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The Intertemporal Substitution and Income Effects of a VAT Rate Increase: Evidence from Japan

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Abstract

One of the biggest political issues in Japan is an increase in the rate of value added tax (VAT). In this paper, we evaluate its impact on household expenditure, using Japan's April 1997 VAT rate increase from three to five percent as a case study. A rate increase induces price hikes, and provided this increase in price levels is anticipated, households should engage in intertemporal substitution of purchases. In addition, if households are not compensated for the rate increase, it has the potential to induce an income effects on household consumption. Based on monthly household expenditure data, we find that households spent ¥30,231 more in the quarter prior to the rate increase than they would have in its absence, while the income effect was negligible. Consistent with theoretical predictions, increased outlays on durable and storable non-durable goods and services were responsible for roughly three-quarters of the observed intertemporal substitution effects. Contrary to conventional wisdom, we find that the VAT rate increase had no impact on real household spending following its implementation, once we have accounted for intertemporal substitution, which caused a large transitory disturbance in household expenditures.

Keywords: value added tax, intertemporal substitution, and consumer behavior.

JEL classification: H24; H31; D12

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1. Introduction

An increase in the rate of value added tax (VAT) is one of the biggest political issues facing Japan and other developed countries today. As a result of aging populations and a slow-down in economic growth, public pension systems have been strained in countries which rely on an unfunded, or pay-as-you-go, pension system, and rate increases in VAT are viewed as an attractive option to fill the budget gap. While economic theory is basically favorable to VAT (see, for example, Slemrod and Bakija 2008), the introduction of VAT, or a rate increase, is a politically sensitive issue, not only because of its distributional effects, but also because of its potentially negative impact on household consumption.

Increases in VAT rates should affect household spending primarily in two ways, since the rate increase would likely be passed on to consumers in the form of higher retail prices. First, anticipation of higher future prices should lead households to accelerate their purchases, as households change the timing of purchase to avoid the higher tax rate. As a result, we would expect to observe an increase in household spending during the period between announcement and implementation of the rate increase, and a decline thereafter, which is the intertemporal substitution effect. This will cause a large macroeconomic disturbance and reduce consumer welfare. Second, if the VAT rate increase is uncompensated, the higher prices faced by households will reduce their permanent income, which could potentially cause a decline in consumption.¹ As a consequence, we would expect to observe a decline in real household spending following announcement of the rate increase. This is the income effect associated with a consumption tax rate increase.

To estimate the intertemporal substitution and income effects of a VAT rate increase, this paper examines average monthly household expenditure patterns in the months surrounding Japan's April 1997 rate increase from three to five percent. To identify the intertemporal substitution effects, we use a first-difference specification. Deviations in expenditures from month to month will capture the intertemporal substitution effects provided that the income effect is constant over time and there are no major changes in other factors affecting household expenditure from one month to the next. To identify income effects, we use a level specification and further assume the following: all intertemporal substitution occurs between January and

¹ The income effect should be observed provided that households are not Ricardian consumers, nor do they increase their lifetime labor supply or draw down on a buffer stock of savings to compensate for the price increase.

November 1997 and there is little to no change in other factors that may affect household consumption relative to the period in which the rate increase was announced.

Under these identification assumptions, we find that the average Japanese household spent ¥30,231 (in ¥2005, approximately \$302) more in the quarter preceding implementation than they would have in its absence, and real expenditures for each month within the quarter were 0.61, 3.24, and 8.85 percent greater as a result of intertemporal substitution associated with the rate increase. Our findings demonstrate that the intertemporal substitution effects were large though short-lived. Furthermore, the finding that the intertemporal substitution effects prior to the tax change were concentrated only in the quarter prior to implementation suggests that households were unaware of, ignored, or did not find credible two earlier announcements regarding the rate increase, and instead only responded following final passage of the FY 1997 budget that made the rate increase an absolute certainty.

On the other hand, we find that the income effect was not significantly different from zero. The average Japanese household spent only ¥562 (~\$6) less per month as a result of the VAT rate increase. Conventional wisdom holds that the 1997 VAT rate increase was ill-timed and largely responsible for Japan's "double dip" recession of the late 1990's. We instead provide evidence suggesting the rate increase did not have a significant negative impact on household spending in the months following its implementation, once intertemporal substitution is accounted for.

We also decompose both effects by good type. Previous research finds heterogeneity in price sensitivity dependent on the durability or storability of a good or service (e.g. Hendel and Nevo, 2004). Consistent with the literature, we find that intertemporal substitution prior to the VAT rate increase was dominated by increased outlays on durable and storable non-durable goods and services. Increased expenditures on durable goods and services accounted for just under one half of the intertemporal substitution effects, while this group accounts for only one quarter of expenditure shares over the sample period. Storable non-durable goods and services (e.g. laundry detergent) were responsible for 29 percent of the intertemporal substitution effects, while accounting for almost one-fifth of expenditure shares. Not surprisingly, the intertemporal substitution effects for non-storable non-durable goods and services are muted.

The income effect is also decomposed by good type. We find a significant reduction in outlays on durable goods and services, while spending on non-durable goods and services increased, though not by a significant amount. This finding suggests that the income elasticity for durable goods and services is positive and exceeds that for non-durables, a finding consistent with previous research (e.g. Bils and Klenow, 1998).

The implication of this paper is that a relatively modest increase in the rate of VAT induces large macroeconomic disturbances over a short period of time as a result of the intertemporal substitution effects, while consumption over the long-run is not seriously affected. In that sense, a government that plans to introduce a VAT or increase its rate should consider some measures to mitigate the transitory disturbances.²

The remainder of the paper is organized as follows. Section 2 discusses background on Japan's April 1997 VAT rate increase. This section also discusses heterogeneity in the durability and storability of goods and services, and its implication for intertemporal substitution. Section 3 introduces the empirical methodology to identify the intertemporal substitution and income effects. Section 4 presents the design and content of the Japanese Family Income and Expenditure Survey, the household expenditure data we use to estimate the intertemporal substitution and income effects associated with the VAT rate increase. Section 5 presents our results and Section 6 discusses the implications of our results. Section 7 concludes.

2. Tax Rate Change and Price Responses

2.1. Political Process of VAT Rate Increase

VAT in Japan, known as the "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 towards indirect taxation, which is necessary for aging societies relying on unfunded (pay as you go) pension systems. To sustain the pension system, older households must bear a part of the burden. However, an increase in income tax or contribution rates is of little use since the elderly have already retired and no longer pay these taxes. And given that cuts in pension payment levels are politically infeasible, rate increases in VAT are viewed as an attractive option to fill the budget gap.

Unlike VAT in most other countries, Japan's consumption tax has a single flat rate with a relatively small number of exemptions.³ The initial rate was three percent and remained at that level until April 1, 1997, when the rate was increased to five percent. A flat rate implies that a change in tax rate hardly affects the relative prices among goods and services that are subject to

² Bütler (2000) analyses the political feasibility of pension reform options including a VAT rate change.

³ 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. Despite these exemptions, Japan's VAT is one of the broadest in the world.

the tax, making it is easier to identify the intertemporal substitution and income effects associated with the rate increase. We choose to focus only on the 1997 VAT increase since the 1989 VAT introduction coincided with the removal of several other indirect and excise taxes, and thus relative prices of goods and services subject to the consumption tax were affected, which complicates the analysis.

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 VAT 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 only be imposed 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 VAT rate increase was scheduled to become effective 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 VAT rate to five percent as planned.

The events described above suggest that it is difficult to decide when the government "announced" the VAT rate increase. Furthermore, 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. If the consumption tax rate increase induced an income effect, identification of the effect requires knowledge of the timing of announcement, since the Life-Cycle Permanent Income Hypothesis (LCPIH) predicts that a rational consumer will reduce their consumption immediately following announcement of the rate increase. We discuss this issue further in section 3.1, and for the remainder of the paper we refer to June 1996 as "initial passage" of the VAT rate increase, and December 1996 as "final passage".

2.2. Potential Confounding Factors

In the empirical analysis, it is important to account for potential confounding factors. In this section, we highlight three events that occurred in 1997 (our period of interest) that could have potentially affected household expenditures in the months surrounding the VAT rate increase: the elimination of a special income tax break, increases in medical copayments, and the Japanese banking crisis. All three events would bias downwards our estimates of the income effects, and perhaps the intertemporal substitution effects.

In January 1997, it was announced that a special income tax break that had been in place for the previous few years would be eliminated. In June and December of each year, the tax break refunded 15 percent of income tax paid over the previous six months in the form of reduced tax withheld. Given this tax change, a rational household would reduce their household spending in January 1997 and subsequent months. As will be discussed below, this would bias downward our estimates of the intertemporal substitution effects prior to the VAT rate increase, as well as our estimate of the income effect resulting from the rate increase. If instead household spending did not respond until June, when households would have expected to receive the refund, only our estimate of the income effect will be biased downward.

In September 1997, copayments on medical costs increased from ten percent to twenty percent, which would likely reduce expenditures on items subject to VAT as health care is largely a necessity. Because we attempt to identify the intertemporal substitution effects off of changes in household expenditure prior to the VAT rate increase, these estimates should not be affected by the copayment change. However, the change will potentially bias downwards our estimate of the income effects resulting from the VAT rate increase.

Finally, in late November 1997, the Japanese banking crisis began with the bankruptcy of Sanyo Securities, and was followed in December 1997 by the bankruptcies of the Hokkaido Takushoku Bank and Yamaichi Securities. According to National Accounts data published by the Cabinet Office, Japanese households sustained a loss in financial wealth of ¥42 trillion (~\$420 billion) in 1997, or roughly \$10,000 per household. The wealth loss suffered by shareholders should have reduced the permanent income of the average Japanese household, and as a result, this event, perhaps even more so than the elimination of special income tax breaks and the increase in medical copayments, will potentially bias downward our estimates of the income effects associated with the VAT rate increase.

2.3. VAT Rate Increase and Price Expectations

In order to make the claim that the VAT rate increase induced both intertemporal substitution and income effects, it must be the case that households anticipated a future increase in price levels as a result of the tax change. While we do not have direct evidence of consumer price expectations before the rate increase, we believe it likely that consumers expected a price increase from March to April 1997 of about two percent on goods and services that were subject to VAT.⁴

As documented by Ishi (2001), the Japanese government's official stance was that the burden of the VAT should be borne fully by consumers at the time of the rate increase.⁵ We also find it likely that the smooth transition to VAT in 1989, in which prices on goods and services subject to the new VAT increased by just under three percent in the month the three percent VAT 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 VAT rate increase is the norm across most countries, which the authors speculate is primarily due to wage rigidities that prevent backward shifting. Alternatively, the results of House and Shapiro (2008) would suggest that the pre-tax prices of durable goods should have risen by two percent following announcement, but prior to the tax change, with a two percent fall immediately after (and thus, no change in after-tax prices before and after the change), since the intertemporal elasticity of investment for long-lived durable goods is nearly infinite. Indeed, a German study cited by Carroll et al. finds nearly full forward shifting of a VAT rate increase, with one-third of the shift occurring before enactment as a result of intertemporal substitution. While the timing of the price increase may depend on the durability of a good or service, it seems reasonable to believe that consumers expected about a two percent increase in prices at the time of the VAT rate increase.

