The impact of a permanent VAT hike and a temporary VAT cut on household spending: Evidence from Hypothetical Scenarios

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Abstract

This paper examines the impact of a change in the value added tax (VAT) rate on household spending based on randomly assigned hypothetical VAT rate scenarios in Japan. Our findings are as follows. First, an unanticipated VAT hike from the current 10% to 20% lowers real non-durable spending, but is not statistically significant. Second, an unanticipated temporary VAT cut from 10% to 0% significantly stimulates household spending through intertemporal substitution effects. Finally, the way in which increased tax revenue by the VAT hike is used and the way in which decreased tax revenue by the VAT cut is compensated do not affect household spending behavior. That is, the Ricardian Equivalence holds.

Keywords: value added tax, household expenditure, hypothetical scenarios, randomized control trial

JEL Classification: E21, E62, H20, H31

Corresponding author: Takeshi Niizeki (takeshi.niizeki@chiba-u.jp). The experiment was approved by the research ethics committee at Ehime University in 2022. We are grateful to Tomoharu Mori and Kohei Kubota for their constructive comments as a discussant at the Japan Institute of Public Finance Annual Meeting and at the Japanese Economic Association Annual Meeting. We would also like to thank Masahiro Hori, Keiko Murata, Koichiro Iwamoto, Junya Hamaaki, Fumihiko Suga, Kazuhito Higa, Taiyo Fukai, Kyogo Kanazawa, participants at Applied Economics Workshop (Keio University), and DSGE Workshop for their valuable comments. We are also grateful to INTAGE Inc. for providing us with the data we employed in the current analysis. This research is financially supported by Chiba University. The views expressed in this paper are those of the author and do not represent those of the institutions with which we are affiliated.

1. Introduction

In many developed countries, value added tax (VAT) has been continuously increased to secure stable tax revenues, raising concerns about their impact on household spending through negative income effects. On the other hand, in some countries, such as the U.K. and Germany, have temporarily cut VAT rate during the Great Recession and the COVID-19 pandemic as part of household spending stimulus measures. However, there is limited analysis of the impact of VAT changes on household spending.

One of the main reasons is that, in many cases, all households face the same VAT changes, making it impossible to observe changes in household behavior if there were no change in the VAT. That is, in econometric terms, there is only treatment group and no control group. To address this identification problem, this paper provides randomly selected treatment groups with hypothetical VAT change scenarios and examines how their spending plans change as a result. We randomly divided our sample into three main groups. The first treatment groups (Groups 1 and 2) are provided with an *unanticipated permanent* VAT hike scenario in which the VAT rate permanently changes from the current 10% to 20%. The second treatment groups (Groups 3 and 4), on the other hand, are provided with an *unanticipated temporary* VAT cut scenario in which the VAT rate would fall from the current 10% to 0% for one year only. Finally, the control group (Group 5) is given a scenario in which the current 10% VAT rate would continue in the future.[1]

Household spending may depend on the use of tax revenue increased by the tax hike. If the increased tax revenue is used for something that does not directly affect households' lifetime resources, such as paying down the national debt, there may be a large negative income effect. On the other hand, if it is used to reduce income taxes to offset the burden on households, their expected lifetime resources,

[1] Japan's VAT rate has been gradually raised since its introduction in 1989, reaching 10% in 2019. Necessities such as food are subject to an 8% reduced tax rate. There are also tax-exempt items such as rent, medical treatment, and school education.

and hence household spending, may remain unchanged (Cashin and Unayama 2021). Therefore, the increased tax revenue is set to be used to pay down the national debt in Group 1 and to implement income tax cuts in Group 2. Similarly, the tax revenue deficiency caused by the temporary VAT cut is set to be financed by government borrowing in Group 3 and by income tax increases in Group 4. See Figure 1 for a summary of group assignments and Appendix C for the specific wording provided to each group.

Our findings are summarized as follows. First, an unanticipated VAT hike from the current 10% to 20% lowers the expected growth rate of real non-durable spending by 0.72–0.83 percentage points, but the impact is not statistically significant. On the other hand, the VAT hike increases the willingness to purchase durable goods. The interpretation of this result is discussed in Section 3. Second, an unanticipated temporary VAT cut from the current 10% to 0% raises the expected growth rate of real non-durable spending by 4.31–4.90 percentage points and also increases the willingness to purchase durable goods by 45 percentage points. Finally, the way in which increased tax revenue by the VAT hike is used and the way in which decreased tax revenue by the VAT cut is made up do not affect household spending behavior. In other words, the Ricardian Equivalence is not rejected.

This study seeks to contribute to the literature in the following respects. First, this study exploits the exogenous variations in VAT rates generated by randomly presenting different VAT rate scenarios, making the analysis more internally valid. Previous studies have sought to identify causal relationships through comparing expenditures with other countries with no change in VAT rates over the same time period (Baudisch and Neuenkirch 2023, D'Acunto et al. 2022, Crossley, Low, and Sleeman 2014), comparing purchases of taxable and non-taxable items (Crossley, Low, and Sleeman 2014), taking advantage of the strengths of high-frequency and high-granularity data (Cashin and Unayama 2021, 2016), and exploiting differences in perceived pass-through rates (Bachman et al. 2021). Our new identification strategy is expected to provide complementary evidence to previous studies.

Second, it provides new insights into the literature on the response of household spending to *unanticipated* income changes. To date, numerous previous studies have conducted so-called excess sensitivity test (Jappelli and Pistaferri 2010, Hsieh 2003, to name a few) to examine whether household spending responds to anticipated income changes. However, sufficient evidence has not yet been accumulated regarding reactions to unanticipated income changes. This may be attributed to the fact that unanticipated income changes are often unobservable to econometricians (Pistaferri 2001). For example, when a household income falls by 5%, it is difficult for econometricians to determine whether it was anticipated or unanticipated for that household. To address this issue, previous studies rely on hypothetical income changes (Fuster, Kaplan, and Zafar 2021, Jappelli and Pistaferri 2020, 2014, Christelis et al. 2019, Bunn et al. 2018, Sahm, Shapiro, and Slemrod 2012), and this study provides complementary evidence in this area.[2] In addition, this paper also examines whether the Ricardian Equivalence holds (for a discussion of recent research on the Ricardian Equivalence, see Meissner and Rostam-Afschar 2017). That is, in the case of a VAT hike, for example, we examine whether household spending differs between the case where the increased tax revenue is used to reduce income tax and the case where it is used to redeem government bonds.

The remainder of the study is organized as follows. The next section provides a review of the experimental design and data, while Section 3 presents the estimation results. Section 4 examines the heterogeneity of household responses, and Section 5 discusses some remarks on the interpretation of the results. Finally, Section 6 concludes.

2. Experimental design and data

Data collection was conducted from February 1 to February 7, 2022, based on a pool of individuals

[2] Note that unanticipated changes in VAT rate can be considered as unanticipated changes in real income through changes in inflation rate.

registered with INTAGE Inc., one of the largest research firms in Japan. We asked 37,465 randomly selected individuals aged 20 to 69 from the pool to participate in the survey, which was completed once we had received responses from approximately 4,000 respondents. The survey consists of five questions, with a median (mean) response time of 1 minutes 48 seconds (6 minutes 34 seconds).

As shown in Figure 1, we randomly assigned all respondents to one of five groups. After providing hypothetical VAT rates, we elicited the information on the inflation expectations over the coming year based on the provided VAT rate. To do so, respondents were asked to answer the inflation expectations based on the goods and services purchased by the respondent households, rather than the inflation expectations at the national level. In addition, to make it easier to answer the question, we asked them in the form of how much they thought that the current price of 110 yen including tax would be sold for over the coming year. The inflation expectations are calculated from the results of these responses.

