent level, respectively.

TABLE 4. HETEROGENEITY ACROSS HOUSEHOLD TYPE

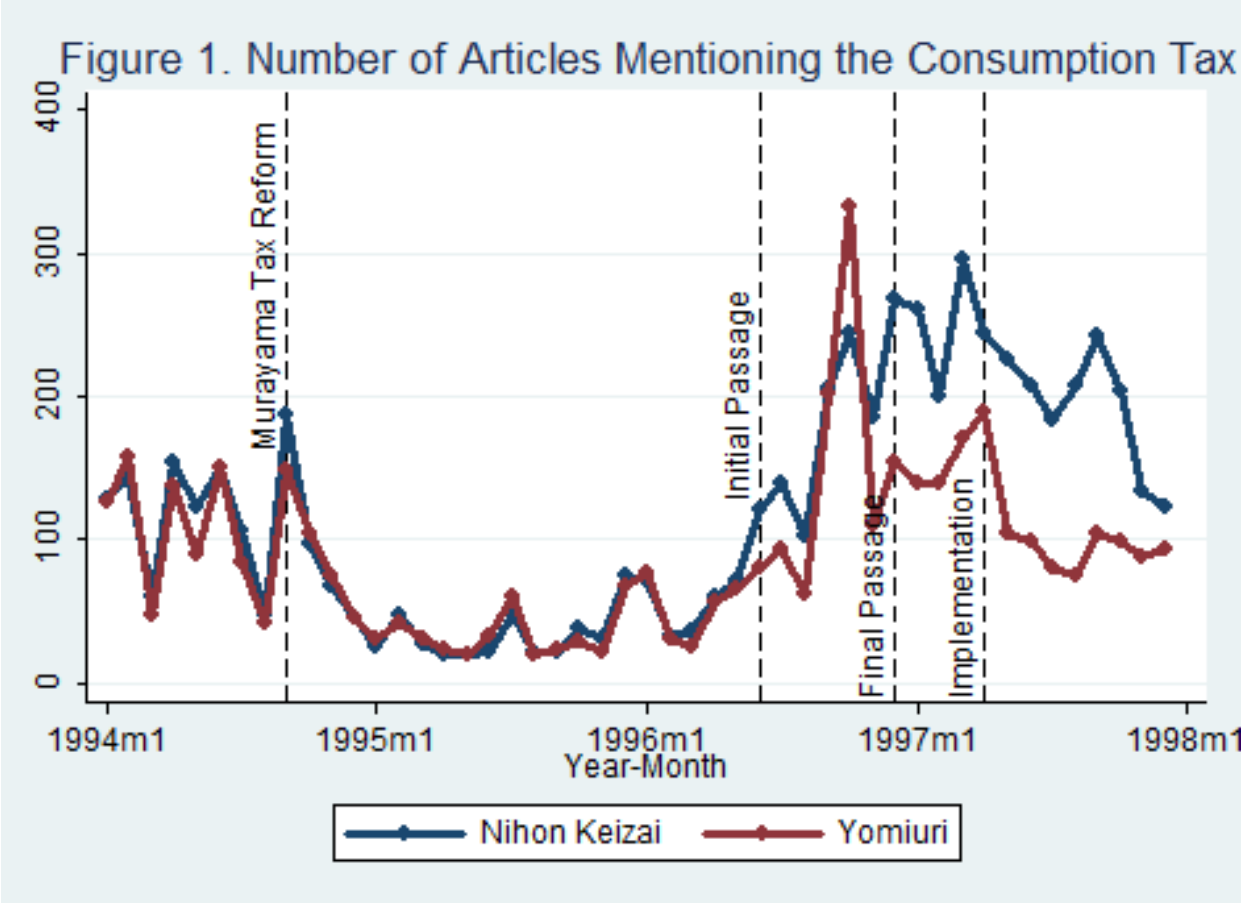
	Dependent Variable: Non-storable non-durable (multiplied by 100)							
	(1)		(2)		(3)		(4)	
	Coef.	Standard error	Coef.	Standard error	Coef.	Standard error	Coef.	Standard error
First Difference of Month dummies								
$\Delta \boldsymbol{D}_{\text{Mar,1997}}$	1.19	0.89	3.95**	2.00	1.48	1.11	1.70	1.21
Month Dummies								
$\boldsymbol{D}_{\text{Oct,1996}}$ (a)	-0.82	0.85	-1.37	2.00	-1.88	1.10	0.25	1.09
$\boldsymbol{D}_{\text{Nov,1996}}$ (b)	0.99	0.81	2.28	2.22	1.18	1.06	1.28	1.10
$\boldsymbol{D}_{\text{Dec,1996}}$ (c)	-0.13	0.86	-0.27	2.05	0.39	1.10	-0.74	1.13
$\boldsymbol{D}_{\text{Apr,1997}}$ (d)	-0.57	0.93	-0.36	1.94	-0.36	1.17	-0.80	1.22
(a)+(b)+(c) (p-value for F-test)	0.04 (0.97)		0.36 (0.62)		0.23 (0.81)		0.23 (0.55)	
Implied the IES (=(d) divided by 2.39) [95% Conf. Interval]	-0.24 [-1.01, 0.53]		-0.15 [-1.75, 1.45]		-0.15 [-1.11, 0.81]		-0.34 [-1.34, 0.67]	
Sample Period	1992-2002		1992-2002		1992-2002		1992-2002	
Sample Group	Working		No Job		Higher Income		Lower Income	
Observations	539,073		107,827		311,837		335,063	

