The Salient Effect: Evidence from the Consumption Tax Hike in Japan*

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1 Introduction

There are a growing number of studies on the inattentiveness of consumers to some types of incentives. While a standard assumption of economics is that agents optimize fully with respect to incentives, the past studies reject fully optimizing behavior. Inattention and imperfect optimization are some of the important issues, particularly in the tax system. A seminal paper by Chetty et al. (2009) studies the impact of price display on the demand of healthcare goods and alcohol using the data of retail sales and show that posting tax-inclusive price tags reduces demand by 8 percent, which is almost the same rate as the tax rate, which is 7.375 percent.

A newly enacted law by the Japanese government allows us to use a natural experiment approach to investigate the impact of tax display. In October 2013, the Japanese government enacted the Act Concerning Special Measures for Correcting Practices Impeding Consumption Tax Pass-on (消費税転嫁対策特別措置法) to pass-on the consumption tax smoothly and properly. In Japan, a consumption tax was introduced for the first time in April 1989. The tax rose by 2% in April 1997 and was gradually raised to 8% in April 2018 and to 10% in October 2019.[1] After the enactment of the law, the tax-included price was not required to be presented on goods or services until after a year and half from the date of the consumption tax hike to 10%.[2] Retailers had to prominently display the (tax added) gross price before October 2013, while they could choose to display the tax-exclusive price tag after that.

To evaluate the impact of which price tags are displayed on goods in demand, we conduct a nationwide survey on the tax display of retailers. We ask respondents to answer when and whether they changed the price display after the enactment of the law to identify the timing of the change in price display. We combine the survey data with the sales data of the respondents to examine the impact of a change in the price tag. The unique data allows us to measure the effect of tax-salience not only on the demand of various goods but also on a nationwide scale. To further identify who underreacts to taxes that are not salient, we also combine the survey data on the tax display of retailers with the households' expenditure data. The data from households collects when, where, and who purchases what goods by how much. This novel data allows us to examine which types of households spend less at stores which use a *tax-inclusive* price display.

*We thank INTAGE Inc. for giving us access to the data on each household's consumption and store-level scanner data. We also thank the discussant, Yasutora Watanabe, for invaluable inputs and participants in the 2020 Spring meeting of Japanese Economic Association. We are also thank Koichi Kimura, Eiichiro Sato, Rui Ota, Qing-Yuan Sui, and participants in the 2018 Japanese Joint Statistical Meeting and seminars at Ministry of Finance and Ministry of Economy, Trade and Industry for their comments and suggestions. Nakazono acknowledges financial support from JSPS KAKENHI Grant Number 19K13649.

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[1] In the Japanese consumption tax system, there is no tax on the fees for medical treatment, housing rent, tuition fees for schooling, etc. In October 2019, a reduced tax rate was introduced for the first time. While the standard tax rate is 10 percent, a levy of 8 percent is applied to food and newspapers.

[2] As of December 2019, the tax-included price display is allowed until the end of March 2021. More details about the law is available at https://www.jftc.go.jp/en/legislation_gls/190708.pdf.

2 Empirical Framework

Our empirical framework depends on the approach which Chetty et al. (2009) propose. Let $x(p, \tau)$ denote demand as a function of the posted price and consumption tax, where p is denoted as the pretax price of goods x. Because in this case, the posted price is tax-exclusive, consumers must pay the total price of x at the register, which is $q = (1 + \tau)p$. In the neoclassical full-optimization model, $x(p, \tau)$ equals to $x((1 + \tau)p, 0)$, which depends only on the total tax-inclusive price, $(1 + \tau)p$. If consumers optimize fully, a one percent increase in the pre-tax price p and a one percent increase in the tax-inclusive price $(1 + \tau)$ reduces demand by the same amount. In this case, the price elasticity of demand $\varepsilon_{x,p} \equiv -(\partial \log x) / (\partial \log p)$ equals the tax elasticity of demand $\varepsilon_{x,1+\tau} \equiv -(\partial \log x) / (\partial \log (1 + \tau))$. However, if consumers underreact to taxes that are not salient and the price display is exclusive of the consumption tax, $\varepsilon_{x,p}$ is larger than $\varepsilon_{x,1+\tau}$.