As seen in Table 1, average prices on goods and services subject to VAT rose by 2.45 percent between March and April 1997, due mostly to a rather large increase in the price of durable goods and services of 3.18 percent, while the price changes for non-durable goods and services were closer to 2 percent. Furthermore, it does not appear as if there is any systematic

⁴ Again, access to the Consumer Sentiment Survey should allow us to say more about consumer's price expectations at the time of the rate increase.

⁵ When the VAT 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 VAT 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.

tendency for prices to increase markedly in April (prices in April 1996 and April 1998 increased by 0.56 and 0.17 percent, respectively), which leads us to believe that this price increase was primarily due to the tax change. Nor do we observe any systematic decline in prices after April 1997 that would suggest retailers bore any burden of the tax over a longer time frame. Finally, we do observe an increase in the price of durable goods of 1.36 percent in March 1997, but the subsequent increase in durable price levels in April 1997 would appear to be at odds with House and Shapiro's prediction.

2.4. Heterogeneity in the Durability and Storability of Goods and Services

The intertemporal substitution effects will depend not only on the intertemporal elasticity of substitution in consumption, but likely to an even greater extent on the durability and storability of the goods and services. For these types of goods and services, households can choose the timing of purchase, and hence price changes could affect the timing of expenditures, but not necessarily consumption levels. Earlier studies such as Westin (1975) note that durable goods offer a relatively constant service flow over moderate time periods, and thus the timing of their replacement should be highly discretionary, coinciding with periods characterized by relatively low prices, as would be the case in the period following announcement, but prior to implementation, of a VAT rate increase. More recently, House and Shapiro (2008) show that for sufficiently short-lived tax subsidies, and sufficiently long-lived capital goods, the elasticity of investment should be nearly infinite. That is, firms who had originally planned to make capital investments in the future have strong incentives to instead make the investment during the period of the subsidy. The authors' predictions can easily be applied to our framework, where the period preceding implementation serves as a proxy for a temporary tax subsidy, and household durable goods stand in for long-lived capital goods. As a result, we would expect to observe a rather large increase in outlays on durable goods and services prior to the rate increase.

Because the durability and storability of non-storable non-durable goods and services is, by definition, limited, any intertemporal substitution that occurs as a result of the rate increase in this category should be attributable to the intertemporal elasticity of substitution in consumption, or perhaps a limited amount of storability if purchases occur just before the rate increase.

3. Empirical Methodology

3.1. Baseline Model

Based on the standard LCPIH with taste shifter, household expenditure can be written in a simple form. We express real monthly household expenditures in year y and month m as follows:

$$E_{y,m} = \delta_m + T_{y,m} + B_{y,m}$$

where δ_m is a seasonal effect, $T_{y,m}$ is a tax effect, and $B_{y,m}$ is an effect for all other factors that determine expenditure independent of the tax change and season.

We further decompose the tax effect into the period-specific intertemporal substitution effect, $\gamma_{y,m}$, and the income effect, α , which is assumed to be constant over time. That is,

$$T_{y,m} = \alpha + \gamma_{y,m} \quad \text{following announcement}$$

The major concern for our empirical model is what constitutes “announcement”. As mentioned above, the LCPIH predicts that the income effect will appear when a rate increase is announced. However, in practice, it is difficult to determine the timing of announcement since there is heterogeneity of information and/or awareness.⁶ In addition, the Murayama reform package’s goal of revenue neutrality would suggest the absence of an income effect. To elucidate these issues, we examined the number of articles mentioning the consumption tax in the Nihon Keizai Shinbun, Japan’s leading business newspaper with a circulation of over three million (in 2010), and the Yomiuri Shinbun, 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” in the months leading up to and following the VAT rate increase.⁷ 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 is a steady upward trend in coverage of the proposed rate increase beginning with initial passage in June 1996, a spike in coverage in October 1996, which coincided with elections to the Lower House of the Diet, and overall coverage peaks in the months following final passage, but prior to the tax change, with nearly 300 articles in the Nihon Keizai Shinbun mentioning the consumption tax in March 1997. While heavy coverage of

⁶ We have looked at Consumer Sentiment Survey to measure consumer awareness of the rate increase and find no relation between the rate increase and their inflation expectations.

⁷ Circulation numbers come from Japan’s Audit Bureau of Circulations.

the consumption tax issue in 1994 Q4 suggests households may have been aware the Murayama reform package was intended to be revenue-neutral, the conventional wisdom is that the April 1997 VAT rate increase had a significant negative impact on household spending. To test this conjecture, we consider “announcement” of the VAT rate increase to be “final passage” in December 1996, since this legislation made the rate increase a certainty and this period coincided with heavy news coverage.

In addition to this difficulty, there is a growing literature that suggests the income effects associated with tax changes are absent until the tax change is implemented. Watanabe et al. (2001) examine the spending responses of Japanese households to more than 40 changes in national income tax, local income tax, consumption tax, and social security contributions that occurred between 1975 and 1998. The authors find that over 80 percent of Japanese households respond to tax changes at the time of implementation, as opposed to the time of announcement, and conclude that most Japanese households follow a “near-rational” decision rule, in which the costs of obtaining and processing information associated with a policy announcement outweigh the benefits from improved consumption smoothing.⁸ Recent work by Mertens and Ravn (2010) using U.S. quarterly GDP data further supports this finding.⁹

As a result, the first month in which we allow for tax effects, $T_{y,m}$, is January 1997. We mentioned above that the Japanese banking crisis was responsible for a sizeable wealth loss for the average Japanese household, and we believe that it had a significant negative impact on expenditures beginning in December 1997. Since we are unable to disentangle the effects of the banking crisis and the tax change on household spending, we cannot examine the tax effects beyond November 1997. As a consequence, we must make the following assumption, which applies to both our estimation of the intertemporal substitution and income effects:

- 1) All intertemporal substitution occurs between January and November 1997.

Assumption (1) is potentially problematic. A model such as House and Shapiro’s would predict that intertemporal substitution should be spread out over a long period of time, especially for long-lived durable goods. That is, households may have brought forward purchases of long-

⁸ The authors define “announcement” as the date which the Liberal Democratic Party (LDP) Tax Committee submits a proposal report to the government. This is followed by Cabinet approval of the proposal, which is then followed by Diet approval. They consider submission of the report to be “announcement” because Cabinet and Diet approval are virtually guaranteed following the Tax Committee’s submission.

⁹ Previous work by Poterba (1988), Parker (1999), and Souleles (1999, 2002) also finds that U.S. household spending does not respond to anticipated tax changes until the tax change is implemented.

lived durable goods (e.g. refrigerators) that would not have been made for perhaps several years in the absence of the VAT rate increase. If this was the case, then the post-tax change intertemporal substitution effects will not reach zero by the end of our estimation period, the sum of the estimated pre-tax change and post-tax change intertemporal substitution effects will be positive, and as a result, our estimate of the income effect will have an upward bias. To address this issue, we first note that it is unlikely that households are as forward looking as firms, which is the environment from which results in House and Shapiro (2008) are derived. Nevertheless, it is not unreasonable to believe that some households brought forward purchases that would have occurred after 1997 had the VAT rate increase not been imposed. As a result, we run a robustness check in which we exclude expenditures on durable goods from the analysis.¹⁰ Furthermore, the results from our intertemporal substitution analysis will allow us to test the null hypothesis that all intertemporal substitution occurred between January and November 1997.

3.2. Identifying the intertemporal substitution effect

This section considers identification of the intertemporal substitution effects. The main idea of our identification strategy is the following: by taking first differences, we can cancel out the income effect in all months save the month in which the income effect first appears, since the income effect is assumed to be constant once it has appeared. Formally, taking the first difference of expenditures yields

$$E_{y,m} - E_{y,m-1} = \delta_m - \delta_{m-1} + T_{y,m} - T_{y,m-1} + B_{y,m} - B_{y,m-1}$$

Suppose $B_{y,m}$ follows either of the two conditions listed below:

- 1) There is no change from one month to the next
- 2) $B_{y,m}$ follows a linear trend

Under condition (1), the term $B_{y,m} - B_{y,m-1}$ cancels out, while under condition (2), the term $B_{y,m} - B_{y,m-1}$ yields a constant. More generally, if there is little change in $B_{y,m}$ other than the linear trend, the first differences can be approximated as

¹⁰ If preferences over durables, storable non-durables, and non-storable non-durables are not homothetic, and in particular if expenditures shares on durables increase with income, while shares for storable non-durables and non-storable non-durables decrease with income, then it is possible that our robustness check estimate will yield an income effect that does not differ significantly from zero (or is even positive) while the true income effect is negative. This would be the case if the VAT rate increase led households to substitute away from durable goods towards storable non-durables and non-storable non-durables.

$$E_{y,m} - E_{y,m-1} \approx \text{constant} + \delta_m - \delta_{m-1} + \gamma_{y,m} - \gamma_{y,m-1} + \alpha I$$

where I is an indicator function that takes on a value 1 in the month when the income effect appears and zero in others. In addition, the identification assumption (1) highlighted in the previous subsection implies that the term $T_{y,m}$ takes non-zero values only in 1997. Accordingly, the empirical specification is as follows:

$$\Delta E_{y,m} = \Delta \delta_m + \Delta T_{1997,m} + \Delta u_{y,m}$$

where δ_m is the coefficient on an indicator function that takes on a value of 1 in month m , $T_{1997,m}$ is the coefficient associated with an indicator function that takes on a value of 1 in month m of the year 1997, and $u_{y,m}$ represents unobservables affecting expenditure in year y and month m .¹¹ First differencing removes the income effect in all months other than the month in which the income effect first appears. Given our identification assumptions, this implies that the intertemporal substitution effect estimate for January 1997 will be biased downwards by the amount of the income effect.

Figure 3 graphically depicts identification of the monthly tax effects using the above first differenced specification. The top figure presents household expenditures in levels (assuming seasonal effects have already been removed), where the rate increase causes a deviation in spending from the trend level, E^* , in periods $y, m - 1$ and y, m , with the tax effects in the two periods given by $T_{y,m-1}$ and $T_{y,m}$, respectively. Once we take first differences (depicted in the bottom figure), in order to identify the coefficient $T_{y,m}$, we must also difference out the coefficient for the previous month, $T_{y,m-1}$.

With this specification, we can identify the period-specific intertemporal substitution effects before and after the tax change. If the income effect appears in month s , the coefficient $T_{1997,s}$ will capture both the intertemporal substitution and income effects, while the coefficients $T_{1997,m}$, $s \neq m$, will identify the intertemporal substitution effects only. If the income effect appears following “final passage” of the VAT rate increase, the sum of the coefficients $T_{1997,1}$, $T_{1997,2}$, and $T_{1997,3}$ will provide a lower bound on the intertemporal substitution effects

¹¹ As a robustness check, we also add year dummies to the above specification. These dummies capture average monthly growth rates in household spending within a year relative to the omitted year, and are important if growth rates varied considerably over the sample period. We find that inclusion of year dummies does not significantly impact the results of our baseline specification.

resulting from the VAT rate increase. That is, the coefficients represent total household spending (or the percentage increase in household spending if using a log specification) in the three months leading up to the VAT rate increase that would not have been observed had a rate increase not been implemented or announced in advance. Our claim that the estimates provide a lower bound are further reinforced by the possibility that the announcement in January 1997 of the elimination of special income tax breaks caused a reduction in household expenditure during the first quarter of 1997.