Note: This table presents estimates from a regression based on Equation (5). The dependent variable is the first difference of the logarithm of monthly household expenditures. 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, the first difference of month dummies, age of household head the first differences of the following variables: indicators for each interview; the number of household members, working members, members under age 18, and members over the age of 65. *, **, and *** represent significance at the 10, 5, and 1 percent level, respectively.

TABLE 5. ARBITRAGE EFFECTS FOR STORABLES AND DURABLES

	Non-storable non-durable (multiplied by 100)		Storable non-durable (multiplied by 100)		Durables (multiplied by 100)	
	(1) (Regression (3) in Table 2)		(2)		(3)	
	Coef.	Standard error	Coef.	Standard error	Coef.	Standard error
First Difference of Month dummies						
$\Delta \boldsymbol{D}_{\text{Feb,1997}}$	-1.10	0.78	0.01	0.87	7.16	3.40
$\Delta \boldsymbol{D}_{\text{Mar,1997}}$	0.56	0.91	10.06***	0.97	21.89***	3.71
$\Delta \boldsymbol{D}_{\text{Apr,1997}}$	-0.89	0.94	-3.80***	1.01	-0.35	3.72
$\Delta \boldsymbol{D}_{\text{May,1997}}$	-1.54*	0.90	-0.73	0.91	2.07	3.24
$\Delta \boldsymbol{D}_{\text{Jun,1997}}$	0.06	0.78	1.21	0.83	6.93**	2.94
p-value for F-test for All $\Delta \boldsymbol{D}$ =0	0.139		0.00***		0.00***	
Month Dummies						
$\boldsymbol{D}_{\text{Oct,1996}}$ (a)	-0.93	0.78	1.13	0.85	0.78	3.13
$\boldsymbol{D}_{\text{Nov,1996}}$ (b)	1.21	0.76	-1.91**	0.88	-4.02	2.95
$\boldsymbol{D}_{\text{Dec,1996}}$ (c)	-0.05	0.79	1.58*	0.94	3.41	3.03
$\boldsymbol{D}_{\text{Apr,1997}}$	-0.71	1.15	-2.43*	1.28	-8.13*	4.72
Sample Period	1992-2002		1992-2002		1992-2002	
Sample Restriction	Yes		Yes		Yes	
Observations	646,900		646,900		646,900	

Note: This table presents estimates from a regression based on Equation (5). The dependent variable is the first difference of the logarithm of monthly household expenditures. 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, the first difference of month dummies, age of household head the first differences of the following variables: indicators for each interview; the number of household members, working members, members under age 18, and members over the age of 65. *, **, and *** represent significance at the 10, 5, and 1 percent level, respectively.



Source: Authors' calculations. Circulation numbers come from Japan's Audit Bureau of Circulations.