Next, we asked about the percentage change in tax-inclusive *non-durable* spending of respondent households over the coming year compared to the last year. While we do not explicitly instruct respondents to answer *nominal* expenditure growth rates, we assume that they are answering nominal values to this question. To derive the *real* non-durable spending growth rate, we subtract the inflation expectations from the (nominal) expenditure growth rate.

Finally, we asked whether durable goods are a good time to buy over the next year. This type of question is often used in previous studies for ease of answering (e.g., Bachman, Berg, and Sims 2015). The exact wording of all questions is included in Appendix C. The information on respondents' demographics (age, sex, household pretax income, etc.) is provided free of charge by INTAGE Inc.

Table 1 summarizes descriptive statistics by group. Respondents are excluded from the sample if they are students or if we do not know whether they are working. We also confine our analysis to only those respondents for whom all variables necessary for the analysis are not missing. The final

sample size is 1,401. As can be seen in Table 1, the respondent characteristics do not greatly differ across the groups. Indeed, all groups pass the hypothesis test of whether the random assignment is successful (see Table A1). The bottom of Table 1 reports the means for each group for the post-treatment outcome variables, but detailed comparisons will be made in the next section.

Before presenting the results in the next section, it is worth summarizing what the outcome variables in this paper represent. While we ask about inflation expectations for the coming year, we ask about (nominal) spending growth expectations for the coming year *compared to the past year*. Thus, unlike the former, the latter explicitly requests a comparison with the outcome for the past year. However, even in the former, the question is asked in the form of how much the respondents think that what was 110 yen including tax will be for the coming year. Therefore, we believe that it is safe to say that respondents who received the VAT scenario, as depicted in Figure A1, are essentially answering outcomes for the coming year compared to before the VAT change.

In each scenario, the theoretically possible mechanisms and consequences are as follows. In the unanticipated VAT hike scenario (Groups 1 and 2), respondents would likely consider it a negative permanent income shock. This is because their purchasing power will decline even though their nominal expected lifetime income will remain unchanged. On the other hand, this scenario should not lead to intertemporal substitution effects. This is because the VAT hike was an unanticipated event. Therefore, what we examine here is not the effects of unconventional fiscal policy (i.e., policy to stimulate spending by taking advantage of intertemporal substitution effects caused by announcing a future VAT hike), but the extent to which household spending is affected solely by the negative income effect of the VAT hike.

In the unanticipated temporary VAT cut scenarios (Groups 3 and 4), the abolition of the VAT for one year only is expected to have strong intertemporal substitution effects, stimulating household spending to a large extent. This prediction is supported both by theoretical and empirical evidence

(Parodi 2023, Bachman et al. 2021, Baker, Johnson, and Kueng 2021, Agarwal, Marwell, and McGranahan 2017, Crossley, Low, and Sleeman 2014, Crossley, Low, and Wakefield 2009). Moreover, the demand-stimulating effects produced by changes in inflation expectations should theoretically occur in more durable goods (Bachman et al. 2023). We test this theoretical prediction by using the willingness to purchase durable goods as the outcome variable.

For Groups 3 and 4, the VAT cuts may also produce positive income effects, but they are likely to be small. First, since the VAT cuts are limited to one year, its impact on households' lifetime resources is likely to be small. Second, not only for Group 4, where the shortfall in tax revenue is covered by an income tax hike, but also for Group 3, where the shortfall is covered by the issuance of government bonds, if households anticipate future tax hikes, the impact on households' lifetime resources is likely to be small. Thus, we assume that the response of household spending in Groups 3 and 4 is primarily driven by intertemporal substitution effects.

As for the impact on household spending of how the increased tax revenue is used and how the shortfall in tax revenue is compensated, no ex ante judgement can be made since it depends on how households perceive the changes in income taxes and the national debts. Therefore, in the next section, we discuss households' perceptions of these based on the estimation results obtained.

3. Results

3.1. Graphical analysis

Figure 2 shows a histogram of expected tax-inclusive prices by group over the next year. There are several findings. First, about 40% of the control group expect that what was 110 yen including tax will continue to be sold at 110 yen, but there are more than 30% who expect it to be 115 yen or more. This means that even if there were no change in the VAT rate, households expect prices to rise, and the average inflation expectations for the control group are calculated to be about 2.77% (see Table 1).

On the other hand, in Groups 1 and 2, which face a permanent VAT hike, about 70% of respondents expect tax-inclusive prices of 120 yen or more over the next year. The average inflation expectations for Groups 1 and 2 are 6.25% and 6.10%. Thus, compared to the control group, the inflation expectations for Groups 1 and 2 are 3.48 and 3.33 percentage points higher, and this additional increase can be attributed to the permanent VAT hike.

Now let us calculate the pass-through rates of the VAT hike scenarios based on Panel A in Table 2. Note that, in our questionnaire, the upper limit of the expected tax-inclusive price is "121 yen or more". In what follows, we will assign 121 yen to the upper limit of the expected price and call this the baseline case. First, the expected price level for the control group (Group 5) is 113.0 yen, while it is 116.9 yen and 116.7 yen for Groups 1 and 2, respectively. If complete pass-through occurs, it would be 123.3 yen, whereas if the pass-through rate is 0%, the expected price level remains at 113.0 yen. Thus, the pass-through rate is approximately 37% = (116.9-113.0) / (123.3-113.0) for Group 1 and 36% for Group 2.

In Groups 3 and 4, which were given the scenario of a temporary VAT cut, about 45% of respondents expect the price to be 100 yen over the next year. The average inflation expectations for Groups 3 and 4 are -3.16% and -3.38%. Thus, compared to the control group, the inflation expectations for Groups 3 and 4 are 5.94 and 6.15 percentage points lower, and this additional decrease can be attributed to the temporary VAT cut. Calculating the pass-through rate in the manner as Groups 1 and 2 above, the pass-through rate is approximately 64% for Group 3 and 66% for Group 4 (see Panel A in Table 2). We discuss whether these (subjective) pass-through rates are plausible in Section 4.

Panels B and C in Table 2 show the pass-through rates when the upper limit of the expected price is 125 yen and 130 yen, respectively. As can be seen, the higher the upper limit, the higher the pass-through rate, but the difference is relatively small. Thus, we will proceed with our analysis based on the baseline case in Panel A.

Figure 3 illustrates the expected growth rates of (nominal) non-durable spending by group. Compared to the control group, Groups 1 and 2 have about half of the respondents who say they will increase (nominal) non-durable spending by more than 10%, but the impact on real expenditure is not clear from this figure, since these groups also expect tax-inclusive prices to rise by about 6.2%. Groups 3 and 4, on the other hand, have higher growth rates of (nominal) non-durable spending than the control group, even though they expect tax-inclusive prices to decline by more than 3%. In other words, the expected growth rates of *real* non-durable spending are significantly higher than the control group.

Finally, Figure 4 illustrates the distribution of expected growth rates of *real* non-durable spending, calculated by subtracting the inflation expectations from the growth rates of nominal non-durable spending, by group. First, the control group provides us with the growth rates of real non-durable spending that households would expect if the VAT rate were permanently at 10%. Over 40% of households have a growth rate of 0%, with the average being 1.19%.[3] On the other hand, the permanent VAT hike groups have many observations around 1–2%, with the average being 0.22–0.37%. Thus, compared to the control group, the results suggest that the permanent VAT hike possibly had a negative impact on real non-durable spending. This is consistent with the hypothesis that households viewed the permanent VAT hike as a negative permanent income shock, but we will check whether the difference is statistically significant later when we run the regression analysis.