3.3. Identifying the Income Effect

To identify the income effect associated with the VAT rate increase, we use a level specification. Our basic strategy is to sum up the total tax effects in order to cancel out the intertemporal substitution effects. Under identification assumption (1) above, the sum of the coefficients associated with an indicator function that takes on a value of 1 in month m of the year 1997 yields the sum of income effects over the months after firstly appearance. We can then divide this sum by the number of months since “announcement” to get the average monthly income effect associated with the rate increase.

In addition to identification assumption (1) above, we implicitly assume that there is little to no change in $B_{1997,m}$ relative to a pre-defined base period, which we define as the quarter prior to the period when the tax change begins to affect expenditures. This is a stronger assumption than was made for $B_{y,m}$ in the identification of the intertemporal substitution effect, where we allowed for the possibility of a linear trend. We cannot do so for the income effect, since the trend cannot be canceled out by summation.

To minimize the potential change in $B_{1997,m}$, we choose as our base average monthly expenditures in the fourth quarter of 1996, which coincided with “final passage” of the rate increase. If households did not perceive the Murayama reform package as revenue-neutral, our analysis above suggests that an income effect would appear following submission of the fiscal year 1997 budget, given the certainty now attached to the legislation and heavy news coverage during this period.¹² Several events other than the VAT rate increase, which were discussed in Section 2.2, will potentially bias downwards our estimates of the income effect. To the extent that

¹² We also experimented with a specification that defined December 1996 as the base period, since household expenditures in this month should best reflect underlying economic conditions just prior to the appearance of the tax effects, once we control for seasonality. The coefficients were qualitatively similar to our baseline specification, but the variance-covariance matrix was highly singular, and as a result, we do not report the results here.

these events reduced household spending, it further reinforces our findings below that the VAT rate increase had no impact on household spending.

The following empirical specification will allow us to identify the income effect associated with the VAT rate increase:

$$E_{y,m} = \delta_m + B_y + T_{1997,m} + \epsilon_{y,m},$$

where δ_m is a coefficient associated with an indicator function that takes on a value of 1 in month m , B_y is a coefficient associated with an indicator function that takes on a value of 1 in each month of year y , $T_{1997,m}$ is a coefficient for an indicator function that takes on a value of 1 in month m of the year 1997, and $\epsilon_{y,m}$ accounts for unobservables affecting expenditures in each period. We do not include a year dummy for 1997, since the specification contains a full set of year-month indicators for 1997. Furthermore, the dummy for 1996 takes on a value of 1 only in the months January to September. As a result, the omitted period is 1996 Q4, since average monthly household expenditures during this quarter serve as the base against which 1997 monthly expenditures are compared.

Provided the aforementioned assumptions hold, summing the $T_{1997,m}$ coefficients and dividing by the number of months since “final passage” will yield the average change in monthly spending resulting from the VAT rate increase. Alternatively, we can examine individual $T_{1997,m}$ coefficients in the later months of 1997, months for which the post-rate increase intertemporal substitution effects should have had less of an impact on household spending. Both approaches are used in the analysis below.

4. Data¹³

4.1. The Japanese Family Income and Expenditure Survey (JFIES)

To estimate the intertemporal substitution and income effects associated with the VAT rate increase, we utilize data from the Japanese Family Income and Expenditure Survey (JFIES) for the period 1992-2000. The JFIES is a panel survey in which households are interviewed each month for six consecutive months. It is a rotating panel, which means that in each month, one-sixth of the households are interviewed for the first time, one-sixth for the second time, and so on. Because of the overlapping nature of the data, a monthly cross-section is not a random sample, an

¹³ Much of the information below regarding the JFIES design and content is drawn from recent work by Stephens and Unayama (2011).

issue we address below. In any given month, approximately 8,000 households are interviewed. Households record daily expenditure, income receipts, and tax payments in a diary that is collected once a month. Monthly household demographic information and labor force participation are also included.

While one of the goals of the survey is to collect expenditure data from a nationally representative sample of households, two notable exclusions from the survey are agricultural workers and households with only one individual.¹⁴ If the response of these two groups to the consumption tax rate changes differed systematically from those covered by the survey, our estimates of the intertemporal substitution and income effects will not be indicative of the average Japanese household, but rather the average non-agricultural, multi-person household.

The JFIES expenditure data is highly disaggregated by item type, which is critical for our purposes, given our distinction between durable, storable, and non-storable non-durable goods and services and the fact that some goods and services were exempt from the VAT, and should be excluded from our estimates. For example, the data allows us to distinguish between expenditures on fresh vegetables, which we consider a non-storable non-durable good, and processed vegetables, which we define as a storable non-durable good, for reasons that will be made clear below. In addition, we can separate expenditures on, say, medical services, which are exempt from VAT, from those on medical supplies, which are not.

4.2. Categorizing Goods and Services

Our categorization of goods and services is a two-step process. First, we exclude expenditures on goods and services that were not subject to the VAT (see footnote 7). As a result, the ‘total expenditure’ category includes only goods and services that were subject to the VAT. Second, we divide the ‘total expenditure’ category into three subsets: durable, storable non-durable, and non-storable non-durable goods and services. We do so because we expect the intertemporal substitution effects to differ markedly across categories, as discussed above.

We define durable goods and services 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

¹⁴ As of 2002, single-person and agricultural households are included in 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.

such as home repair and tailoring, which consumers derive benefits from long after the service is provided.

We define storable non-durable goods and services as those that depreciate slowly over time if not used and fully if in use. 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.

We define non-storable non-durable goods and services 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 category also includes services such as taxi service, which must be immediately consumed at the point of purchase. See Appendix Table A.1 for a complete categorization of durable, storable non-durable, and non-storable non-durable goods and services.

4.3. Aggregation and Deflation of Monthly Expenditures

Our initial dataset consists of item-specific average monthly household expenditures for single-year birth cohorts, where a household is placed into a cohort based on the year of birth of the household head. Each cohort is assigned a sample weight based on its share of the population (where the cohort sample weight is a function of the sample weights for the households that belong to the cohort). After eliminating expenditures on VAT-exempt goods and services and placing each good or service into its respective category, we take a weighted sum of monthly household expenditures, with the weights being a cohort's sample weight as a fraction of the sum of sample weights. This weighted sum yields nominal monthly expenditures for the average Japanese household on durable, storable, and non-storable non-durable goods and services that were subject to VAT.

We then deflate nominal monthly expenditures for all goods and services, durable goods and services, storable goods and services, and non-storable non-durable goods and services that were subject to VAT, using VAT-inclusive consumer price indices specific to our categories.¹⁵ We are left with real monthly expenditures for the average Japanese household from 1992-2000.

¹⁵ 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.

Table 2 presents summary statistics for the four expenditure categories over the sample period, while Figure 2 depicts the percentage deviation in seasonally-adjusted monthly expenditures from the sample average.¹⁶ Note that real household spending remains relatively stable between 1994 and 1997. Household spending again begins to decline in 1998, and continues its downward trend through the remainder of the sample period. Finally, note that there was a large spike in household spending in the first quarter of 1997, which suggests that the intertemporal substitution effects associated with the VAT rate increase were significant.

5. Estimates of Intertemporal Substitution and Income Effects

5.1. Descriptive Results

This section presents simple figures which complement the regression analysis below. Figure 4 plots the residuals of regressions of the logarithm of (real monthly) total, durable, storable non-durable, and non-storable non-durable expenditures on month indicators. The residuals represent the seasonally-adjusted percentage deviation in monthly expenditures in each respective category from the sample average. Figure 4 covers the periods following the initial announcement of the VAT rate increase in late 1994 to December 1998.

We observe a steady upward trend in expenditures during the first quarter of 1997, which peaks in March 1997, the month prior to implementation. This suggests that the intertemporal substitution effects associated with the rate increase were significant. Furthermore, household expenditures do not appear to respond to the impending VAT rate increase in any manner until the first quarter of 1997, which followed final passage of the fiscal year 1997 budget and immediately preceded implementation of the rate increase.

In April 1997, we observe a sharp drop in spending from the previous month, but the decline in spending is a return to spending in line with average expenditures in 1995 and 1996. We expected to observe a larger decline in expenditures in April 1997, as one might expect that those most likely to avoid the tax by bringing forward purchases were those who originally planned to make durable purchases soon after implementation. We suspect that some retailers did not immediately raise their prices on April 1, 1997, allowing consumers additional time to make purchases subject to the lower VAT rate. Spending remains slightly below average for the next quarter, but appears to recover by late third quarter 1997, suggesting that the income effects associated with the VAT rate increase were minimal.

¹⁶ To remove seasonal effects, we regress the log of expenditure on month dummies, and plot the residuals.

In order to graphically investigate whether the rate increase had any impact on spending in the long run, Figure 5 plots the percentage deviation in 1997 seasonally-adjusted monthly expenditures from 1996 Q4 average seasonally-adjusted monthly expenditures. Following implementation of the rate increase, household spending trended slightly below the 1996 average, before dropping sharply in December 1997, likely as a result of the onset of the Japanese banking crisis. Given that most of the decline in the months immediately following implementation is due to intertemporal substitution (and perhaps the elimination of special income tax breaks and higher medical copayments), it would appear that the income effect resulting from the rate increase was small.

In Figures 4 and 5, we observe a sharp drop in spending in December 1997, which coincided with the onset of the Japanese banking crisis. Because we believe this crisis had a lasting impact on household expenditures, our estimation period is restricted to the January through November 1997, as we cannot disentangle the effects of the crisis and any additional effects of the VAT rate increase that may have persisted beyond November.

When we decompose total expenditures into expenditures on durables, storable non-durables, and non-storable non-durables, a richer story emerges. As expected, the intertemporal substitution effects for durable goods and services appear to be quite large. In March 1997, for example, spending on durables was more than 20 percent higher than it was in 1996 Q4 when the rate increase was passed. Spending the month prior to that was also well above the base period average. Following implementation, expenditures on durables declined, remaining below 1996 Q4 average monthly expenditure for the remainder of the year, which suggests that households may have significantly cut back on durable outlays as a result of the rate increase. Expenditures on storable non-durable goods and services around the time of the VAT rate increase also appear to be consistent with theoretical predictions. We observe a large spike in expenditures on storable non-durables in March 1997, followed by several months of below average expenditures that gradually return to trend. This suggests that households did indeed engage in stockpiling prior to the tax change in order to avoid higher future prices, and consistent with the results of Hendel and Nevo (2006), duration until the following purchase is longer following a period of relatively low prices.

As noted above, we expect to observe little intertemporal substitution among non-storable non-durables goods and services relative to durables and storables, since by definition, these goods are limited mainly to intertemporal substitution in consumption. By and large, this is what we observe. There does appear to be an increase in expenditures on non-storable non-durables in

the quarter prior to the tax change, which we attribute to the intertemporal elasticity of substitution in consumption, and perhaps a limited amount of storability. Also note the rather significant decline in non-storable non-durable expenditures in the two quarters following initial passage of the rate increase (see Figure 4). We initially suspected that liquidity constrained households reduced expenditures on non-storable non-durables during these months in order to finance durables purchases prior to the rate increase. However, the summer of 1996 was much cooler than average, which resulted in a reduction in cooling costs. Furthermore, an E. Coli outbreak in July 1996 led to a large decline in purchases of fresh meat, vegetables, and fruit.