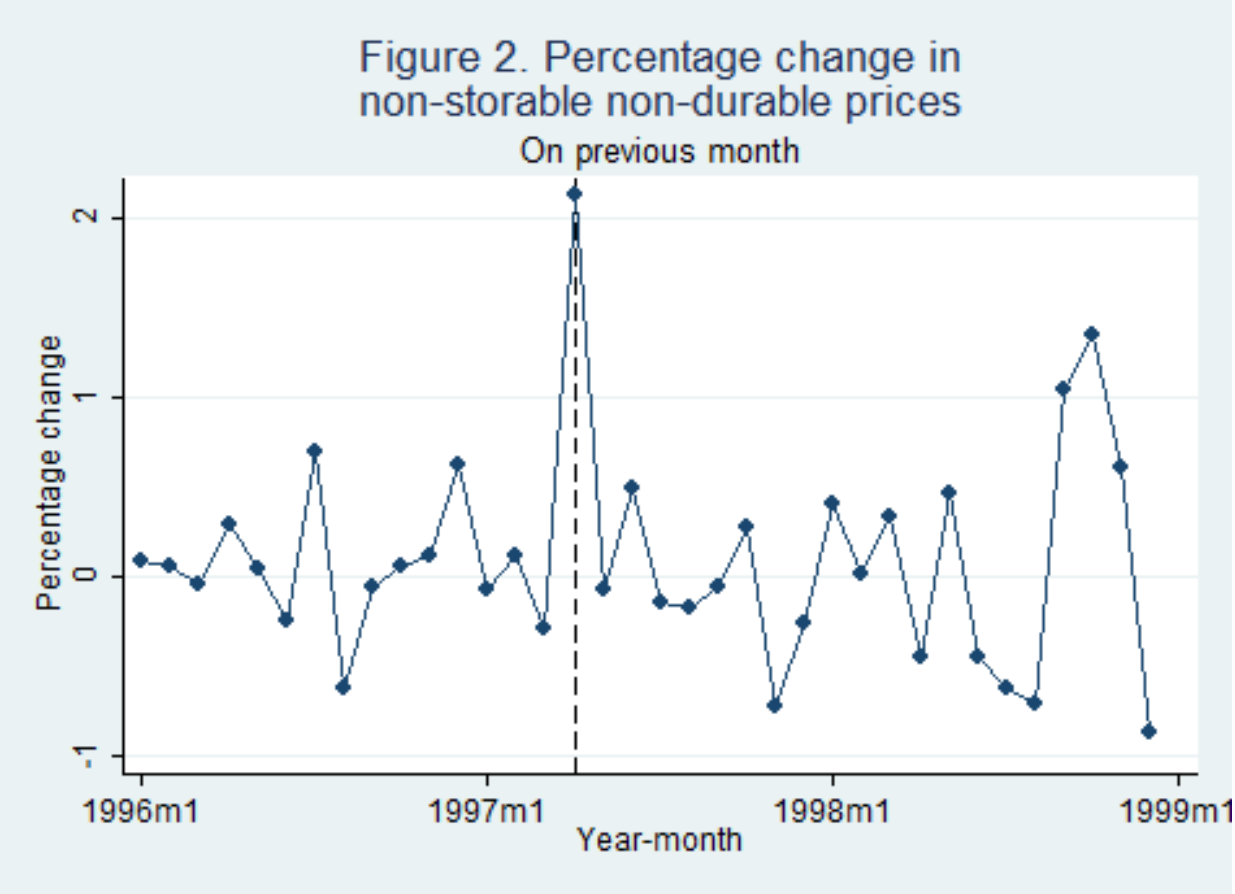


Figure 2 presents the month on month percentage change in seasonally-adjusted non-storable non-durable prices. To remove seasonality, we regress the consumer price index for non-storable non-durable goods and services on month dummies. The residuals are added to the constant in the regression to obtain a seasonally-adjusted price index. We then calculate the percentage change from one month to the next in the seasonally-adjusted price index. The dashed vertical line in the figure is April 1997, the month of implementation.