Following Chetty et al. (2009), we test whether consumers underreact to the consumption tax when the tax display is less salient by the following estimation equation:

$$\log x(p, \tau) = \alpha + \beta \log p + \theta_\tau \beta \log(1 + \tau), \tag{1}$$

where θ_τ measures the degree to which consumers underreact to the consumption tax. Because $\varepsilon_{x,1+\tau} = -\theta_\tau \beta$, θ_τ can be identified by the following equation:

$$\theta_\tau = \frac{\partial \log x}{\partial \log(1 + \tau)} \Big/ \frac{\partial \log x}{\partial \log p} = \frac{\varepsilon_{x,1+\tau}}{\varepsilon_{x,p}}$$

Our strategy to identify θ_τ also follows Chetty et al. (2009). The effect of the inclusive-tax display on demand is

$$\log x((1 + \tau)p, 0) - \log x(p, \tau) = (1 - \theta_\tau)\beta \log(1 + \tau).$$

Because $\varepsilon_{x,p} = -\beta$, we identify the parameter θ_τ by the following equation:

$$(1 - \theta_\tau) = -\frac{\log x((1 + \tau)p, 0) - \log x(p, \tau)}{\varepsilon_{x,p} \log(1 + \tau)}. \tag{2}$$

If all consumers optimize fully and take the consumption tax into account, the tax-inclusive tags that are salient should never influence demand. In this case, $\theta_\tau = 1$. If all consumers ignore the consumption tax in deciding what to purchase, the salient tax display reduces demand by $\varepsilon_{x,p} \log(1 + \tau)$. In this case, $\theta_\tau = 0$.

3 A difference-in-difference analysis

3.1 Research design

How do households underreact to taxes that are not salient? In order to estimate θ_τ, which measures the degree to which consumers underreact to the consumption tax, we use Equation (2). First, we estimate the numerator in Equation (2), which is the difference in demand between the control and treatment stores. Second, we estimate $\varepsilon_{x,p}$ by regression $\log(x)$ on price. Then, we calculate the parameter θ_τ by Equation (2). The following subsection

explains how we identify which retailers use the tax-inclusive/exclusive display and when the treatment store changes the tax display from tax-inclusive tags to tax-exclusive tags. After that, we show how the demand elasticity of price $\varepsilon_{x,p}$ is estimated.

3.2 Identification of changes in the price display at retailers

In order to identify which retailers change the tax display from the tax-inclusive tags to the tax-exclusive tags and when they do so, we conduct a questionnaire survey of retailers in April 2019. The survey respondents are chain stores of supermarkets, drug stores, convenience stores, and home centers. We ask 282 firms by telephone, e-mail, or fax to answer (1) the price display which they use and (2) whether they changed the price display to the tax-exclusive tags after the enactment of the Act Concerning Special Measures for Correcting Practices Impeding Consumption Tax Pass-on.[3] Responses are obtained from 191 firms: the breakdown is 108 supermarkets, 52 drugstores, 2 convenience stores, and 29 home centers.[4] Thus, the response rate of the survey is approximately 68%.

3.3 The data on retail sales

In order to estimate the impact of a change in posted prices, we combine the survey data with the POS data on the retail sales of each respondent. The data comes from SRI and it was collected by Intage Inc. SRI is a nationwide retail store panel survey and it collects data from approximately 4,000 stores nationwide including supermarkets, home centers/discount stores, and drug stores, etc. Survey items are the date of sales, volume of sales, and amount of sales of food excluding fresh food, beverages, and alcohol at each store by barcode identification. We combine the SRI data on the monthly volume of sales and the unit selling price with the survey of the price display of the survey respondents.

3.4 Estimating demand elasticity of price and θ_τ by using a difference-in-differences approach

First, we estimate the demand elasticity of price $\varepsilon_{x,p}$, which is in the denominator of Equation 2. We regress on the monthly volume of sales on average unit price for 1 year until just before the consumption tax hike in April 2014. Our estimation result shows that the estimate of the elasticity of price is approximately 1.0. This is similar to Chetty et al. (2009): they report that the elasticity of price is in the range of 1.0 to 1.5.[5]

Second, we compute the numerator that is the difference in quantity demanded between the control and treated groups. The treated groups are the stores which change the price display from the tax-inclusive price tags to the tax-exclusive price tags, while the control groups are the stores which do not change the price display until the consumption rate hike in April 2013. We calculate the average growth rates of quantity sold per store per month for each group. In order to difference out time-trends, we use a difference-in-difference (DID) approach.