Recall that intertemporal substitution for long-lived durable goods may take place over a long period of time, which would invalidate our assumption that the pre- and post-tax change intertemporal substitution effects offset each other within our estimation period. For this reason, we also examine non-durable (both non-storable and storable) expenditures separately in Figure 5, because the intertemporal substitution effects associated with these goods and services likely did not persist beyond our estimation period. We observe a pattern for non-durables and storable non-durables similar to what we observe for total expenditures. Spending in these sub-categories initially fell below the 1996 Q4 average immediately following implementation, but returned to (or exceeded) the 1996 average by late third quarter 1997 before falling sharply in December 1997. This further suggests that the income effect resulting from the VAT rate increase was small, especially given that third quarter expenditures returned to or exceeded the 1996 Q4 average.

5.2. Regression Analysis

Below we present the results of regression analysis based on the specifications discussed in Section 3. Before showing the results, note that our estimation procedure is slightly complicated by the fact that the JFIES is a rotating panel survey and the sample weight for a household may differ in each period during which it is interviewed. Recall that our sample consists of aggregated household-level data. If we assume the existence of household fixed effects, then differencing will not completely remove the fixed effects because the household's weight in the sample varies from month to month. As a result, there may be serial correlation in the residuals up to six lags, since each household remains in the sample for six consecutive months. To address the problem of serial correlation, we utilize the Newey-West (1987) estimator, which corrects for serial correlation up to a specified number of lags, and also allows for arbitrary forms of heteroskedasticity.

Table 3 presents log- and level-deviations in average household expenditures from trend for each month of 1997.¹⁷ As discussed in section 3.2, we interpret the coefficients on the January 1997 to March 1997 indicators as a lower bound on the (pre-rate increase) intertemporal substitution effects associated with the April 1997 VAT rate increase.

We find the intertemporal substitution effects to be both statistically and economically significant. Total expenditures on goods and services subject to the VAT increased significantly in each of the three months following final passage, but preceding implementation, of the rate increase. We observe spending increases of 0.61, 3.24, and 8.85 percent in the first three months of 1997, respectively (relative to what we would have observed in the absence of a rate increase), which amounted to an increase in per-capita household expenditures of ¥30,231 (in 2005 ¥; approximately \$302) in the first quarter of 1997.

Increased outlays on durable goods and services prior to the tax change were responsible for most of the observed intertemporal substitution. Durable expenditures increased by 8.9 and 19.35 percent in February and March of 1997, respectively, and accounted for 55 percent of the intertemporal substitution that occurred in March 1997, despite the fact that durables comprised only 25 percent of household expenditure shares over our sample period. The durable response was driven largely by purchases of household appliances, consumer electronics, and clothing.

A significant amount of intertemporal substitution is also evident among storable non-durable goods and services. Outlays on storable non-durables increased by 9.98 percent in March 1997, with the average Japanese household spending ¥6,774 (~\$68) more in the first quarter of 1997 on storables than they otherwise would have in the absence of a rate increase. The response is largely due to increased expenditures on domestic storables, such as laundry detergent, and rail passes, which in Japan are good for several months after first use. Households also spent significantly larger amounts on non-storable non-durable goods and services in the first quarter of 1997, which is consistent with a positive intertemporal elasticity of substitution in consumption, and perhaps some last minute stockpiling of fresh food.

Finally, in regards to the intertemporal substitution effects, we should note that we cannot reject the null hypothesis that the sum of the intertemporal substitution effects between January and November 1997 is zero. That is, we cannot reject Assumption (1) above, which states that all intertemporal substitution occurred between January and November 1997. This finding holds not only for total expenditures and non-durable expenditures, but also durable expenditures, for

¹⁷ The full specification can be found in Appendix Tables A.2.1 and A.3.1. Appendix Tables A.2.2 and A.3.2 add year dummies to the baseline specification to control for heterogeneity in growth rates over the sample period.

which intertemporal substitution is more likely to extend beyond our estimation period. As a result, we are confident that our estimates of the income effect will not be biased upwards due to a failure of Assumption (1).

Relying on the level specification laid out in Section 3.3, Table 4 presents several different tests for whether there was a significant reduction in household spending (independent of the intertemporal substitution effects) following implementation of the VAT rate increase.¹⁸ In general, our results suggest that the rate increase did not have a significant impact on real household expenditures, a finding which stands in contrast to the conventional wisdom that the consumption tax rate increase was largely responsible for Japan's recession in the late 1990s, but is consistent with the revenue-neutral nature of the tax reform package that the VAT rate increase was a part of.

Our first test for the income effect examines total expenditures on goods and services subject to the VAT. We find that real monthly household spending declined by only ¥562 (~\$6) as a result of the rate increase. Even when we make the extreme assumption that the large decline in household spending in December 1997 was due to the rate increase rather than the bank crisis, as we do in test (2), we find that average monthly household spending following implementation did not differ significantly from the 1996 Q4 average. Given our belief that the steep decline in December 1997 expenditures was largely a result of the bank crisis as well as the possibility that the elimination of special income tax breaks and higher medical copayments further reduced spending after the VAT rate increase, it would appear that the VAT rate increase had no more than a small negative impact on household spending.

Despite the small negative impact, the rate increase does appear to have led to a change in the composition of expenditures, as expenditures on durables decreased significantly during the estimation period, while spending on non-storable non-durables increased significantly. This finding suggests that preferences are non-homothetic, and in particular, that the income elasticity of demand for durable goods and services exceeds one.

Another method to determine whether the VAT rate increase lead to a significant reduction in household spending is to examine the percentage deviation (from the 1996 Q4 seasonally-adjusted monthly average) in spending several months after the tax change, but prior to the bank crisis, periods in which the post-tax change intertemporal substitution effects should have been smaller. In particular, we examine the coefficients for September, October, and November 1997. Doing so, the rate increase appears to have had a somewhat larger impact on

¹⁸ The full specification can be found in Appendix Table A.4.

household spending than is suggested by our first two tests. Average household spending in October and November 1997 was ¥3,812 (~\$38) and ¥4,205 (~\$42) lower than average monthly spending in 1996 Q4.¹⁹ Even so, it would appear that the VAT rate increase led to at most a modest reduction in household spending, and the event is perhaps undeserving of the disproportionate blame it often receives for Japan's recession of the late 1990's.

5.3 Robustness Checks

One might worry that the error terms for durables, storables, and non-storable non-durables are contemporaneously correlated. To allow for this possibility, we jointly regressed durable, storable and non-storable non-durable expenditures on the right-hand side variables given in (1) using a seemingly unrelated regression (SUR) framework. Doing so does not impact our results in a meaningful way. We also augmented our baseline first-difference specification with the inclusion of year dummies to control for the possibility of heterogeneous growth rates over the sample period. Inclusion of the year dummies did not significantly impact our results, as seen in Appendix Tables A.2.2 and A.3.2.

5.4 Revenue Losses

A direct result of intertemporal substitution on the part of Japanese households is revenue losses to the government. To obtain a rough estimate of the losses sustained by the government as a result of pre-announcement, we put the pre-tax change intertemporal substitution effects into 1997 ¥ using the March 1997 CPI data that we constructed for all goods and services subject to the VAT. We multiply this amount by 0.02, the amount of the rate increase, to get an estimate of the revenue loss per household. Finally, we multiply by the total number of households in Japan in March 1997 (45.4 million, according to the Labor Force Survey) to derive the total revenue loss sustained by the Japanese government. We find that the Japanese government sustained a revenue loss of roughly ¥26.5 billion (~\$265 million) as a result of pre-announcement of the rate increase, which amounted to 0.26 percent of fiscal year 1997 VAT revenue.

¹⁹ The first bank failure occurred in the second half of November 1997, and may have contributed to the reduction in spending in that month.

6. Discussion

In this paper, we characterized the household spending response to Japan's April 1997 VAT rate increase from three to five percent, demonstrating the following:

- 1) In the quarter following the final passage of legislation, but prior to implementation, Japanese households engaged in a significant (both statistically and economically) amount of intertemporal substitution, which resulted in modest revenue losses for the Japanese government.
- 2) Increased outlays on both durable and storable non-durable goods and services were responsible for the vast majority of the intertemporal substitution effects.
- 3) The income effect of the rate increase was negative, but small.

We now consider each of the findings in turn.

Despite two prior announcements of the impending VAT rate increase in September 1994 and June 1996, Japanese households did not engage in a significant amount of intertemporal substitution until after final passage of the rate increase legislation in December 1996. This finding suggests households were either unaware of, ignored, or did not perceive as credible the initial announcements. Based on our examination of newspaper references to the consumption tax increase (and assuming coverage was similar in other papers), we consider it to be unlikely that households were unaware of the likelihood of a rate increase, especially following the June 1996 legislation, which coincided with a steady upward trend in news coverage. If households simply ignored the initial announcements, perhaps because the costs of processing the information regarding the rate increase outweighed the benefits of bringing forward purchases (especially those on durable goods), this suggests that governments need not worry much about the timing of announcement, since households will not engage in intertemporal substitution until the final few months before implementation, and some delay between announcement and implementation is inevitable. It is also plausible that households did not perceive as wholly credible the initial announcements regarding the VAT rate increase. The initial announcement in November 1994 set only a target date of April 1997 for the rate increase, while the June 1996 legislation left open the possibility that the rate increase would not take effect as scheduled. As has been well documented in the literature on firm investment (e.g. Dixit and Pindyck, 1994), given the irreversibility of investment decisions, and an environment characterized by uncertainty, there is an option value to waiting for more complete information. Until the fiscal year 1997 budget was submitted, the VAT rate increase was not an absolute certainty, and therefore households may have been biding their time until it became so. We tend to favor this latter

explanation for the late (though large) response by Japanese households. If this was the case, it would suggest that governments should be deliberately vague regarding the timing of VAT implementations or rate increases in order to minimize the amount of time available to households to engage in intertemporal substitution, which, as has been highlighted in prior literature on the imposition of a consumption tax (e.g. Kaplow, 2008), reduces its efficiency by leaving less capital available to be taxed inelastically following implementation.

While we lack data on the intertemporal substitution effects of VAT rate increases in other countries, the response in Japan strikes us as quite large. Recall that a two percent increase in the VAT rate caused a nine percent increase in expenditures on goods and services subject to VAT in the month prior to implementation, and expenditures on durable goods and services increased by nearly 20 percent that same month. This begs the question of whether we should expect to observe such a response in other countries that adopt a VAT or increase their rate. One reason for the large response is that Japan is a developed economy, and as documented by Summers and Heston (1988), durable goods and services comprise a larger share of expenditures in high income countries than in developing or transition economies, who have been the most frequent adopters of VAT in recent years (Ebrill et al., 2001). As a result, we should expect the magnitude of intertemporal substitution in a developed economy such as Japan to exceed that in less developed economies. On the other hand, dwellings in Japan are on average smaller than in other developed economies such as the United States, and thus storage space is more dear, so we might expect that intertemporal substitution of storable non-durable goods and services in the United States would exceed what we observed for Japan should the U.S. impose a VAT in the future.