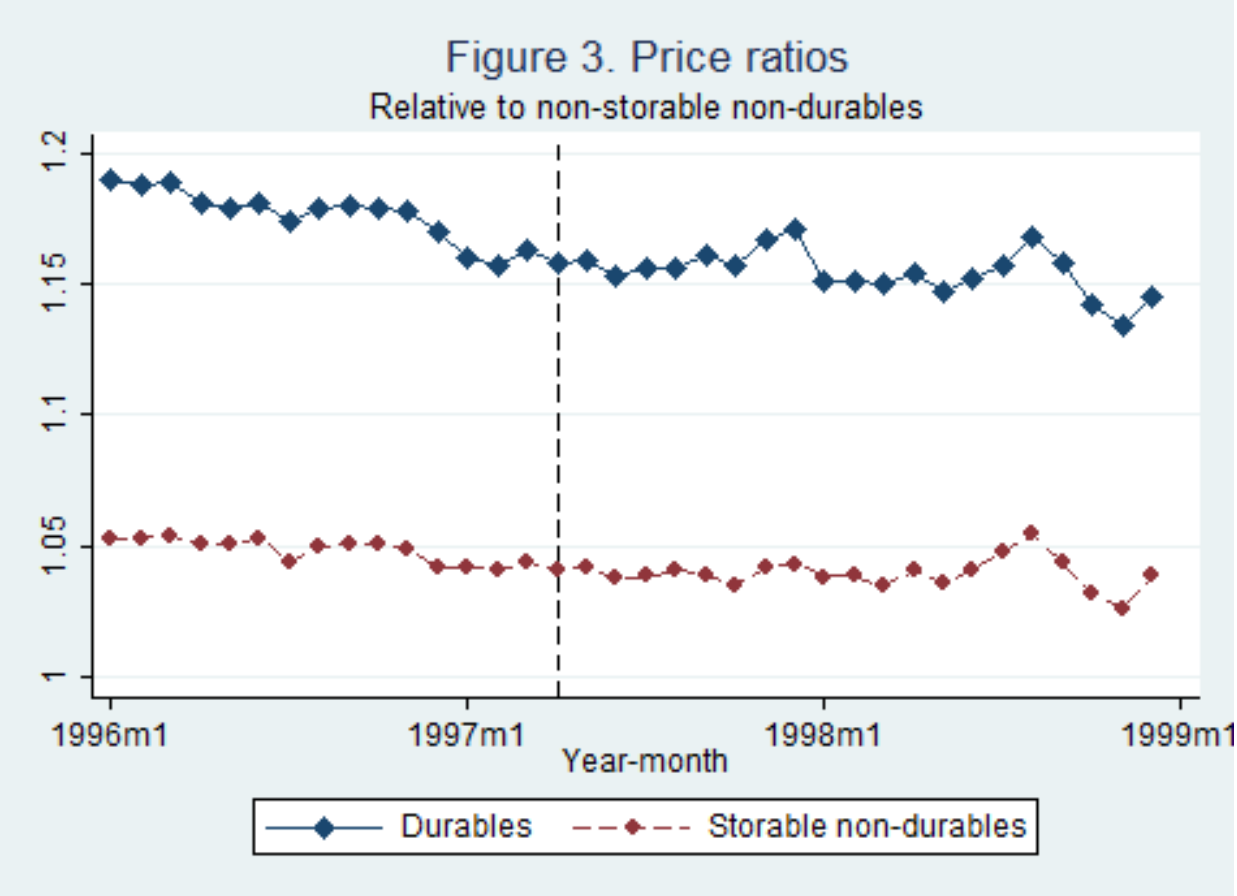


Figure 3 presents the ratio of seasonally-adjusted durable and storable non-durable prices to non-storable non-durable prices. To remove seasonality, we regress the consumer price indices for durables, storable non-durable, and non-storable non-durable goods and services on month dummies. The residuals are added to the constant in the regression to obtain seasonally-adjusted price indices. To calculate the ratios, we divide the seasonally-adjusted durable and storable non-durable price by the seasonally-adjusted non-storable non-durable price in each month. The dashed vertical line in the figure is April 1997, the month of implementation.