The distribution of the temporary VAT cut groups is the most dispersed, with clearly more observations to the right of 0%. Thus, a temporary VAT cut is likely to stimulate real non-durable spending, and as noted above, intertemporal substitution effects are the possible mechanism behind it. One might wonder whether significant intertemporal substitution effects occur for *non-durable* spending. Since our non-durable spending is the residual obtained by subtracting durable spending

[3] According to the latest Family Income and Expenditure Survey by the Ministry of Internal Affairs and Communications, the growth rate of *real* non-durable spending for 2022 compared to 2021 is 1.73%. Thus, 1.19% is a plausible figure.

from total spending, it includes spending on *semi*-durable such as clothing, as well as *storable* non-durable such as rice, canned goods, detergent, and commuter passes. Thus, the intertemporal elasticity of substitution for non-durable, including *semi*-durable and *storable* non-durable, is considered to be reasonably high (Niizeki and Hori 2023).

3.2. Regression analysis

In order to make the above discussion more quantitative and to check for statistical significance, we perform a regression analysis below. The estimation equation is as follows.

$$y_i = \alpha + \sum_{g=1}^{4} \beta_g Group_{g,i} + \gamma' x_i + \varepsilon_i, \quad (1)$$

y_i is the outcome variable, $Group_{g,i}$ is each group dummy, and x_i is a vector of control variables, and ε_i is the error term. The control variables are male dummy, age, work dummy, number of children, household pretax income, marriage dummy, and each region dummy. Since the control group (Group 5) is excluded, β_g represents the extent to which the outcome of group g is different compared to the control group. Since the assignment to each group is conducted randomly, control variables are not essential. In fact, the results do not differ significantly regardless of the presence or absence of control variables, but this paper reports the estimation results with control variables.

Table 3 represents the estimation results. First, column (1) shows that compared to the control group, the permanent VAT hike groups have a 2.62 percentage point higher expected (nominal) non-durable spending growth rate, while the temporary VAT cut groups have a 1.26 to 1.63 percentage point lower rate. Columns (2) and (3) show that the results of decomposing these nominal values into inflation expectations and expected real non-durable spending growth rate. The permanent VAT hike groups have 3.35–3.45 percentage points higher inflation expectations than the control group, resulting

in 0.72–0.83 percentage points lower expected growth rate of real non-durable spending, but the difference is *not* statistically significant.[4] To the extent that households perceive the unanticipated permanent VAT hike as a negative permanent income shock, this result is somewhat puzzling. In what follows, five possible explanations will be explored in depth. The first four are not very convincing, and the last one is considered to be the most plausible.

The first explanatory factor that could explain this excess smoothness (Campbell and Deaton 1989) is insurance. Indeed, under complete markets, all types of idiosyncratic income shocks to households can theoretically be insured. However, this explanation does not apply in the current case since an unexpected permanent VAT hike is not an insurable idiosyncratic shock such as an unanticipated illness or unemployment, but an aggregate shock that is difficult to insure.

Second, households may have already anticipated VAT hikes. Japan's government debt-to-GDP ratio at the time of the experiment was over 250%, the worst among developed countries, but the VAT rate was relatively low at 10%. Thus, it is possible that many households anticipated that the government would further increase the VAT rate in order to achieve fiscal consolidation. In this case, spending may have already declined when they anticipated it and did not significantly respond when the VAT hike was implemented. However, it is dubious that many households would have anticipated the VAT rate to double from 10% to 20% at once.

Third, many households may not have viewed the VAT hike as a negative permanent income shock. Cashin and Unayama (2021) report that the 1997 VAT hike in Japan did not produce negative income effects because of the income tax cut implemented at the same time. Their finding is consistent with the fact that real spending did not significantly respond in Group 2, where the increased tax revenue is returned as an income tax cut. However, this hypothesis cannot convincingly explain the

[4] As with Table 2, we also conduct estimations for cases where the upper limit of expected tax-inclusive price is set at 125 yen and 130 yen (Table A2). We find that the higher the upper limit, the greater the negative response to the VAT hike, but with the exception of Group 2 at 130 yen, no significant results are obtained.

significant increase in the desire to purchase durable goods in response to a VAT hike.

Fourth, households have non-separable preferences of habit formation, and as a result, they may respond gradually to negative income shocks. Similar to the current paper, Kubota (2010) examines the response of Japanese household spending to a hypothetical permanent income change in which monthly income drops by 30% starting next month and then stays the same for the rest of their lives. He finds that the largest proportion of households (41.7%) chose "reduce spending now and maintain it at that level," but the second largest proportion (38.6%) chose "gradually reduce spending and eventually level off." The latter household response is consistent with habit formation. However, the habit formation hypothesis cannot explain why household spending responds strongly to temporary VAT cuts. In addition, as with the third hypothesis, it cannot explain why household attitude for durable goods purchases responds positively to permanent VAT hikes.

The fifth hypothesis, and the one we consider the most plausible, is that many households may expect a gradual pass-through of the VAT hike to tax-inclusive prices. Two results support this interpretation. First, the pass-through rates for VAT hike scenarios are 36–37%, which are far from complete pass-through. This may be because households expect the pass-through to be gradual over several years. Second, as shown in column (4), compared to the control group, the permanent VAT hike groups respond that it is a good time to buy durable goods in the coming year by about 20 percentage points. This result is puzzling to the extent that one assumes that a permanent VAT hike would result in negative income effects. However, if households expect a gradual pass-through, that is, a gradual increase in tax-included prices over time, they may consider it better to purchase durable goods while prices are relatively low.

Next, the temporary VAT cut lowers inflation expectations by 5.94–6.16 percentage points and increases expected growth rate of real non-durable spending by 4.31–4.90 percentage points. Furthermore, the fraction of respondents who say it is a good time to buy durable goods in the coming

year is also 45 percentage points higher than the control group. As discussed earlier, these are likely due to intertemporal substitution effects.

Finally, no significant differences in coefficients were detected between Groups 1 and 2 and between Groups 3 and 4 for all outcomes (see p-values at the bottom of Table 3). This result is consistent with the Ricardian Equivalence. However, it is also possible that respondents did not read the given scenario thoroughly. They might have understood the VAT rate path given to them, but responded without understanding how the increased tax revenue would be used or how the shortfall in tax revenue would be made up. Since we unfortunately do not have enough information in this experiment to test which possibility is more plausible, it is left for future research.

4. Heterogenous responses

4.1. Borrowing constraint

According to the permanent income hypothesis (PIH), borrowing-constrained households are expected to respond more strongly to a positive income shock (in our case, a temporary VAT cut). To test this hypothesis, we used Q1, which asked "Is your household currently in a situation where you want to increase consumption by taking out a loan, but are unable to do so?" We created a borrowing constraint dummy, assigning a value of one to respondents who answered yes and zero to those who answered no, and added the interaction term in Equation (1). As shown in Table 1, the proportion of borrowing constrained households in our sample is about 8%, which is not very different from previous studies in Japan (see Hara, Unayama, Weidner 2016, for example).

Table 4 summarizes the estimation results. Note that groups 1 and 2 and groups 3 and 4 are each summarized as VAT hike groups and VAT cut groups since there was no significant difference between these groups. Column (3) shows that, for temporary VAT cuts, borrowing constrained households have a 0.23 percentage point higher expected real expenditure growth rate than those without such

constraints, but this is not a significant difference. Thus, in our analysis, we did not find solid evidence that borrowing constrained households respond more to temporary VAT cuts.

4.2. Income

VAT is generally considered regressive. According to the survey that asked Japanese households and economists to evaluate the VAT, the most common response was "fair and appropriate" for economists, while "regressive" ranked first for households, ahead of "negative impact on the economy" in second place (Umeda, Kawamoto, and Hori 2018). The accumulation of evidence on whether VAT is regressive is still in progress and no consensus has been reached. For example, Crossley, Low, and Wakefield (2009) argue that the temporary VAT cut in the U.K. in the aftermath of the Great Recession was *regressive*, while Bachman et al. (2021) report that the temporary VAT cut in Germany amid the COVID-19 disaster was *progressive*. The current paper attempts to provide additional insight into whether VAT is regressive by examining the spending response to changes in the VAT rate by income group.