Numerous articles in the popular press and a handful of academic articles have blamed the 1997 VAT rate increase for triggering Japan's economic slump of the late 1990s. While we are constrained by the inherent difficulty of separately identifying the intertemporal substitution effects and the income effect as well as disentangling the effects of the Japanese banking crisis and the VAT rate increase on expenditures after November 1997, our analysis suggests that in the months following implementation but prior to the banking crisis, the VAT rate increase had no more than a small negative impact on real household spending, with spending on goods and services subject to the VAT falling by well less than the amount of the rate increase. While this finding should not be surprising given the revenue-neutral nature of the Murayama tax reform, alternative explanations, which are more convincing if households perceived the VAT rate increase to be uncompensated, do exist. This analysis has neglected the impact of consumption

tax rate changes on labor supply. It is entirely possible that households react to rate increases not by reducing consumption, but by increasing their lifetime labor supply, an empirical question that would be difficult to ascertain. Another possibility is that households draw down on buffer stocks of savings, which also seems plausible in a country with a high savings rate like Japan. Clearly, more research needs to be done on the longer-term impact of VAT changes on household spending, labor supply, and saving (not to mention the fact that one of the primary rationales behind a tax-mix switch away from income taxation and towards consumption taxation is the removal of the disincentive to save that exists under an income tax), preferably in a country where the change was not soon followed by another major event that significantly impacted household expenditures, and in a country that has experienced both compensated and uncompensated rate hikes.

The International Monetary Fund (IMF) recently recommended that Japan raise its consumption tax rate from five to fifteen percent in order to reduce its public debt, which as a percentage of GDP is one of the highest in the world, and the highest among developed countries.²⁰ The current debate among economists and policymakers is whether to phase in such an increase.²¹ Unfortunately, our analysis focuses on only one modest rate increase, and as such, it is difficult to contribute to this debate without making assumptions about government objectives. Future researchers in this area should seek out a country with expenditure data similar to the JFIES which has experienced both small (1-2 percent) and large (≥ 5 percent) VAT rate increases. If the intertemporal substitution effects are increasing and convex in the tax change, the disruption to macroeconomic stability and the present discounted value of revenue losses sustained by the government would be greater the larger is the rate increase. This would suggest that a gradual phase-in of, say, one percent per year would be the appropriate policy. If, however, the intertemporal substitution effects are concave in the tax change, a larger rate increase would be warranted, whereas intertemporal substitution that is linear in the tax change might also suggest a larger rate increase due to the relative administrative ease of a single tax rate increase.

Given additional assumption about government objectives, we can use Japan's experience to make conjectures about whether a phased-in rate increase is appropriate. Suppose that the government has the dual objectives of maximizing revenue and minimizing disruptions to macroeconomic stability. Clearly, one large rate increase would maximize revenue, while a

²⁰ "IMF urges tax increase to tackle Japan debt," Reuters, July 14, 2010, <http://www.reuters.com/article/idUSNLEIE69620100714>

²¹ Hayashi, Yuka. "Japan Looks Hard at Trimming Huge Debt," The Wall Street Journal Online, March 1, 2010, <http://online.wsj.com/article/SB10001424052748703940704575089952215368646.html>

phase-in would minimize disruptions to macroeconomic stability. The larger is the intertemporal substitution response to a rate increase, the more desirable a phase-in would become. Thus, given Japan's large response to the modest 1997 rate increase, a phase-in of future rate increases could be more desirable. Related to this, phase-ins might be more appropriate for developed economies, as their larger expenditure shares on durable goods imply a greater amount of intertemporal substitution than in developing economies.

7. Conclusion

This paper examines the intertemporal substitution and income effects associated with a VAT rate increase, using Japan's April 1997 rate increase as a case study. We find that households engaged in a significant amount of intertemporal substitution in the quarter following announcement of, but prior to, the rate increase. Two earlier announcements regarding the rate increase appear to have been ignored, likely because they were non-binding and did not make the rate increase a certainty. Consistent with theoretical predictions, we find that the vast majority of the intertemporal substitution response was due to increased outlays on durable and storable non-durable goods and services, suggesting that the intertemporal substitution response will be larger in developed economies, where expenditures shares for durables are relatively high.

Contrary to the conventional wisdom, but consistent with the revenue-neutral nature of the tax reform package of which the VAT rate increase was a part, we find evidence suggesting that the VAT rate increase had little to no negative impact on household spending in Japan, though we stress that our results are only suggestive, given the inherent difficulty of separately identifying income and substitution effects and our inability to disentangle the effects of the rate increase and the banking crisis after November 1997.

Future research in this area should examine the sensitivity of the intertemporal substitution response to both small and large rate changes in order to judge whether phased-in rate increases are appropriate. In addition, examination of cases in which a major crisis did not closely follow a rate change and for which there is heterogeneity in the amount of compensation provided would be helpful in determining the effect of rate increases on household spending over the long-run.

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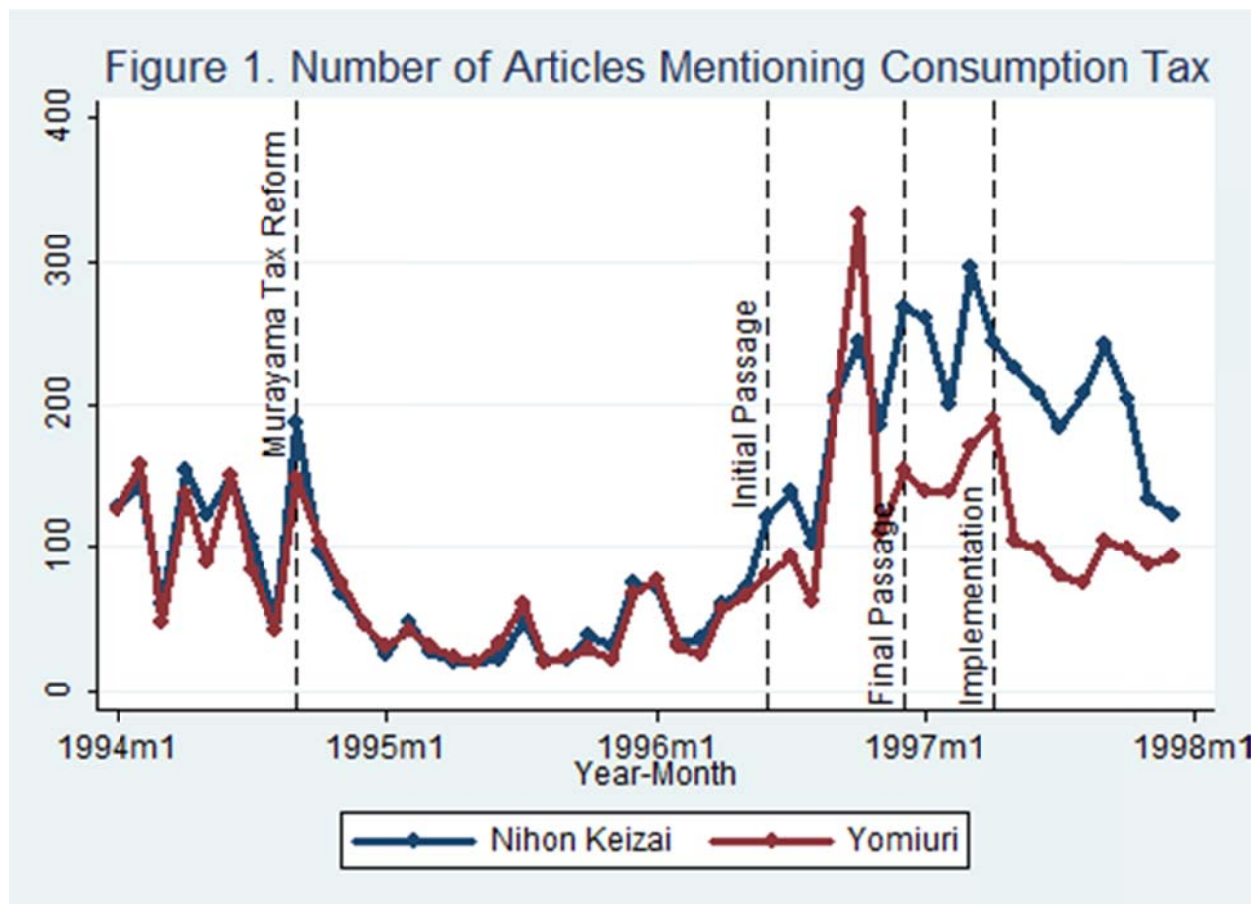
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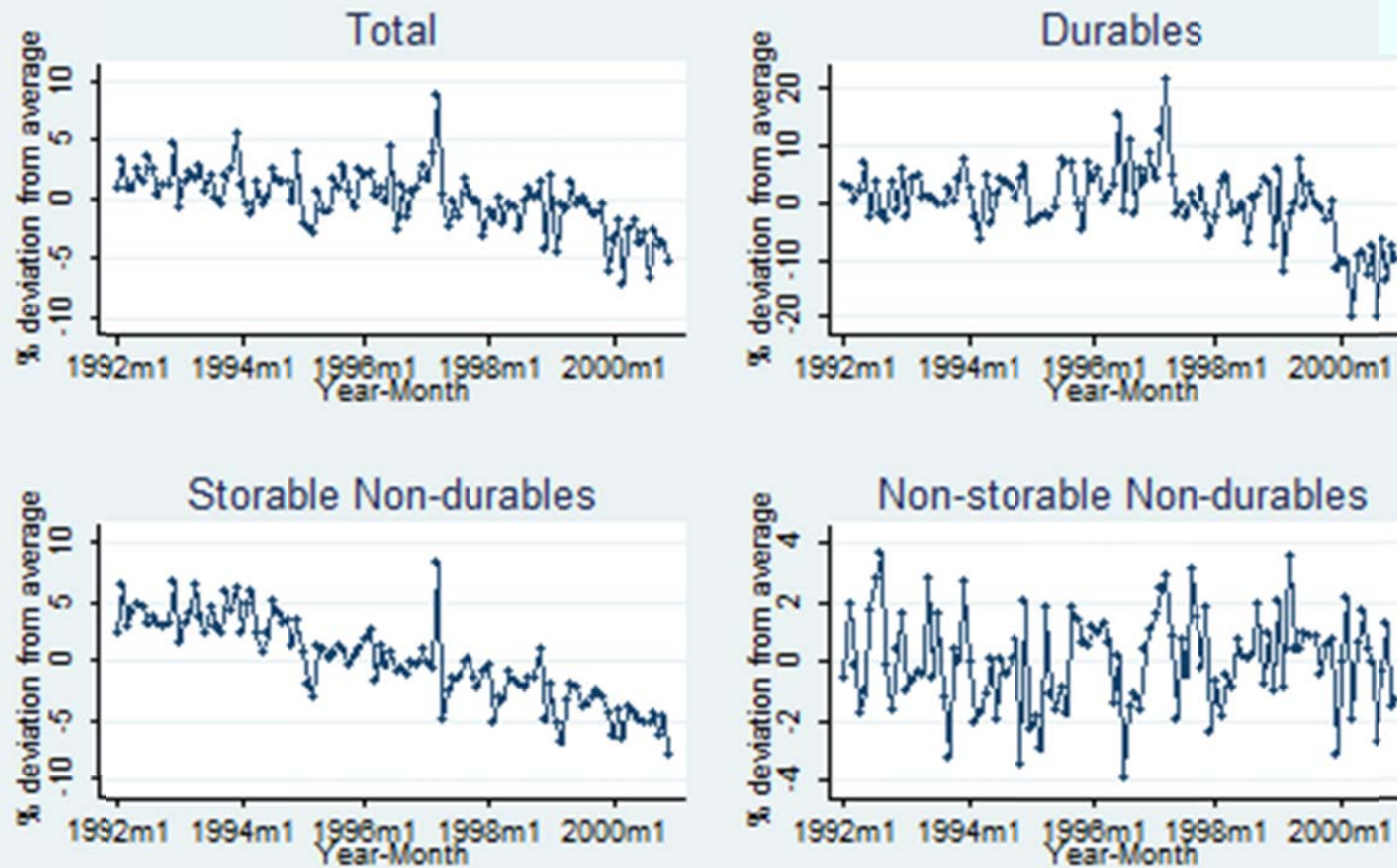
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Source: Authors' calculations.