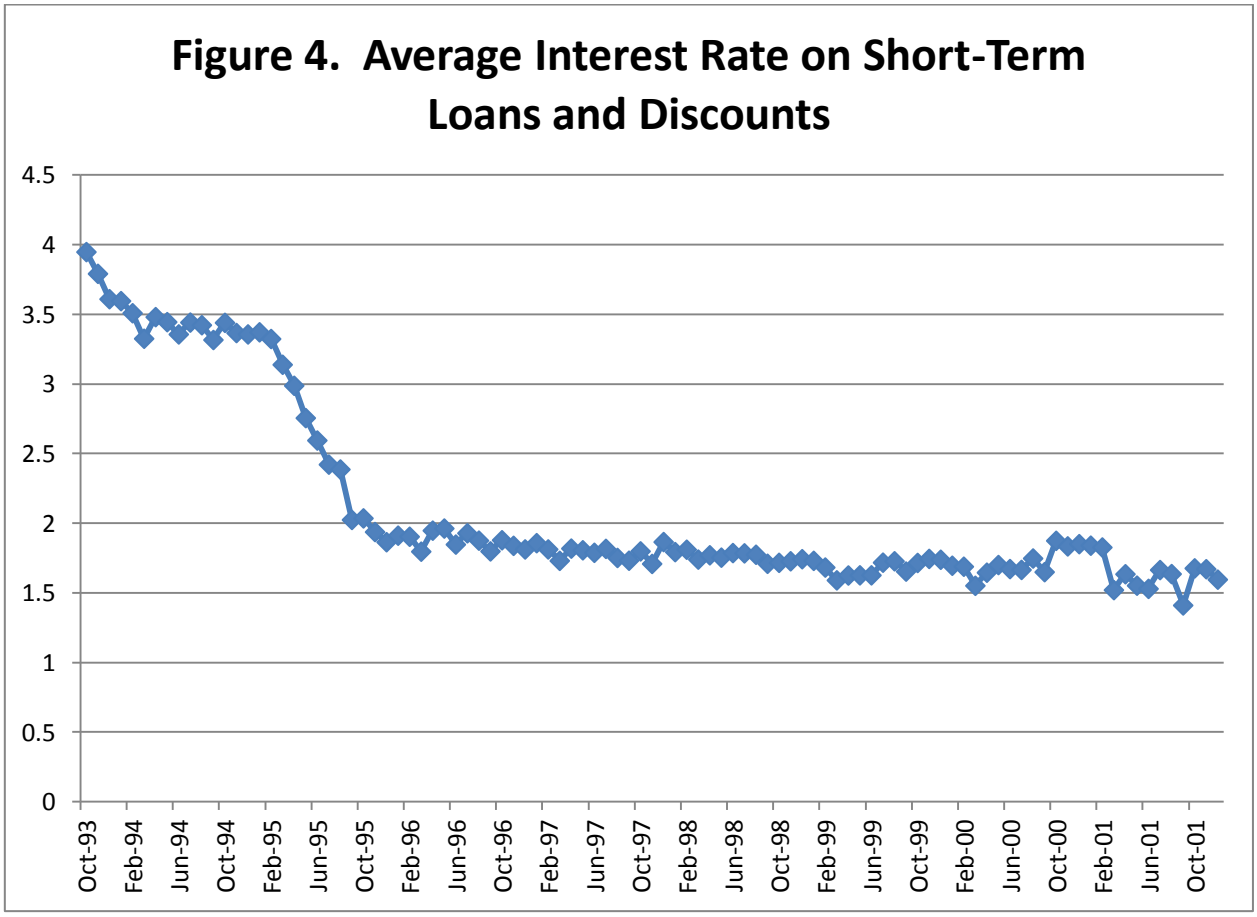
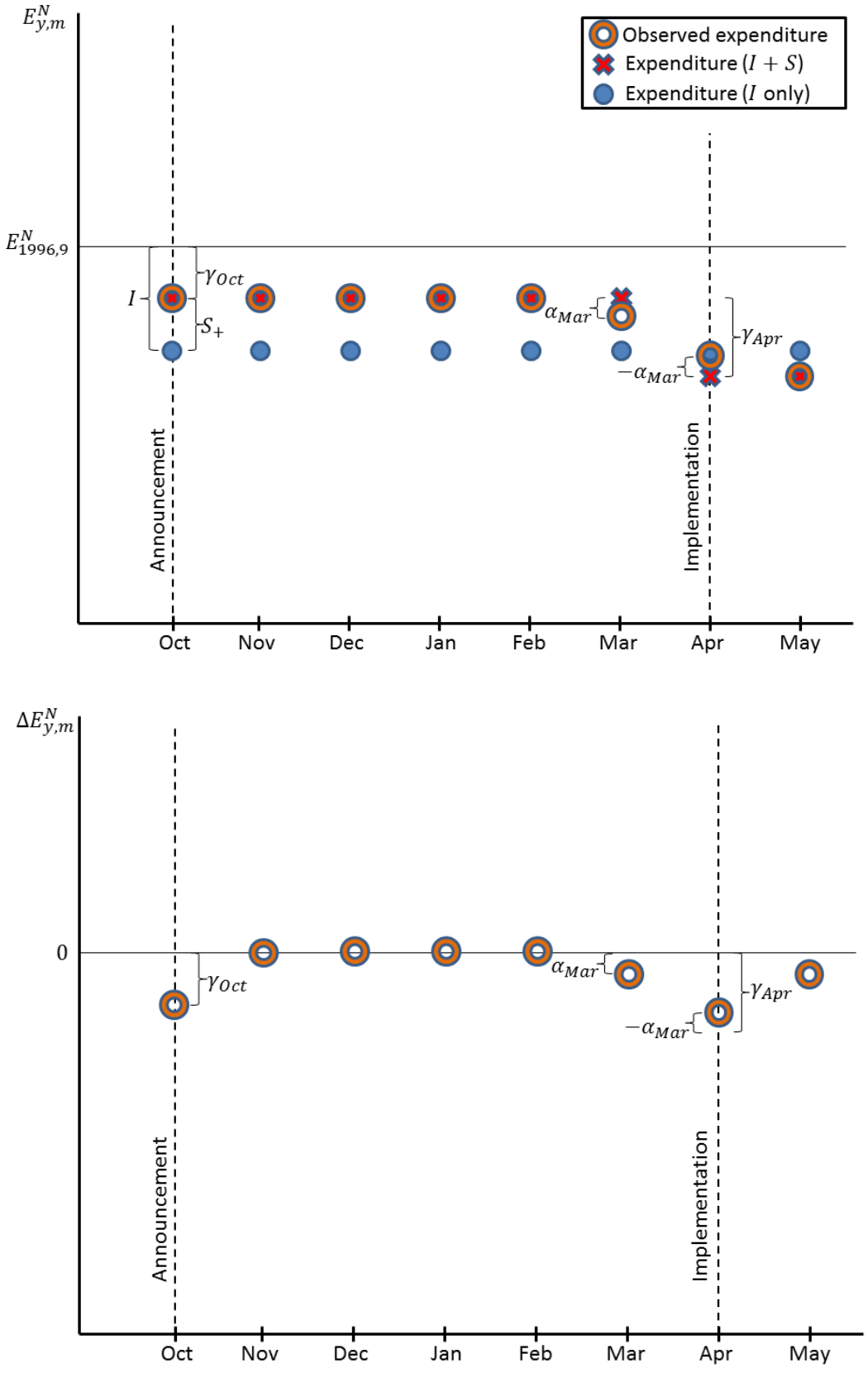