Figure 5 illustrates the estimation results of equation (1) for each income group. The dependent variable is expected growth rate of real non-durable spending. First, as confirmed in Table 2, the spending response to a permanent VAT hike is not significantly different for most income groups than for the control group. More importantly, there are also no significant differences in spending responses across income groups. Thus, we find that the permanent VAT hike is neither regressive nor progressive.

On the other hand, the spending response to a temporary VAT cut is much larger for households with income equal to or above 10 million yen (about 87,000 US dollars) than for other income groups. This difference is statistically significant (see Table A3). Thus, the temporary VAT cut is regressive in the sense that the rich spend more. Column (2) of Table A3 shows that the larger spending response of high-income households is attributed to the fact that they expect prices to fall to a greater extent. Note

that the rich tend to purchase more luxury goods at the 10% standard VAT rate, while the poor tend to purchase more necessities at the reduced rate of 8%. Thus, the rich would benefit more from the 0% VAT rate since the prices they face would be lower.

4.3. Age

Responses to household spending to changes in the VAT rate may also differ by age. For example, since the consumption basket varies by age, the impact on inflation expectations may differ even for the same VAT rate change. In addition, the PIH with no bequest motives predicts that the spending response to a temporary income shock (in our case, a temporary VAT cut) will be greater for older people with shorter life expectancies.

Table 5 shows the estimation results that include the interaction term for the old dummy which takes a value of one for those aged 60 or over, and zero otherwise. Column (3) shows that, compared to young, the expected real non-durable spending growth rate of old is 2.12 percentage points *lower* for temporary VAT cuts. This result contradicts the prediction of the PIH with no bequest motives discussed above. According to column (2), the reason seems to be that the old do not expect the VAT cut to lower the inflation rate much. Since the old consume large amounts of tax-free medical services, they may think that the benefits of the VAT cut would not be substantial.

5. Discussion on the (subjective) pass-through rates

The VAT pass-through rates in this paper are subjective expectations of each respondent and may deviate from what is observed when VAT rates actually change. This section provides a brief review of the pass-through rates of VAT and individual excise taxes and discusses whether the pass-through rates obtained in this paper are realistic.

Japan has so far experienced only VAT hikes, with the following pass-through rates reported:

under-shifting (Shiraishi 2022), complete pass-through for 63% of goods (Shoji 2022), and 50% (Hiraga 2020). On the other hand, various pass-through rates have been reported in Europe with respect to tax cuts: 17–31% for restaurants in Sweden and Finland (Harju, Kosonen, and Skans 2018), 50% for hairdressing in Finland (Kosonen 2015), 100% for food in Norway (Gaarder 2018), 57% for New cars and 77% for housing repair in France (Carbonnier 2007), 10% for sit-down restaurants in France (Benzarti and Carloni 2019), 40–83% for fuel in Germany (Montag, Sagimuldina, and Schnitzer 2020), and 100% for electricity in Belgium (Hindriks and Serse 2022).

In addition, estimates of the pass-through rates using pooled data for both tax hikes and tax cuts include the following: 21% for all goods in 17 European countries (Benedek et al. 2020), 85% for cigarette in the U.S.（Harding, Leibtag, and Lovenheim 2012), 70–100% for gasoline in the U.S. (Doyle and Samphantharak 2008), and 84–133% for clothing and personal care in the U.S. (Poterba 1996).

One important feature regarding pass-through is asymmetry. Benzarti et al. (2020) focus on a temporary VAT cut that occurred in the hairdressing sector in Finland and find that the pass-through rate was twice as high for tax hike as for tax cut. Using VAT data for European countries, they also report that the pass-through was 34% for tax hikes and 6% for tax cuts. Similarly, Doyle and Samphantharak (2008) report that in a temporary cut in the gasoline sales tax in the U.S., the pass-through rate was 70% at the time of the tax cut, but 80–100% when it returned to its original level. On the other hand, some studies find no evidence of asymmetry in pass-through rates (Hindriks and Serse 2022, Benedek et al. 2020).

In conclusion, estimation results for pass-through rates are difficult to compare since the settings such as country, time horizon, type of good, and estimation methodology differ across the studies. However, based on the survey of previous studies, it appears that the pass-through rates we obtained (about 36–37% for tax hikes and about 64–66% for tax cuts) do not deviate significantly from the

results of previous studies. However, none of the previous studies support our result that pass-through rates are higher for tax cuts than for tax hikes. Therefore, it is important to note that the responses of household spending to the VAT hike (VAT cut) that we have obtained may be underestimated (overestimated).

6. Conclusion

In this paper, we examined the impact of a change in VAT rate on household spending behavior by presenting a random set of hypothetical VAT rate scenarios. Our findings are as follows. First, the permanent VAT hike had no significant negative impact on real household spending in the year ahead. One possible underlying mechanism is that people may expect a gradual pass-through. Second, we found that a temporary VAT cut greatly stimulates households' real non-durable spending and willingness to purchase durable goods. This is likely attributable to intertemporal substitution effects.

We also found that there is heterogeneity in the response of household spending to changes in the VAT rate. High-income earners are more likely to benefit from temporary VAT cuts. We also found that old do not change their spending much in response to temporary VAT cuts. This suggests that the response of spending may differ depending on the consumption basket.

The current analysis can be extended in several ways. First, while this paper only included in the analysis one year after the VAT rate change, it is important to examine longer-term responses of household spending. When viewed cumulatively, the impact of a permanent VAT hike may be more significant due to habit formation and/or gradual pass-through. It is also worth examining the extent to which a temporary VAT cut will be followed by a subsequent rebound in spending (mainly on durable goods). Second, it is also important to conduct experiments under more realistic settings. Changes in VAT rate are usually made over a smaller range than in the setting of our paper. Thus, it is necessary to confirm whether household spending would be similar to the results of this paper even

under such a more realistic VAT rate change. Addressing these questions will be left for future research.

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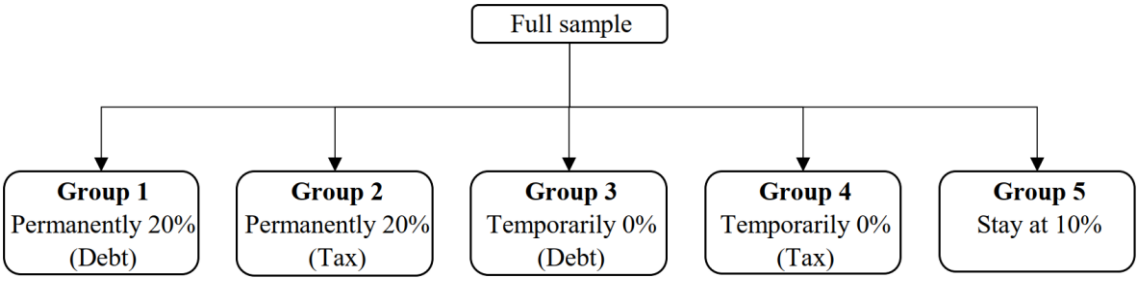
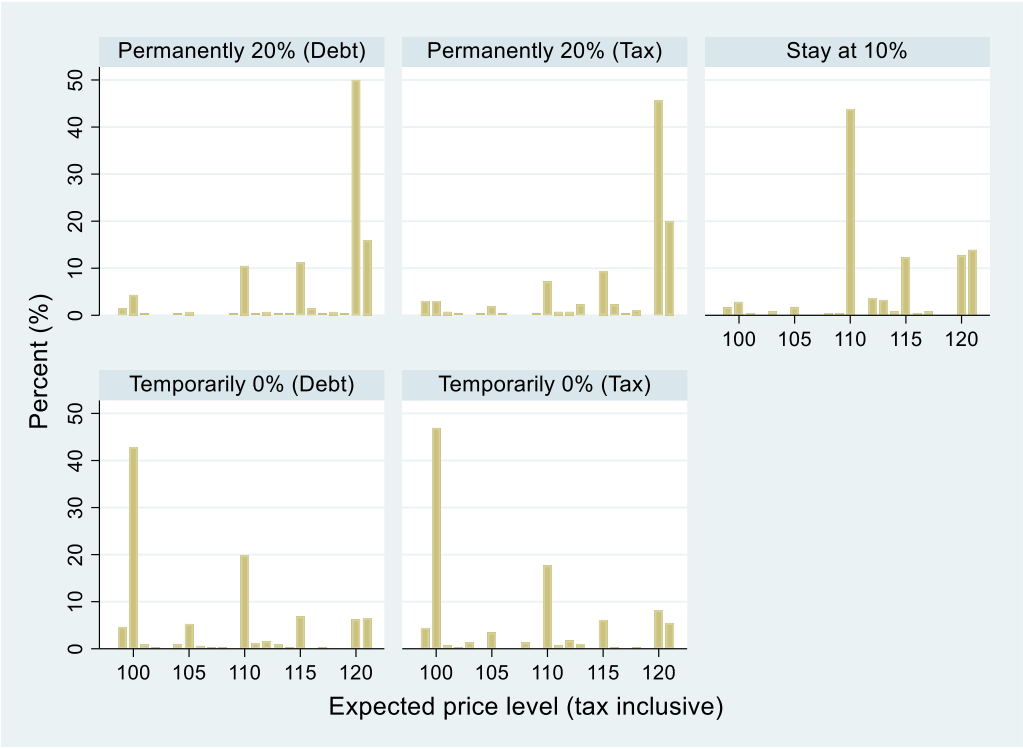
Figure 1: Group assignments