Figure 2. Real Monthly Expenditures
Seasonal effects removed



Note: The above figures are the residuals from a regression of the logarithm of real monthly expenditures on month indicators.

Figure 3. Identifying the Effects of a VAT Rate Increase on Household Spending Using a First-Differenced Specification

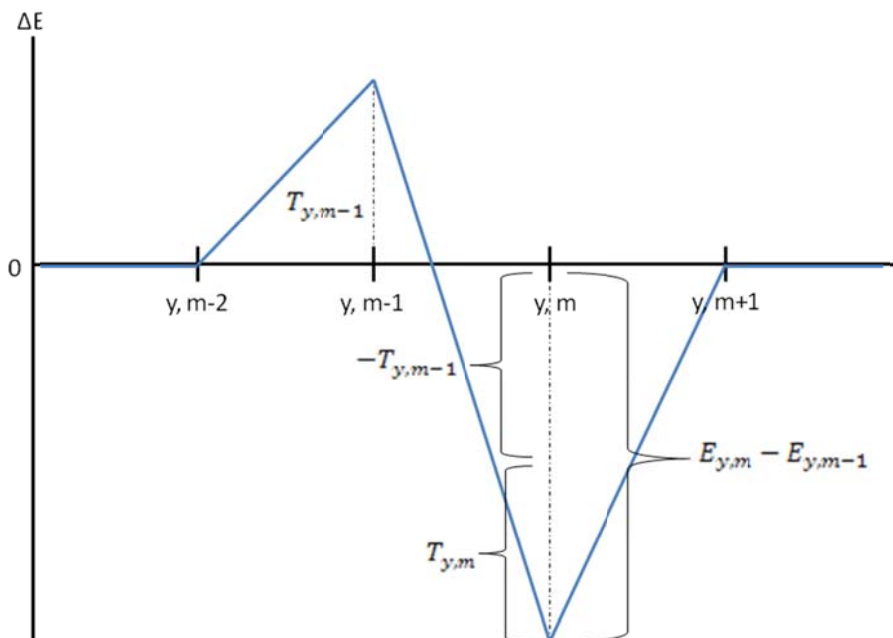
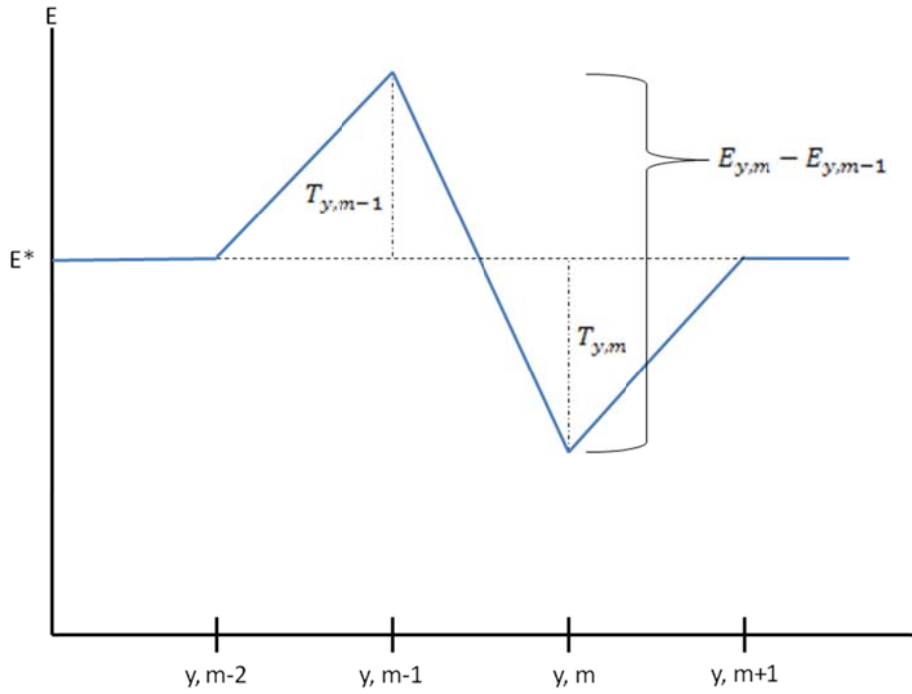
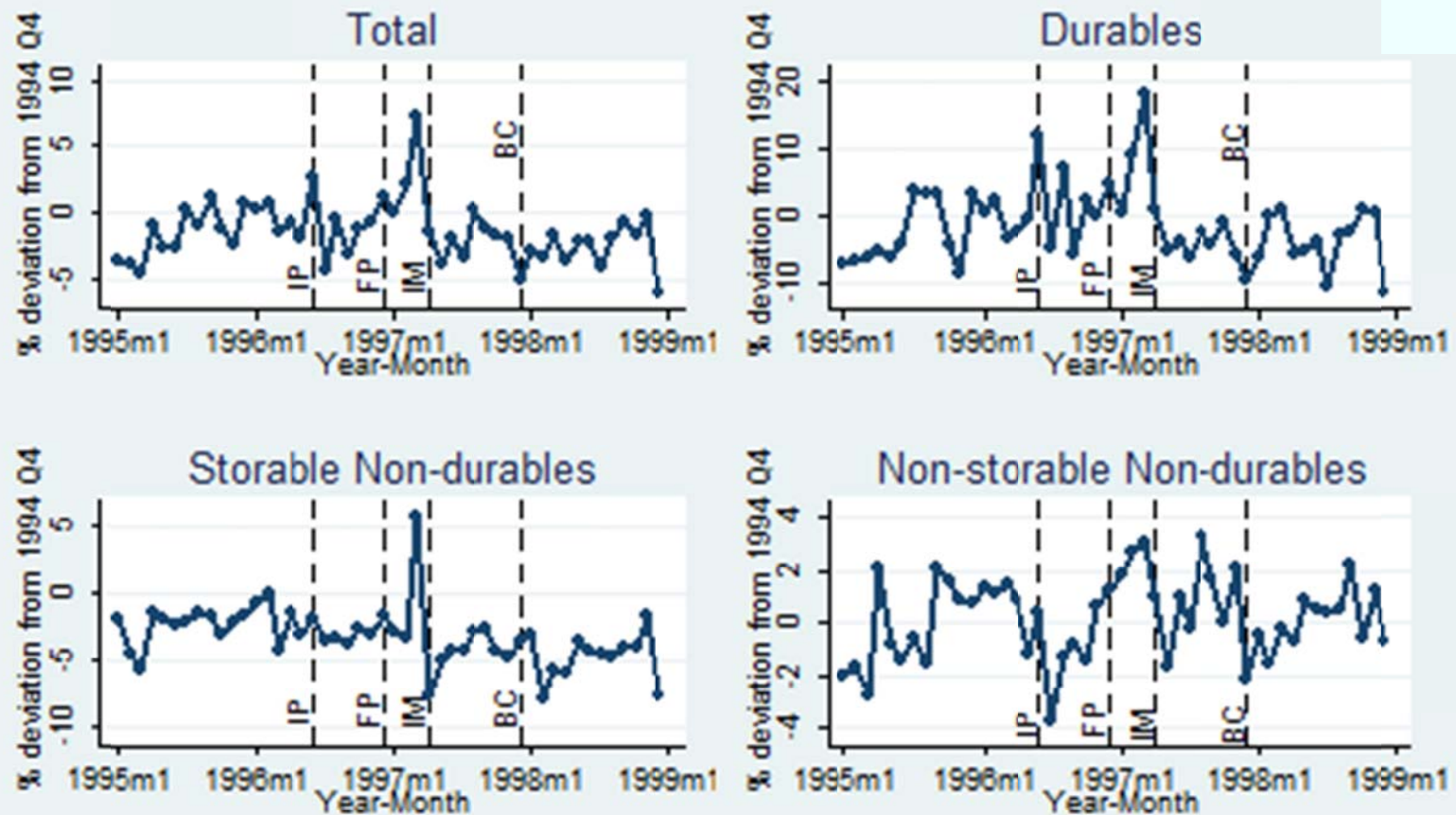


Figure 4. Real Monthly Expenditures (1995-1998)

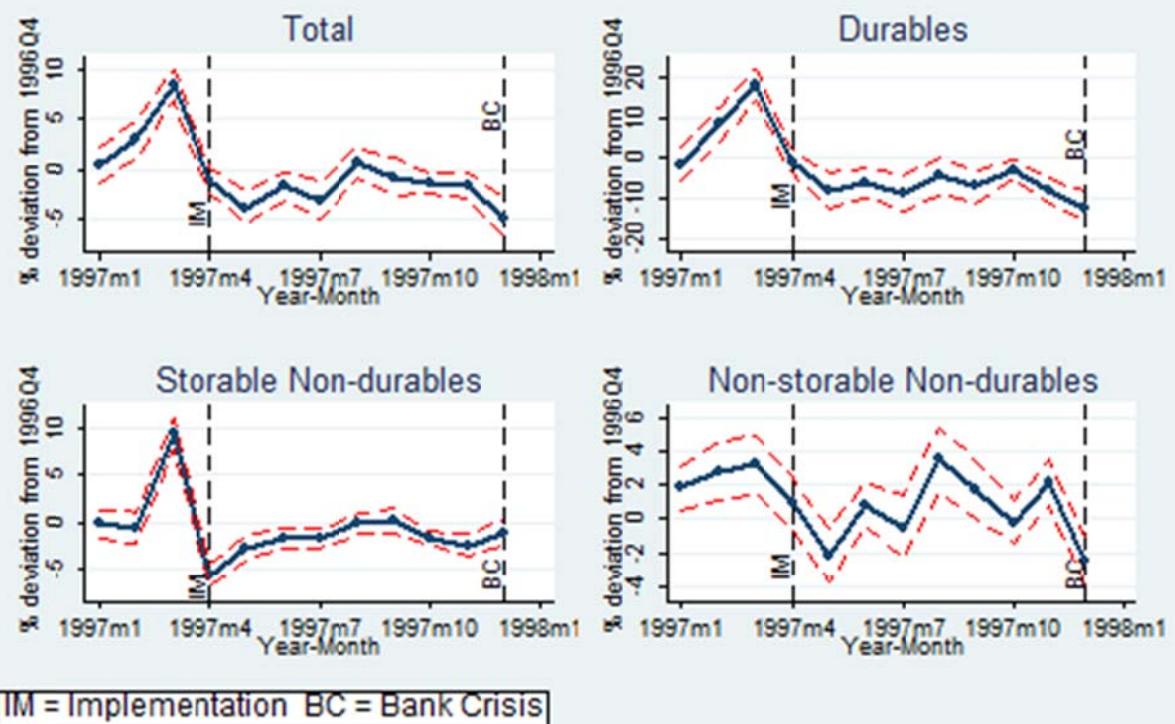
Seasonal effects removed



IP = Initial Passage FP = Final Passage IM = Implementation BC = Bank Crisis

Note: The above figure plots the residuals from a regression of the logarithm of real monthly expenditures on month indicators, using the Newey-West estimator to correct for serial correlation and arbitrary forms of heteroskedasticity in the error terms.