[3]The 282 firms are surveyed because the POS data on their retail sales which a marketing research company, Intage Inc., provides is available.

[4]According to the annual report for 2014 by National Supermarket Association of Japan, the number of the firm which affiliate with industry associations are 540.

[5]Using the data on the retail sales of toiletries, Chetty et al. (2009) report that the elasticity of demand is 1.59. Because they chose products with relatively high prices so that the dollar amount of the sales tax was nontrivial, their estimates of elasticity is relatively high.

Specifically, we take the difference of the growth rates of the quantity sold between the control and treated groups. The baseline and treatment period are set to be the first half and second half of the fiscal year 2013 because approximately 15% of the surveyed stores change their price display from the tax-inclusive tags to the tax-exclusive tags in October 201Table 1 summarizes the DID approach. The growth rates are -7% and -10% in the treated and in the control groups, respectively. The results show that the growth rates of the quantity sold in the treated groups are larger than those of the control groups. Our focus is on difference between -7% and -10%. This is the effect of posting tax-inclusive prices, that is 3%. Because the consumption tax rate is 5% until the fiscal year 2013, our DID analysis shows that a one percent increase in posted prices reduces 0.6% of products sold.

Finally, using the estimates of demand elasticity and the results of the DID analysis, we identify the degree of underreaction to the consumption tax that is not fully salient. Given the consumption tax rate of 5 percent and a demand elasticity of 1 percent, plugging these values into Equation (2), yields a point estimates of $\theta_\tau = 1 - (3\%) / (1.0 \times \log(1 + 5\%)) \simeq 0.4$. That is, a 10 percent tax increase reduces demand by the same amount as a 4.0 percent price increase. In the case of the consumption tax hike to 8% in April 2014, the difference in the demand of products sold among the posted prices, which are tax-inclusive/exclusive, can be 3.2%.[6]

4 Who underreacts to taxes that are not salient?

As we discover the underreaction of households to taxes that are not salient, another question arises as to whether there are income differences in reaction to taxes that are not salient. Goldin and Tariana (2013) find evidence that income differences affect attentiveness to cigarette taxes. Goldin and Tariana (2013) find that all consumers respond to taxes that appear in the posted price, while only low-income consumers respond to taxes that are salient. That is, the posted price does not influence the decision-making of low-income consumers, while only high-income consumers are inattentive to the posted price.

In this section, we examine who underreacts more to taxes that are not salient, exploiting the data not on retailers' sales but on households' expenditure. We combine the survey of the posted price among retailers with the data on households' expenditure. The data on households' consumption expenditure is the panel data (SCI-personal) in Japan, which is collected by a marketing company, Intage. Intage asks over 50,000 individuals to report what items they buy on a daily basis. The data basically covers consumer goods with bar-codes.[7] The data also includes covariates of the survey respondents such as sex, age, income, etc. The data is novel because it records who purchases what items and when and how much they pay for it. Thus, the data allows us to identify not only the stores where consumers purchase each commodity, but also the income which they earn. We investigate whether only low-income consumers are attentive to less salient taxes that are levied on daily commodities.

We conduct two types of DID approach: Before and after the consumption tax hike in April 2014, we compare the purchase volume of low- and high-income consumers at treated stores with that of control stores.[8] Here, treated and control stores are denoted as the stores which use a tax-exclusive and tax-inclusive price display,

[6] Our estimate of θ_τ is larger than that of Chetty et al. (2009), that is 0.35. The reason for the higher estimate in this study is because the data we use includes less elastic goods such as food and beverages compared with goods in the Chetty et al. (2009) study.

[7] The data covers neither fresh food nor durable goods.

[8] We compare them for 6 months before and after April 2014, because more than half of respondents changed posted prices from a tax-inclusive to a tax-exclusive display at the timing of the tax hike.

respectively. When they are fully attentive to posted price, consumers do not change their consumption bundle among retailers using a tax-inclusive or a tax-exclusive display even after the consumption tax hike. However, when they are not inattentive to less salient taxes, the purchase volume at stores that use a tax-exclusive display becomes larger than that at stores that use a tax-inclusive display after the consumption tax hike.