Notes: The words in parentheses represent how the increased tax revenue is used or how the decreased tax revenue is made up. Group 5 is the control group.

Figure 2: Distribution of expected price level (tax inclusive) by group



Notes: The figure illustrates for each group the answer to the question, "How do you think the future path of the consumption tax rate given above will affect the tax-inclusive prices of goods and services purchased by your household over the next year? Please answer by how much you think that goods and services that used to cost 110 yen including tax will now be sold for." The options for answer are from 99 yen (or less) to 121 yen (or more) in increments of 1 yen. When calculating inflation expectations, respondents who chose 99 yen or less and 121 yen or more were assigned 99 yen and 121 yen, respectively.

Figure 3: Distribution of expected growth rates of (nominal) spending by group

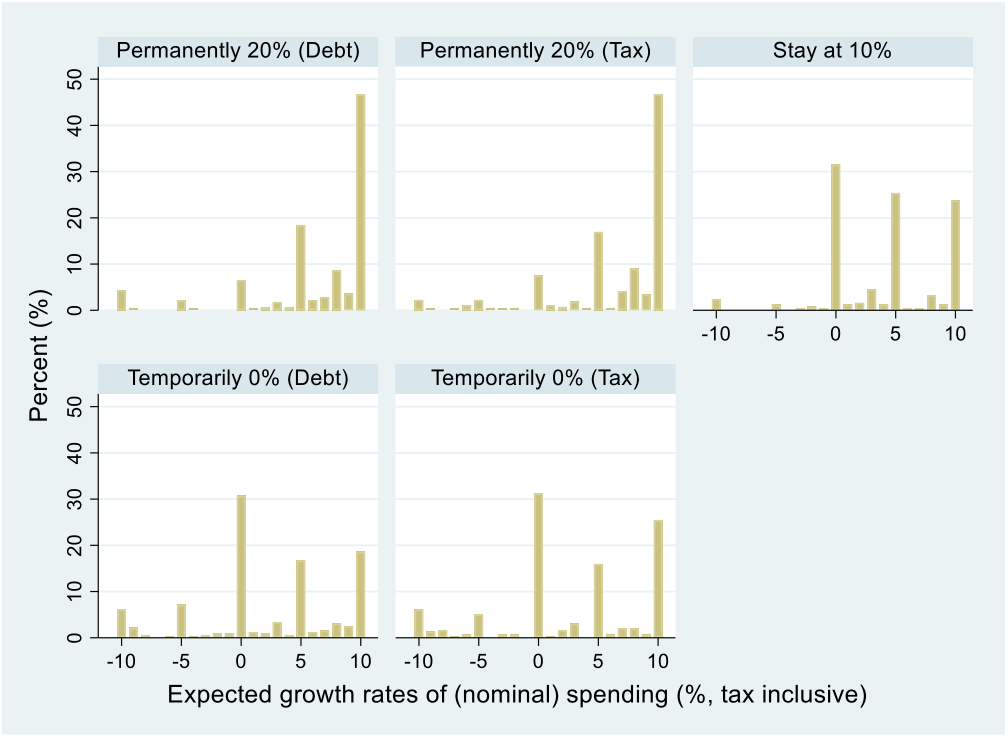


Figure 4: Distribution of expected growth rates of real spending by group

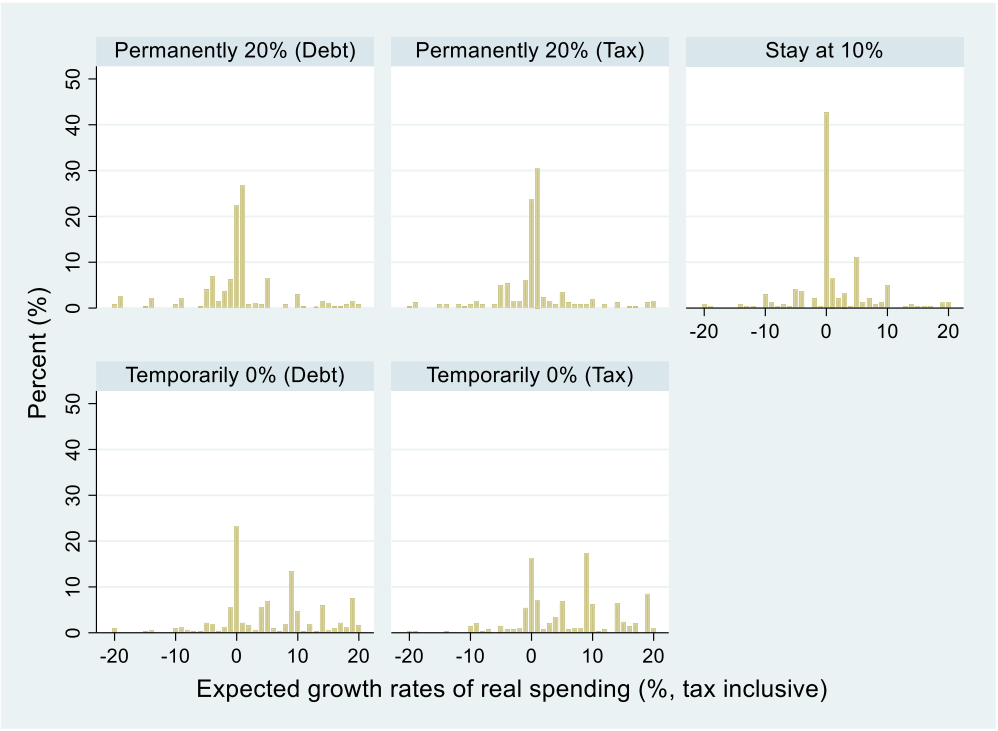


Figure 5: Distributional consequences

Notes: The figure shows that the treatment effects for each income group for the permanent VAT hike group (Groups 1 and 2) and the temporary VAT cut group (Groups 3 and 4). The estimates shown on the vertical axis are derived from estimation results from regressing expected growth rate of real non-durable spending on two treatment dummies and control variables for each income group. The results are shown with 90% confidence intervals. Household pretax income is shown in 10,000 yen units.