Figure 4 presents the average contracted interest rate on short-term loans and discounts. These are the average interest rates applied to a contract of less than one year between commercial banks and lenders. The data comes from the Bank of Japan.

FIGURE 5. IDENTIFICATION OF THE INTERTEMPORAL SUBSTITUTION EFFECT



APPENDIX TABLE. CATEGORIZATION OF GOODS AND SERVICES SUBJECT TO THE CONSUMPTION TAX

Durables	Storable Non-Durables	Non-Storable Non-Durables
Tools	Grains (e.g. noodles)	Bread
Cooking appliance	Fish (dried, fish paste)	Fish (fresh)
Refrigerator	Meat (processed)	Meat (raw)
Vacuum	Dairy (e.g. butter)	Dairy (e.g. milk)
Washing machine/dryer	Vegetable (e.g. beans)	Vegetable (fresh)
Other household durables (e.g. microwave)	Fruit (canned)	Fruit (fresh)
Air conditioner	Oils, spices, and seasonings	Cake
Fan heaters	Sugar	Cooked food (e.g. sushi)
Stove	Sweets (e.g. chocolate)	Electricity
Other heating and cooling appliances	Cooked food	Natural gas
General furniture	Beverages (e.g. tea)	Water
Clock	Alcoholic beverages	Gasoline
Lighting	Light bulbs	Flowers
Floor coverings and curtains	Domestic goods (e.g. laundry detergent)	Newspaper
Other interior furnishings	Cloth	Eating out
Bedding	Medicine	Domestic services
Utensils	Medical supplies (e.g. bandages)	Bus fare
Japanese clothing	Stationery	Taxi fare
Western clothing	Film	Airfare
Women's coats	Recording media (e.g. CD)	Other public transit
Shirts	Pet food	Automotive fees
Underwear	Personal care items (e.g. toothbrush)	Automotive insurance
Other clothing	Tobacco	Telephone service
Footwear	Rail service	Recreational good repair
Automobile		Recreational durable good repair
Other vehicle		Lodging
Bicycle		Package tour
Auto parts		Lesson fees
Telephone		Television service
Textbook		Movie or play admission
Television		Other admissions
Stereo		Other recreational services
Portable audio equipment		Other insurance
Video recorder		Social expenses (e.g. money gifts)
Camera	**(Durables Cont.)**	
Computer	Personal effects (e.g. umbrella)	
Musical instrument	Handbag	
Desk	Accessories (e.g. watch)	
Other recreational durable goods	Other personal effects (e.g. cane)	
Golf equipment	Home repair (e.g. plumbing)	
Other sporting goods	Clothing services (e.g. tailoring)	
Sport outfits	Auto repair	
Toys	Personal care services (e.g. haircut)	
Other recreational goods	Personal effect services (e.g watch repair)	
Books	Personal care item (e.g. hair dryer)	