Figure 5. Percentage Deviation in Real Monthly Expenditures Relative to 1996 Q4 base period



Note: The above figure is constructed in the following manner:

- 1) The logarithm of monthly expenditure is regressed on month indicators
- 2) The monthly log residuals for 1996 Q4 are averaged
- 3) We subtract the average log residuals for 1996 Q4 from the 1997 monthly log residuals, and plot.

Table 1. Consumer Price Index for Goods and Services Subject to VAT 1996-1998						
	1996		1997		1998	
Month	CPI	Percent Change*	CPI	Percent Change	CPI	Percent Change
January	103.28	-0.10	103.37	-0.24	104.79	-0.01
February	103.04	-0.24	103.14	-0.23	104.52	-0.26
March	103.22	0.18	103.18	0.04	104.97	0.43
April	103.80	0.56	105.70	2.45	105.14	0.17
May	103.97	0.17	105.84	0.13	105.59	0.42
June	103.47	-0.48	105.84	0.00	105.00	-0.56
July	103.43	-0.04	105.29	-0.52	104.11	-0.85
August	103.25	-0.17	105.42	0.12	103.97	-0.13
September	103.62	0.36	105.80	0.36	105.03	1.02
October	103.81	0.18	106.08	0.26	106.05	0.97
November	103.38	-0.41	105.10	-0.92	105.92	-0.12
December	103.62	0.23	104.80	-0.29	105.32	-0.56

*Percent change on prior month

Note: Base year is 2005.

Table 2. Summary Statistics for Real Monthly Expenditures on Goods and Services Subject to VAT (in 2005 ¥)					
Expenditure Category	Observations	Mean	Std. Dev.	Min	Max
Total	108	251,547	26,287	212,907	341,050
Durables	108	62,959	11,690	42,779	102,049
Storable Non-Durables	108	56,872	7,613	47,323	85,074
Non-Storable Non-Durables	108	131,716	10,504	117,237	154,525

Note: Divide sample averages by 100 to get a rough approximation of real monthly expenditures on items subject to VAT in U.S. dollars.

Table 3. Deviations in Seasonally-Adjusted Real Household Spending from Trend, 1997

Expenditure Category	Month	% Change	Std. Error	Change (in 2005 ¥)	Std. Error
Total	January	0.61	1.66	786	5,107
	February	3.24**	1.29	6,104	4,016
	March	8.85***	1.18	23,341***	3,566
	April	-0.73	1.00	-2,463	3,088
	May	-3.42***	1.05	-8,742***	3,069
	June	-1.14	0.95	-3,490	2,691
	July	-2.58**	1.04	-7,243**	2,840
	August	1.40	0.89	2,677	2,462
	September	-0.03	1.02	-1,037	2,935
	October	-0.58	0.84	-2,280	2,579
	November	-0.68	1.01	-2,503	3,103
	December	-4.01**	1.66	-13,350**	5,110
Durables	January	-1.27	2.91	-2,379	2,149
	February	8.90***	2.27	2,216	1,644
	March	19.35***	2.57	12,015***	1,745
	April	0.81	2.32	-741	1,606
	May	-5.75**	2.86	-4,135**	1,818
	June	-3.26	2.78	-2,889	1,744
	July	-5.56**	2.84	-4,185**	1,776
	August	-0.82	2.78	-1,544	1,536
	September	-2.64	2.45	-2,136	1,585
	October	1.74	2.14	81	1,361
	November	-2.96	2.47	-2,190	1,610
	December	-6.66**	2.91	-5,855***	2,153
Storable Non-durables	January	0.82	1.15	745	1,036
	February	0.14	1.10	308	846
	March	9.98***	0.99	5,721***	749
	April	-5.30***	0.99	-2,600***	780
	May	-2.62**	1.04	-1,325	811
	June	-1.82*	0.99	-950	791
	July	-2.09**	0.98	-1,276	776
	August	-0.76	0.96	-583	767
	September	-0.63	1.02	-571	825
	October	-2.74***	0.97	-1,749*	772
	November	-3.69***	1.02	-2,271***	855
	December	-2.55**	1.14	-2,092**	1,032
Non-storable Non-durables	January	1.34	1.06	1,865	1,566
	February	2.42**	1.13	2,841*	1,548
	March	2.90***	1.04	4,116**	1,500
	April	0.64	0.89	770	1,242
	May	-2.43***	0.90	-3,201**	1,239
	June	0.67	0.74	752	1,005
	July	-0.66	0.91	-927	1,213
	August	3.41***	0.91	4,931***	1,284
	September	1.69*	0.86	2,030*	1,130
	October	-0.21	0.81	-289	1,091
	November	2.20***	0.64	2,675***	884
	December	-2.53**	1.06	-3,893**	1,567

The above table presents the coefficients for differenced year-month indicators from regressions of first differenced (log first differenced) real monthly household expenditures on a constant, differenced month indicators, and differenced year/month indicators for 1997 using the Newey-West estimator to correct for serial correlation. The coefficients in Column 3 represent the percentage deviation in household spending from trend, while the coefficients in Column 5 represent the change in average household expenditures from trend. Each regression includes month indicators to control for seasonal variation in expenditures. In addition, a second specification includes year dummies to control for heterogeneity in spending growth over the sample period. *, **, *** represent statistical significance at the ten, five, and one percent levels, respectively.

Table 4. Tests for Significance of Income Effects

Test [†]	Total		Durables		Storable Non-durables		Non-storable Non-durables	
	Sum	p-value	Sum	p-value	Sum	p-value	Sum	p-value
1) $\sum_{m=1}^{11} T_{1997,m} = 0$	-562	0.77	-1,623	0.09*	-348	0.29	1,695	0.03**
2) $\sum_{m=1}^{12} T_{1997,m} = 0$	-1,784	0.28	-2,230	0.01***	-395	0.14	1,220	0.09*
3) $T_{1997,9} = 0$	-2,620	0.34	-4,321	0.00***	53	0.91	2,089	0.07*
4) $T_{1997,10} = 0$	-3,812	0.03**	-2,266	0.01**	-940	0.00***	-259	0.77
5) $T_{1997,11} = 0$	-4,205	0.05**	-4,891	0.00***	-1,277	0.01***	2,634	0.0***

[†]The p-values for tests (1) and (2) are derived from F-tests, while the p-values for tests (3)-(5) are derived from t-tests. We interpret the sums for tests (1) and (2) as the change in average monthly spending resulting from the VAT rate increase, while the sums for tests (3)-(5) represent the seasonally adjusted change in spending in month m resulting from the VAT rate increase.

*, **, and *** represent statistical significance at the ten, five, and one percent level, respectively.

Appendix

Table A.1. Categorization of Goods and Services Subject to VAT

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	Flowers
Lighting	Light bulbs	Newspaper
Floor coverings and curtains	Domestic goods (e.g. laundry detergent)	Eating out
Other interior furnishings	Cloth	Domestic services
Bedding	Medicine	Bus fare
Utensils	Medical supplies (e.g. bandages)	Taxi fare
Japanese clothing	Gasoline	Airfare
Western clothing	Stationery	Other public transit
Women's coats	Film	Automotive fees
Shirts	Recording media (e.g. CD)	Automotive insurance
Underwear	Pet food	Telephone service
Other clothing	Personal care items (e.g. toothbrush)	Recreational good repair
Footwear	Tobacco	Recreational durable good repair
Automobile	Rail service	Lodging
Other vehicle		Package tour
Bicycle		Lesson fees
Auto parts		Television service
Telephone		Movie or play admission
Textbook		Other admissions
Television		Other recreational services
Stereo		Other insurance

Portable audio equipment		Social expenses (e.g. money gifts)
Video recorder		
Camera		
Computer		
Musical instrument		
Desk		
Other recreational durable goods		
Golf equipment		
Other sporting goods		
Sport outfits		
Toys		
Other recreational goods		
Books		
Personal care item (e.g. hair dryer)		
Personal effects (e.g. umbrella)		
Handbag		
Accessories (e.g. watch)		
Other personal effects (e.g. cane)		
Home repair (e.g. plumbing)		
Clothing services (e.g. tailoring)		
Auto repair		
Personal care services (e.g. haircut)		
Personal effect services (e.g. watch repair)		

Table A.2.1 Percentage Deviation on Prior Month's Spending, Baseline Specification

Variable	Total		Durables		Storable Non-durables		Non-storable Non-durables	
	% Change	Std. Err.	% Change	Std. Err.	% Change	Std. Err.	% Change	Std. Err.
Δ February	-10.22	1.07	-10.28	2.92	2.59	1.18	-15.28	0.72
Δ March	8.43	0.95	22.43	2.67	11.99	1.18	0.75	0.61
Δ April	0.68	0.91	12.20	2.12	9.70	1.02	-8.15	0.77
Δ May	-0.17	0.96	5.31	2.40	10.40	0.96	-6.85	0.85
Δ June	-3.66	0.99	8.86	2.63	6.92	0.87	-13.84	0.71
Δ July	7.47	1.23	26.97	2.84	18.33	0.92	-6.38	0.98
Δ August	5.46	1.07	0.43	2.64	16.82	0.90	2.82	0.98
Δ September	-6.96	1.17	-3.06	2.47	5.62	0.97	-13.83	0.92
Δ October	-1.79	1.06	8.40	2.11	11.45	1.00	-11.90	0.92
Δ November	-2.92	1.13	9.94	2.54	9.67	1.01	-14.18	0.68
Δ December	29.14	1.79	52.55	3.11	47.58	1.22	9.10	1.15
Δ Jan 1997	0.61	1.66	-1.27	2.91	0.82	1.15	1.34	1.06
Δ Feb 1997	3.24	1.29	8.90	2.27	0.14	1.10	2.42	1.13
Δ Mar 1997	8.85	1.18	19.35	2.57	9.98	0.99	2.90	1.04
Δ Apr 1997	-0.73	1.00	0.81	2.32	-5.30	0.99	0.64	0.89
Δ May 1997	-3.42	1.05	-5.75	2.86	-2.62	1.04	-2.43	0.90
Δ Jun 1997	-1.14	0.95	-3.26	2.78	-1.82	0.99	0.67	0.74
Δ Jul 1997	-2.58	1.04	-5.56	2.84	-2.09	0.98	-0.66	0.91
Δ Aug 1997	1.40	0.89	-0.82	2.78	-0.76	0.96	3.41	0.91
Δ Sep 1997	-0.03	1.02	-2.64	2.45	-0.63	1.02	1.69	0.86
Δ Oct 1997	-0.58	0.84	1.74	2.14	-2.74	0.97	-0.21	0.81
Δ Nov 1997	-0.68	1.01	-2.96	2.47	-3.69	1.02	2.20	0.64
Δ Dec 1997	-4.01	1.66	-6.66	2.91	-2.55	1.14	-2.53	1.06
Constant	-0.10	0.10	-0.17	0.25	-0.15	0.09	-0.03	0.09

Note: See notes for Table 3.