Table 1: Descriptive statistics

	Group 1 Permanently 20% (Debt)	Group 2 Permanently 20% (Tax)	Group 3 Temporarily 0% (Debt)	Group 4 Temporarily 0% (Tax)	Group 5 Stay at 10%
Characteristics:					
Male	0.58	0.62	0.57	0.64	0.64
Age	47.0	45.6	46.6	47.6	48.6
Worker	0.80	0.82	0.78	0.83	0.83
Marriage	0.76	0.66	0.66	0.67	0.74
Number of children	0.75	0.60	0.65	0.72	0.77
Region					
Hokkaido, Tohoku	0.09	0.13	0.12	0.10	0.09
Kanto	0.38	0.38	0.36	0.35	0.38
Chubu	0.18	0.13	0.19	0.18	0.18
Kinki	0.16	0.17	0.18	0.19	0.20
Chugoku, Shikoku	0.09	0.07	0.05	0.07	0.09
Kyusyu, Okinawa	0.10	0.12	0.10	0.12	0.07
Household pretax income	733	652	679	647	669
Borrowing constraint	0.07	0.08	0.08	0.08	0.09
After treatment:					
Expected growth rates of (nominal) spending (%, a)	6.46	6.47	2.21	2.66	3.96
Inflation expectations (%, b)	6.25	6.10	-3.16	-3.38	2.77
Expected growth rates of real spending (%, a-b)	0.22	0.37	5.38	6.05	1.19
Good time to buy durables	0.42	0.43	0.67	0.66	0.21
Number of respondents (Total=1,401)	276	265	322	294	244

Notes: Of the respondent characteristics, all are dummy variables except for age, number of children, and household pretax income (in 10,000 yen). Borrowing constraint is a dummy variable that takes one if the answer is yes and zero if the answer is no to Q1. Expected growth rate of (nominal) expenditures and inflation expectations are answers to Q4 and Q3, respectively. The expected growth rate of real expenditures is calculated by subtracting the inflation expectations from the expected growth rate of (nominal) expenditures. The good time to buy durables is a dummy variable that takes one if the answer is "It is a good time" and zero if the answer is "It is a bad time" to Q5. See Appendix C for the questionnaire.

Table 2: Expected price level (yen, tax inclusive) by group

Group	Expected price level (yen, tax inclusive) (a) From the survey	(b) Assuming full pass-through	(c) Assuming zero pass-through	Pass-through rate (a-c) / (b-c)
Panel A (121 yen or more=121 yen)				
1 Permanently 20% (Debt)	116.9	123.3	113.0	37%
2 Permanently 20% (Tax)	116.7	123.3	113.0	36%
3 Temporarily 0% (Debt)	106.5	102.8	113.0	64%
4 Temporarily 0% (Tax)	106.3	102.8	113.0	66%
5 Stay at 10%	113.0	-	-	-
Panel B (121 yen or more=125 yen)				
1 Permanently 20% (Debt)	117.5	123.9	113.6	38%
2 Permanently 20% (Tax)	117.5	123.9	113.6	38%
3 Temporarily 0% (Debt)	106.8	103.3	113.6	66%
4 Temporarily 0% (Tax)	106.5	103.3	113.6	69%
5 Stay at 10%	113.6	-	-	-
Panel C (121 yen or more=130 yen)				
1 Permanently 20% (Debt)	118.3	124.7	114.3	39%
2 Permanently 20% (Tax)	118.5	124.7	114.3	41%
3 Temporarily 0% (Debt)	107.1	103.9	114.3	69%
4 Temporarily 0% (Tax)	106.8	103.9	114.3	73%
5 Stay at 10%	114.3	-	-	-

Notes: Panels A, B, and C show the results when the upper limit of expected price level (yen, tax inclusive) is set at 121 yen, 125 yen, and 130 yen, respectively. The lower limit of expected price is set at 99 yen for all panels. The second column represents the average expected price level for each group. The expected price level represents the responses to the question (Q3) of how much you think that goods and services that used to cost 110 yen including tax will be sold for over the coming year. The third column shows that the expected price level that would be obtained if the change in the VAT rate resulted in a complete pass-through. For example, in Panel A, it is calculated by multiplying 113.0 by 1.2/1.1 for Groups 1 and 2, and by 113.0 by 1.0/1.1 for Groups 3 and 4. The fourth column, on the other hand, represents the expected price level when the pass-through rate is zero. The last column shows that the pass-through rate calculated for each group.

Table 3: Regression results

Dependent variable:	(1) Expected growth rates of nominal expenditure (%, non-durable)	(2) Inflation expectations (%)	(3) Expected growth rates of real expenditure (%, non-durable)	(4) Good time to buy durable? (1=Yes, 0=No)
Group 1	2.62***	3.45***	-0.83	0.20***
(Permanently 20%, Debt)	(0.42)	(0.45)	(0.57)	(0.04)
Group 2	2.62***	3.35***	-0.72	0.21***
(Permanently 20%, Tax)	(0.42)	(0.47)	(0.55)	(0.04)
Group 3	-1.63***	-5.94***	4.31***	0.45***
(Temporarily 0%, Debt)	(0.44)	(0.50)	(0.59)	(0.04)
Group 4	-1.26***	-6.16***	4.90***	0.45***
(Temporarily 0%, Tax)	(0.46)	(0.52)	(0.61)	(0.04)
Control variables	✓	✓	✓	✓
p-value for Group1=Group2	0.99	0.82	0.84	0.81
p-value for Group3=Group4	0.44	0.69	0.35	0.98
Number of respondents	1,401	1,401	1,401	1,401

Notes: Each column shows estimation results based on equation (1). The p-values reported at the bottom of the table are for testing whether the coefficients for Groups 1 and 2, and Groups 3 and 4 are the same. Heteroskedasticity-robust standard errors are in parentheses. ***, **, * denote statistical significance at the 1, 5, and 10% levels, respectively.

Table 4: Regression results (borrowing constraint)

Dependent variable:	(1) Expected growth rate of nominal expenditure (%, non-durable)	(2) Expected inflation rate (%)	(3) Expected growth rate of real expenditure (%, non-durable)	(4) Good time to buy durable? (1=Yes, 0=No)
VAT hike groups	2.71***	3.50***	-0.79	0.19***
	(0.36)	(0.40)	(0.49)	(0.03)
VAT hike groups	-1.24	-1.42	0.18	0.16*
×Borrowing constraint	(1.06)	(1.06)	(1.33)	(0.08)
VAT cut groups	-1.58***	-6.15***	4.57***	0.46***
	(0.38)	(0.43)	(0.52)	(0.03)
VAT cut groups	1.53*	1.30	0.23	-0.08
×Borrowing constraint	(0.91)	(1.12)	(1.22)	(0.07)
Number of respondents	1,401	1,401	1,401	1,401

Notes: VAT hike groups consist of groups 1 and 2, and VAT cut groups consist of groups 3 and 4. See also notes for Table 3.

Table 5: Regression results (young v.s. old)

Dependent variable:	(1) Expected growth rate of nominal expenditure (%, non-durable)	(2) Expected inflation rate (%)	(3) Expected growth rate of real expenditure (%, non-durable)	(4) Good time to buy durable? (1=Yes, 0=No)
VAT hike groups	2.40***	3.20***	-0.80	0.21***
	(0.40)	(0.43)	(0.52)	(0.04)
VAT hike groups	1.04*	0.74	0.31	-0.04
×Old	(0.56)	(0.69)	(0.77)	(0.06)
VAT cut groups	-1.28***	-6.41***	5.13***	0.44***
	(0.41)	(0.46)	(0.55)	(0.04)
VAT cut groups	-0.73	1.39*	-2.12**	0.07
×Old	(0.64)	(0.75)	(0.87)	(0.05)
Number of respondents	1,401	1,401	1,401	1,401

Notes: The old dummy takes a value of one if the respondent is 60 years old or older, and zero otherwise. See also notes for Table 4.