Tables 2 shows the result from the DID analysis for high-income consumers. As for high-income consumers, the purchase volume at stores that use a tax-exclusive display becomes significantly larger: the purchase volume is 4.8% higher than that at stores which uses a tax-exclusive display. On the other hand, low-income consumers are *attentive* to taxes that are not salient; the difference in purchase volume at stores which use a tax-exclusive and tax-inclusive price tags is 1.3%, which is not significant. [9][10] Using the subsample from January 2014 to June 2014, we show that low-income consumers decrease the purchase volume at stores which use a tax-exclusive display significantly larger by 6.7% than that at stores that use a tax-exclusive display. These results suggest that while low-income consumers underreact to taxes just after the consumption tax hike in April 2014, they pay more attention to taxes after several months.

5 Conclusion

To evaluate the impact of which price tags are displayed on goods in demand, we conduct a nationwide survey on the tax display of retailers. We ask respondents to answer when and whether they change the price display after the enactment of the law to identify the timing of a change in the price display. We combine the survey data with the sales data of the respondents to examine the impact of a change in the price tag. The unique data allows us to measure the effect of tax-salience not only on the demand of various goods but also on a nationwide scale. To further examine the impact, we also combine the survey data on the tax display of retailers with the households' expenditure data. The data from households collects when, where, and who purchases what goods by how much. This novel data allows us to identify which types of households underreact to taxes that are not salient.

There are four findings. First, we find that the demand of products sold at stores with a tax-exclusive price display is 3% higher than that at stores with a tax-inclusive price display. This may be because households underreact to taxes that are less salient. Second, we find that the degree of underreaction varies among categories such as food, beverages, and alcohol. Households are more attentive to the price tag when shopping for food products, while they are less attentive when shopping for beverages and alcohol. Third, we find that households with a higher income underreact to taxes that are not salient. Those with higher income spend more than 2% at stores which use a *tax-exclusive* price display than those with lower income. This evidence implies that agents with a higher income save information processing costs by paying less attention to taxes that are not salient. Fourth, we find that while both high- and low-income consumers underreact to less salient taxes, for low-income consumers, their underreaction is not permanent but transitory.

[9] We do not report the result from the DID analysis for low-income consumers to save space.

[10] We exclude people who are 55 years old or over from the sample to drop the data on pensioners' expenditure. The income of consumers who retire is generally low, while elderly people possess large assets. They may underreact to taxes that are not salient as high-income households do.

References

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Table 1: Effect of posting tax-inclusive prices on demand sold: A difference-in differences approach

Period	Treated stores	Control stores	Difference
Baseline (2013:04-2013:09)	12.073	10.688	1.385
	(0.911)	(1.355)	(0.047)
	[390]	[426]	[816]
Treatment (2013:10-2014:03)	12.004	10.589	1.415
	(0.908)	(1.366)	(0.048)
	[390]	[426]	[816]
Difference over time	−0.070	−0.100	0.030*
	(0.114)	(0.216)	(0.006)
	[780]	[852]	[1,632]

Notes: Each cell shows (log) mean quantity sold per store per month, for various subsets of the sample. Standard errors (clustered by month) in parentheses, number of observations in square brackets. Treatment period spans for 6 months from October 2013 to March 2014. Baseline period spans for 6 months from April 2013 to September 2013. Standard errors in parentheses are clustered at store levels, * indicates 10%, ** indicates 5% and *** indicates 1% significance.

Table 2: Log purchase volume by households' income over 700 million yen or over: A DID analysis with households' expenditure data for 9 months from January 2014 to September 2014

Period	Treated stores	Control stores	Difference
Baseline (2014:01–2014:03)	1.411	1.473	−0.062
	(1.495)	(1.474)	(2.593)
	[13,928]	[13,928]	[13,928]
Treatment (2014:04–2014:09)	1.391	1.406	−0.014
	(1.477)	(1.437)	(2.555)
	[27,187]	[27,187]	[27,187]
Difference over time	−0.020	−0.067	0.048*
	—	—	(0.075)
	—	—	[41,115]

Notes: Each cell shows (log) mean of monthly quantity purchased per respondent per month, for various subsets of the sample. Standard errors (clustered by month) in parentheses, number of observations in square brackets. Treatment period spans for 6 months from April 2014 to September 2014, which covers just after the consumption tax hike in 1 April, 2014.