Table A.2.2 Percentage Deviation on Prior Month's Spending, Year Dummies Included

Variable	Total		Durables		Storable Non-durables		Non-storable Non-durables	
	% Change	Std. Err.	% Change	Std. Err.	% Change	Std. Err.	% Change	Std. Err.
Δ February	-10.21	1.12	-10.28	3.07	2.60	1.23	-15.28	0.74
Δ March	8.44	1.02	22.43	2.85	12.01	1.27	0.75	0.65
Δ April	0.69	0.97	12.20	2.24	9.72	1.08	-8.15	0.82
Δ May	-0.15	1.03	5.31	2.54	10.43	1.05	-6.85	0.89
Δ June	-3.65	1.07	8.87	2.78	6.96	0.96	-13.84	0.75
Δ July	7.49	1.33	26.98	3.00	18.38	1.02	-6.38	1.04
Δ August	5.48	1.16	0.44	2.77	16.87	1.00	2.82	1.05
Δ September	-6.94	1.26	-3.06	2.60	5.68	1.06	-13.82	0.98
Δ October	-1.76	1.15	8.40	2.22	11.52	1.08	-11.90	0.99
Δ November	-2.89	1.20	9.95	2.68	9.75	1.08	-14.17	0.74
Δ December	29.18	1.89	52.56	3.28	47.66	1.26	9.11	1.21
Year 1993	0.14	0.67	0.37	1.22	0.08	0.58	0.10	0.45
Year 1994	-0.05	0.59	0.15	1.13	-0.13	0.51	-0.04	0.54
Year 1995	-0.02	0.60	0.27	1.28	-0.09	0.47	-0.11	0.52
Year 1996	0.12	0.57	0.37	1.23	0.11	0.52	0.06	0.49
Year 1997	-0.06	0.41	-0.39	0.81	0.23	0.41	-0.06	0.36
Year 1998	-0.35	0.62	-0.46	1.33	-0.50	0.69	-0.08	0.45
Year 1999	-0.07	0.94	-0.10	2.00	0.16	0.58	-0.17	0.61
Year 2000	0.16	0.67	0.37	1.10	-0.17	0.52	0.17	0.62
Δ Jan 1997	0.62	1.73	-1.26	3.02	0.84	1.15	1.34	1.11
Δ Feb 1997	3.23	1.31	8.89	2.29	0.10	1.13	2.42	1.14
Δ Mar 1997	8.80	1.21	19.34	2.61	9.87	0.91	2.90	1.06
Δ Apr 1997	-0.80	1.00	0.79	2.10	-5.49	0.86	0.64	0.89
Δ May 1997	-3.52	1.06	-5.78	2.69	-2.88	0.83	-2.44	0.89
Δ Jun 1997	-1.27	0.95	-3.30	2.55	-2.15	0.75	0.66	0.72
Δ Jul 1997	-2.74	1.13	-5.61	2.72	-2.48	0.81	-0.67	0.94
Δ Aug 1997	1.22	0.95	-0.87	2.54	-1.23	0.86	3.39	0.96
Δ Sep 1997	-0.24	1.12	-2.69	2.41	-1.17	0.98	1.67	0.93
Δ Oct 1997	-0.82	1.02	1.68	2.12	-3.35	1.08	-0.22	0.91
Δ Nov 1997	-0.95	1.21	-3.04	2.69	-4.37	1.18	2.18	0.74
Δ Dec 1997	-4.31	1.92	-6.74	3.24	-3.30	1.36	-2.55	1.28
Constant	-0.09	0.39	-0.24	0.81	-0.11	0.40	-0.01	0.34

Note: See notes for Table 3.

Table A.3.1 Deviation on Prior Month's Spending, Baseline Specification

Variable	Total		Durables		Storable Non-durables		Non-storable Non-durables	
	Change (2005 ¥)	Std. Err.	Change (2005 ¥)	Std. Err.	Change (2005 ¥)	Std. Err.	Change (2005 ¥)	Std. Err.
Δ February	-22762	2395	-4510	1295	1327	587	-19834	926
Δ March	20913	2411	11953	1506	6185	679	1071	840
Δ April	1831	2264	6176	1118	4992	582	-10949	1046
Δ May	-72	2426	2721	1266	5385	581	-9248	1151
Δ June	-8012	2564	4605	1463	3636	575	-18072	964
Δ July	18699	3268	14694	1639	9803	648	-8616	1330
Δ August	13767	2924	597	1336	8983	674	4043	1402
Δ September	-15083	3324	-1096	1533	3114	759	-18020	1229
Δ October	-3405	3175	4464	1316	6155	777	-15655	1267
Δ November	-5892	3444	5250	1640	5256	855	-18431	971
Δ December	80105	5532	32694	2303	29116	1104	13371	1696
Δ Jan 1997	786	5107	-2379	2149	745	1036	1865	1566
Δ Feb 1997	6104	4016	2216	1644	308	846	2841	1548
Δ Mar 1997	23341	3566	12015	1745	5720	749	4116	1500
Δ Apr 1997	-2463	3088	-741	1606	-2600	780	770	1242
Δ May 1997	-8742	3069	-4135	1818	-1325	811	-3201	1239
Δ Jun 1997	-3490	2691	-2889	1744	-950	791	752	1005
Δ Jul 1997	-7243	2840	-4185	1776	-1276	776	-927	1213
Δ Aug 1997	2677	2462	-1544	1536	-583	767	4931	1284
Δ Sep 1997	-1037	2935	-2136	1585	-571	825	2030	1130
Δ Oct 1997	-2280	2579	81	1361	-1749	772	-289	1091
Δ Nov 1997	-2503	3103	-2190	1610	-2271	855	2675	884
Δ Dec 1997	-13350	5110	-5855	2153	-2092	1032	-3893	1567
Constant	-323	289	-135	151	-110	70	-44	117

Note: See notes from Table 3.

Table A.3.2 Deviation on Prior Month's Spending, Year Dummies Included

Variable	Total		Durables		Storable Non-durables		Non-storable Non-durables	
	Change (2005 ¥)	Std. Err.	Change (2005 ¥)	Std. Err.	Change (2005 ¥)	Std. Err.	Change (2005 ¥)	Std. Err.
Δ February	-22750	2502	-4508	1365	1334	611	-19833	948
Δ March	20936	2617	11957	1623	6197	734	1072	904
Δ April	1865	2435	6182	1204	5011	621	-10947	1114
Δ May	-27	2638	2729	1368	5410	637	-9246	1210
Δ June	-7955	2810	4614	1566	3667	640	-18070	1025
Δ July	18767	3555	14706	1751	9840	720	-8613	1415
Δ August	13847	3197	610	1426	9026	746	4046	1496
Δ September	-14992	3599	-1081	1629	3163	824	-18016	1317
Δ October	-3303	3446	4480	1392	6210	838	-15650	1363
Δ November	-5778	3681	5268	1735	5317	911	-18426	1049
Δ December	80230	5822	32715	2426	29184	1154	13377	1789
Year 1993	471	2267	313	909	63	606	152	641
Year 1994	-161	1926	126	817	-100	463	-62	759
Year 1995	-59	1793	226	850	-61	425	-173	716
Year 1996	401	1695	309	816	86	447	85	670
Year 1997	-90	1404	-234	599	194	415	-83	495
Year 1998	-1145	1943	-406	898	-380	538	-131	606
Year 1999	-170	2967	-36	1431	122	570	-255	884
Year 2000	492	2361	295	888	-111	566	253	877
Δ Jan 1997	820	5343	-2373	2232	764	1059	1866	1636
Δ Feb 1997	6035	4090	2204	1638	271	834	2838	1556
Δ Mar 1997	23171	3630	11987	1741	5628	643	4108	1528
Δ Apr 1997	-2735	3076	-785	1445	-2748	620	758	1236
Δ May 1997	-9116	3043	-4196	1653	-1529	577	-3218	1209
Δ Jun 1997	-3966	2665	-2966	1534	-1210	532	731	960
Δ Jul 1997	-7822	3074	-4279	1646	-1591	561	-953	1253
Δ Aug 1997	1996	2634	-1654	1297	-953	613	4900	1352
Δ Sep 1997	-1820	3217	-2264	1529	-997	745	1995	1216
Δ Oct 1997	-3165	3099	-63	1345	-2230	799	-329	1237
Δ Nov 1997	-3490	3683	-2351	1753	-2809	953	2630	1043
Δ Dec 1997	-14439	5928	-6032	2425	-2685	1207	-3943	1885
Constant	-294	1329	-201	579	-89	402	-20	467

Note: See notes for Table 3.

Table A.4. Deviations in 1997 Monthly Spending from 1996 Q4 Base Period, Full Specification

Variable	Total		Durables		Storable Non-durables		Non-durables	
	Coeff.	Std. Err.	Coeff.	Std. Err.	Coeff.	Std. Err.	Coeff.	Std. Err.
February	-23225	2863	-4755	1553	1140	715	-19809	1148
March	20537	2658	11839	1769	6101	752	943	1004
April	1331	2081	6048	879	4680	565	-10930	1126
May	-392	2213	2448	1258	5046	488	-8801	1087
June	-10226	1990	3231	974	3064	483	-18031	854
July	18628	2333	14563	1470	9231	484	-7828	870
August	11846	2514	-506	1232	8254	456	4299	1370
September	-16381	2538	-1419	1124	2277	476	-17877	1268
October	-5940	1934	3384	992	5100	474	-15698	1108
November	-8730	1606	4074	1089	4070	477	-18510	754
December	76963	5995	31423	2805	27800	1193	13256	1744
Year 1992	1448	1917	-2742	962	2149	408	978	826
Year 1993	737	2362	-2522	1095	2123	457	224	886
Year 1994	-1124	2020	-2849	1143	1698	348	-624	872
Year 1995	-3598	2328	-3110	1068	31	327	-580	1112
January 1996	1581	3081	-1752	1506	973	617	2224	1112
February 1996	2857	2881	-558	1394	1424	515	1741	1303
March 1996	-264	2706	-2371	1562	-454	511	2683	1382
April 1996	-1706	2163	-3023	1067	332	446	1218	1160
May 1996	-5575	2537	-2625	1526	-500	494	-2492	1165
June 1996	7148	2004	5409	976	327	433	466	958
July 1996	-12425	2312	-5295	1542	-726	397	-5798	977
August 1996	-47	2486	1718	1285	-516	402	-1831	1510
September 1996	-7464	2812	-5291	1260	-702	508	-1202	1265
January 1997	989	3081	-1761	1506	0	617	2813	1112
February 1997	6294	2881	2629	1394	-194	515	3658	1303
March 1997	22971	2706	11848	1562	5169	511	4980	1382
April 1997	-3184	2163	-1343	1067	-2866	446	1379	1160
May 1997	-10117	2537	-5041	1526	-1510	494	-3127	1165
June 1997	-3446	2004	-3144	976	-846	433	1125	958
July 1997	-9817	2312	-6132	1542	-1117	397	-1408	977
August 1997	1480	2486	-2968	1285	-212	402	4874	1510
September 1997	-3332	2812	-4791	1260	-37	508	1981	1265
October 1997	-3812	1827	-2266	931	-940	314	-259	937
November 1997	-4206	2226	-4891	1187	-1277	486	2634	929
December 1997	-15224	3551	-8909	1725	-912	705	-4006	1125
Year 1998	-5926	2074	-3996	1096	-1255	368	-33	818
Year 1999	-6247	3058	-4432	1558	-1970	344	790	1263
Year 2000	-12798	2026	-9361	888	-2937	493	-109	919
Constant	238976	3081	50838	1506	47570	617	139720	1112

Note: See notes for Table 4.