Online Appendix

Appendix A: Additional Figures and Tables

Figure A1: Clarification of research question for the current analysis

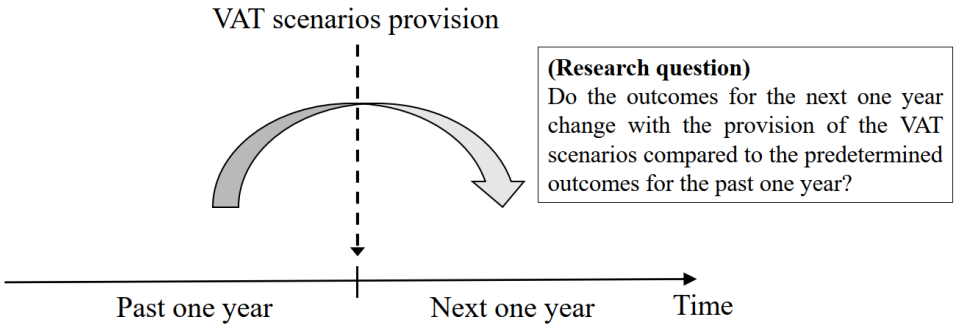


Table A1: Predictability of treatment status

Group		F-statistic	p-value	N
1	Permanently 20% (Debt)	1.40	0.16	1,401
2	Permanently 20% (Tax)	1.23	0.26	1,401
3	Temporarily 0% (Debt)	0.98	0.47	1,401
4	Temporarily 0% (Tax)	0.73	0.73	1,401
5	Stay at 10%	1.49	0.12	1,401

Notes: The table reports the F-statistic and p-value in the F test where all coefficients are zero when each treatment dummy is regressed on the respondent characteristics obtained before the treatment. The respondent characteristics include all variables listed in Table 1.

Table A2(a): Regression results (121 yen or more=**125 yen**)

Dependent variable:	(1) Expected growth rates of nominal spending (%, non-durable)	(2) Inflation expectations (%)	(3) Expected growth rates of real spending (%, non-durable)	(4) Good time to buy durable? (1=Yes, 0=No)
Group 1 (Permanently 20%, Debt)	2.62*** (0.42)	3.54*** (0.52)	-0.92 (0.61)	0.20*** (0.04)
Group 2 (Permanently 20%, Tax)	2.62*** (0.42)	3.58*** (0.54)	-0.96 (0.59)	0.21*** (0.04)
Group 3 (Temporarily 0%, Debt)	-1.63*** (0.44)	-6.19*** (0.56)	4.56*** (0.63)	0.45*** (0.04)
Group 4 (Temporarily 0%, Tax)	-1.26*** (0.46)	-6.46*** (0.57)	5.20*** (0.64)	0.45*** (0.04)
Control variables	✓	✓	✓	✓
p-value for Group1=Group2	0.99	0.93	0.95	0.81
p-value for Group3=Group4	0.44	0.65	0.33	0.98
Number of respondents	1,401	1,401	1,401	1,401

Table A2(b): Regression results (121 yen or more=**130 yen**)

Dependent variable:	(1) Expected growth rates of nominal spending (%, non-durable)	(2) Inflation expectations (%)	(3) Expected growth rates of real spending (%, non-durable)	(4) Good time to buy durable? (1=Yes, 0=No)
Group 1 (Permanently 20%, Debt)	2.62*** (0.42)	3.65*** (0.61)	-1.03 (0.68)	0.20*** (0.04)
Group 2 (Permanently 20%, Tax)	2.62*** (0.42)	3.88*** (0.65)	-1.26* (0.68)	0.21*** (0.04)
Group 3 (Temporarily 0%, Debt)	-1.63*** (0.44)	-6.51*** (0.64)	4.88*** (0.70)	0.45*** (0.04)
Group 4 (Temporarily 0%, Tax)	-1.26*** (0.46)	-6.84*** (0.65)	5.58*** (0.70)	0.45*** (0.04)
Control variables	✓	✓	✓	✓
p-value for Group1=Group2	0.99	0.71	0.74	0.81
p-value for Group3=Group4	0.44	0.61	0.32	0.98
Number of respondents	1,401	1,401	1,401	1,401

Table A3: Regression results (high income v.s. low and middle income)

Dependent variable:	(1) Expected growth rate of nominal expenditure (%, non-durable)	(2) Inflation expectations (%)	(3) Expected growth rate of real expenditure (%, non-durable)	(4) Good time to buy durable? (1=Yes, 0=No)
VAT hike groups	2.38***	3.20***	-0.83	0.19***
	(0.38)	(0.43)	(0.51)	(0.04)
VAT hike groups	1.46**	1.01	0.45	0.09
× High-income	(0.67)	(0.65)	(0.80)	(0.07)
VAT cut groups	-1.53***	-5.74***	4.21***	0.47***
	(0.39)	(0.46)	(0.54)	(0.03)
VAT cut groups	0.52	-2.05**	2.57**	-0.08
× High-income	(0.80)	(0.83)	(1.06)	(0.06)
Control variables	✓	✓	✓	✓
Number of respondents	1,401	1,401	1,401	1,401

Notes: The high-income dummy takes the value of one if the household pretax income is 10 million yen or more, and zero otherwise. See also notes for Table2.

Appendix B: Hypothetical bias

In the current paper, the analysis is based on the assumption that households' responses to a hypothetical VAT rate change are the same as those that would be observed if the VAT rate were actually changed. However, there is no guarantee that these will coincide. In previous studies, the bias in which subjects' responses differ between hypothetical and real situations is called "hypothetical bias". In this Appendix, we briefly review previous studies on hypothetical bias and discuss the extent to which the current analysis suffers from it.

First of all, to our knowledge, no studies have examined the extent to which hypothetical bias exists in households' spending responses to changes in tax rates. One of the fields in which hypothetical bias has been most studied is preferences (time discount rates and risk aversion). Matousek, Havranek, and Irsova (2022) provides a meta-analysis of whether hypothetical bias exists in the measurement of time discount rates, based on 56 papers and 927 observations. The time discount rate is usually measured in the form of an option to receive $100 today versus an option to receive $100+X a year from now. In this case, the hypothetical situation is that the subjects do not actually receive the money, while the real situation is that they do. The difference in time discount rates between the two groups is the hypothetical bias in this case. They find no significant differences between the two groups. Branas-Garza et al. (2023) examine hypothetical bias in time discount rates in three areas: lab, field, and online, and observe no hypothetical bias in any area. Bickel (2009) conduct functional magnetic resonance imaging (fMRI) assessments to subjects and find not only no difference in time discount rates between the two groups, but also no difference in brain activity during responses. No or little hypothetical bias are also reported in risk aversion (Kuhberger, Schulte-Mecklenbeck, and Perner 2002, Irwin, McClelland, and Schulze 1992).

In contrast, there are numerous studies suggesting that hypothetical bias regarding willingness to pay (WTP) for goods and services does exist. Murphy et al. (2005) perform a meta-analysis of 28

studies and 83 observations and find that the mean (median) calibration factor, defined as the mean WTP in a hypothetical situation divided by the mean WTP in a real situation, is 2.60 (1.35). In the field of marketing, Schmidt and Bijmolt (2020) conduct a meta-analysis based on 47 studies and 77 observations that measure WTP for various products. They find that the mean calibration factor is 1.21.

In summary, while hypothetical bias is not observed with respect to preferences, it appears to exist to a reasonable degree with respect to WTP for goods and services. Thus, as hypothetical bias is robustly observed in some areas, the results of our analysis should also be evaluated with caution. However, the VAT burden can be considered a *relevant* and *important* issue for many households. Therefore, we believe that they respond to our survey by imaging their actual reactions in a reasonable way.

References for Appendix B

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Appendix C: Questionnaire and scenarios provided for each group

(Q1) Is your household currently in a situation where you want to increase consumption by taking out a loan, but are unable to do so?

☐ Yes

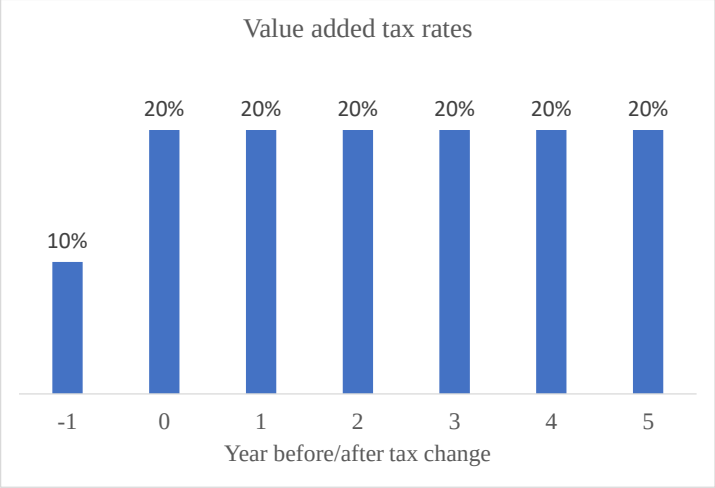
☐ No

☐ I don't know/I don't want to answer

*After Q1, respondents are randomly assigned to one of five groups, each presented with the following scenario.

Group1

As shown in the figure below, assume that the government suddenly decides to permanently raise the consumption tax rate from 10% to 20%, effective today. Assume that the increased tax revenue will be used to repay the national debt. Also, assume that the tax rate on items subject to the reduced tax rate is increased from 8% to 16%.

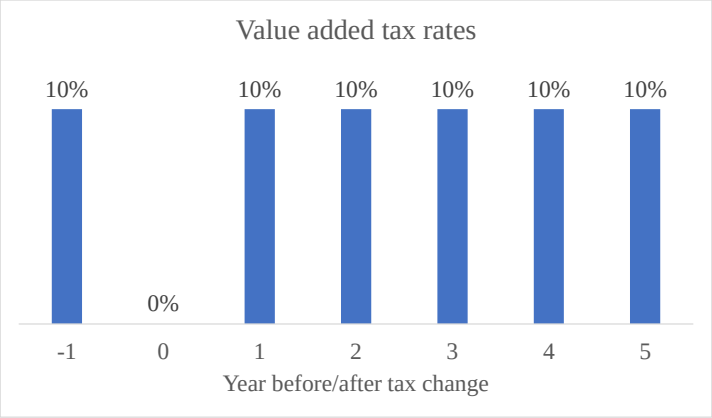


Group2

As shown in the figure below, assume that the government suddenly decides to permanently raise the consumption tax rate from 10% to 20%, effective today. Assume that the increased tax revenue will be used to reduce income taxes. Also, assume that the tax rate on items subject to the reduced tax rate is increased from 8% to 16%.

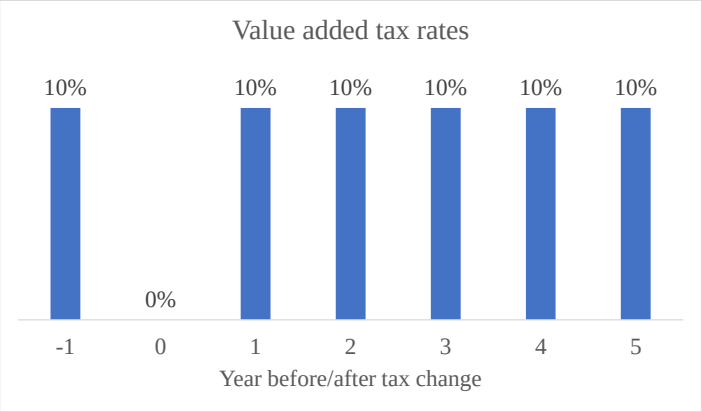
Group3

As shown in the figure below, assume that the consumption tax rate is suddenly reduced from 10% to 0% for one year from today. The decrease in tax revenues will be compensated for by the use of government debt.



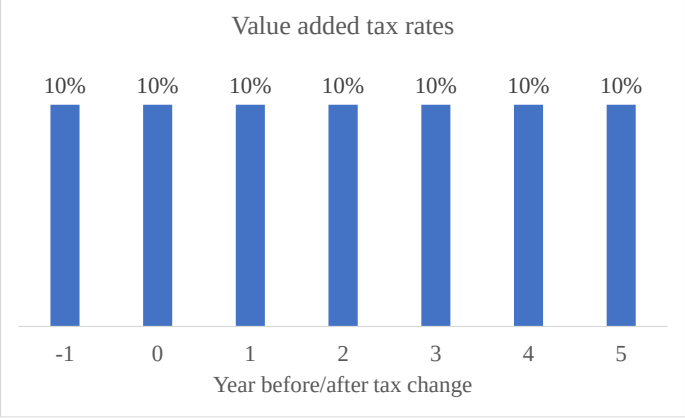
Group4

As shown in the figure below, assume that the consumption tax rate is suddenly reduced from 10% to 0% for one year from today. The decrease in tax revenue will be compensated for by an increase in income tax.



Group5

As shown in the figure below, assume that the consumption tax rate will continue to remain at 10% permanently in the future.



(Q2) To what extent do you think the future path of the consumption tax rate given above will affect your household's well-being over the next year?

- ☐ Quite negatively affected
- ☐ Somewhat negatively affected
- ☐ No impact
- ☐ Somewhat positively affected
- ☐ Quite positively affected
- ☐ I don’t know/I don’t want to answer

(Q3) How do you think the future path of the consumption tax rate given above will affect the tax-inclusive prices of goods and services purchased by your household over the next year? Please answer by how much you think that goods and services that used to cost 110 yen including tax will now be sold for.

- ☐ 99 yen or less
- ☐ 100 yen
- ☐ 101 yen
- ☐ 102 yen
- ☐ 103 yen
- ☐ 104 yen
- ☐ 105 yen
- ☐ 106 yen
- ☐ 107 yen
- ☐ 108 yen

- ☐ 109 yen
- ☐ 110 yen
- ☐ 111 yen
- ☐ 112 yen
- ☐ 113 yen
- ☐ 114 yen
- ☐ 115 yen
- ☐ 116 yen
- ☐ 117 yen
- ☐ 118 yen
- ☐ 119 yen
- ☐ 120 yen
- ☐ 121 yen or more
- ☐ I don't know

(Q4) Based on the future path of the consumption tax rate given above, by how much do you think the amount of (tax included) spending in your household over the next year will change compared to the past year? Please exclude spending on durable goods (e.g., cars and appliances).

- ☐ Increase by 10% or more
- ☐ Increase by about 9%
- ☐ Increase by about 8%
- ☐ Increase by about 7%
- ☐ Increase by about 6%

- ☐ Increase by about 5%
- ☐ Increase by about 4%
- ☐ Increase by about 3%
- ☐ Increase by about 2%
- ☐ Increase by about 1%
- ☐ Remain unchanged
- ☐ Decrease by about 1%
- ☐ Decrease by about 2%
- ☐ Decrease by about 3%
- ☐ Decrease by about 4%
- ☐ Decrease by about 5%
- ☐ Decrease by about 6%
- ☐ Decrease by about 7%
- ☐ Decrease by about 8%
- ☐ Decrease by about 9%
- ☐ Decrease by 10% or more
- ☐ I don't know

(Q5) Based on the future path of the consumption tax rate given above, do you think the coming twelve months will be a good time to buy durable goods (cars, appliances, etc.)?

- ☐ It is a good time
- ☐ It is a bad time
- ☐ I don't know