# Understanding Consumption Behavior:
## Evidence from Consumers' Reaction to Shopping Vouchers*

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**Abstract**

This paper advances our understanding of consumption behavior by employing a unique natural experiment, namely, the 2009 Taiwan Shopping Voucher Program, which was part of its government's fiscal stimulus package. This program was universally eligible and well publicized, and its payment to each individual is medium-sized. We applied survey techniques to collect data on household behavior in using shopping vouchers. Our estimation indicates nontrivial marginal propensity to consume. While the average marginal propensity to consume based on non-crowded-out consumption spending is about a quarter, the overall measure of the average marginal propensity to consume inclusive of out-of-pocket spending is almost one-third. Both estimates are statistically significant at conventional levels.

JEL Classification: C83, D12, E21, E62.

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# 1 Introduction

Should individuals adjust the total amount or the composition of their consumption in response to an anticipated change in their income? According to the Friedman-Hall-McCurdy life cycle-permanent income hypothesis (LCPIH), the answer is negative. Based on the Keynesian conventions or the Thaler-Mankiw rule-of-thumb hypothesis (KCRTH), on the contrary, the answer is positive. Since the end of the 20th century, there has been a new strand of the literature that has been devoted to testing these hypotheses using various fiscal policy changes as natural experiments. Such an endeavor is valuable not only from the economic theory perspective in understanding consumption behavior, but also from the public policy perspective in assessing whether various fiscal stimuli or tax/social security reforms may create any desirable real effects.

In this paper, we revisit this important issue by examining whether consumers in Taiwan responded to a recently implemented fiscal stimulus in the form of shopping vouchers. Taiwan's Shopping Voucher Program (TSVP), which was pre-announced on December 5, 2008 and implemented on January 18, 2009, was aimed at boosting domestic consumption in the wake of the global economic downturn caused by the emerging financial crisis since Fall 2007. The TSVP was universal, entitling every Taiwanese citizen to receive shopping vouchers worth NT$3,600 (approximately US$110, or about 1.05% of annual per capita family income) which could not be cashed and had to be used up by September 30, 2009. The total distribution of the program was NT$83.51 billion (roughly US$2.57 billion), which was about 0.68% of Taiwan's 2008 GDP. In short, the TSVP was a fiscal stimulus leading to a temporary and anticipated uniform increase in income for all individual consumers in Taiwan. In contrast with tax rebates, the TSVP was not in the form of cash, even though it yielded "cash equivalence" because consumers could use the vouchers to simply pay for previously planned consumption and save the money for other purposes. However, an interesting phenomenon developed after the announcement of the TSVP: many vendors responded to the program with various promotions by providing consumers with the incentive to spend beyond the value of their vouchers and beyond their normally planned consumption items (see the examples provided in Section 2 below). Such endogenous responses by vendors break the cash equivalence nature of shopping vouchers, making the TSVP a unique natural experiment for studying consumption behavior.

To enable a fuller examination of the responses of Taiwan's consumers to the TSVP in the presence of the aforementioned vendor promotions, we applied survey techniques to our investigation. We collected individual data by means of telephone interviews conducted between April 15 and May 31, 2009, for about 3-4.5 months since the program was implemented and 4 months prior to the

deadline of the vouchers' redemption. A total of 3,832 individuals were successfully interviewed, based on which we performed decriptive statistical analysis as well as econometric estimation.

To answer the above research questions, our survey was particularly designed to take into account the specific features of the program. Of greatest importance, we solicited information from respondents on the *private-spending crowding-out effect* and *out-of-pocket spending*:

(i) To what extent did the use of shopping vouchers "crowd out" private spending, i.e., by shopping vouchers being used on previously planned consumption items?

(ii) Did the use of vouchers induce "out-of-pocket spending" on top of the shopping vouchers redeemed (where the out-of-pocket spending refers to the additional spending incurred when using shopping vouchers)?

(iii) Did shopping vouchers generate noticeable changes in the composition of consumption?

Moreover, given the presence of promotions by vendors, we sought answers to the following questions concerning the consumer's response to such promotions:

(i) whether or not his/her spending was induced by vendors' promotion programs,

(ii) his/her amount (in ranges) of spending on various categories of consumption items (the spending amounts were asked in ranges in order to make it easier for respondents to answer because it is often difficult for respondents to recall the exact amounts),

(iii) whether or not his/her spending on each category was on items which would have been purchased in the absence of shopping vouchers or in the absence of promotions by vendors, and

(v) the amount of out-of-pocket spendings when using shopping vouchers (also in ranges).

Answers to these questions will allow us to depict a respondent's behavior in using shopping vouchers and the nature of his/her spending.

In this study we use an econometric method which takes into consideration the nature of the data on the amounts of our respondents' shopping voucher and the amounts of the out-of-pocket spending, which are recorded in categories. More specifically, in our empirical analysis, we model respondents' shopping vouchers used on each consumption category by means of the interval regression model, which is estimated jointly with models according to the nature of such spending (i.e., whether the vouchers were used on items which would have been purchased in the absence of shopping vouchers). In these models, the respondents' socioeconomic characteristics are used as explanatory variables. In addition to obtaining a set of parameters which enables us to have a better understanding of an individual's shopping voucher usage behavior, using a respondent's socioeconomic characteristics to explain his/her shopping voucher spending behavior improves the efficiency of the MPC estimates.[1] Moreover, in order to make statistical inferences, we derive the

[1]This improves the efficiency of our MPC estimates in the sense that they have lower asymptotic standard errors.

standard errors of our MPC estimates. Finally, to take into account the fact that a respondent may use more than the amount of the shopping vouchers that he/she received from the government, we use the total amount of shopping vouchers at a respondent's disposal as a weight to compute our MPC's.[2] That is, a higher weight is given to a respondent who has more shopping vouchers at his/her disposal because his/her shopping voucher spending behavior represents more than one person's behavior.

We find that while shopping vouchers have crowded out about three quarters of private spending, they have also generated new (or non-crowded-out) spending inclusive of out-of-pocket spending amounting to almost one-third of the total voucher disbursements. Moreover, in response to the TSVP, consumers shifted their consumption patterns temporarily from nondurable to durable and non-necessary services such as leisure products, dining in restaurants, touring, movies, and beauty salons.

## 2 Related Literature

Our paper is related to a new branch of the literature that examines how consumers react to large or small changes in anticipated income. The underlying empirical strategies employed by previous studies are basically of two strands, with one focusing on estimating the marginal propensity to consume (MPC) and the other on performing the excessive sensitivity test (EST).

Since the latter strand of the literature is methodologically less relevant, our review will be brief. Based on EST, Parker (1999) establishes that (anticipated) changes in the U.S. social security cap have real effects on consumption behavior. Similar conclusions are also reached by other economists applying the same empirical strategy to various natural experiments, including Souleles (1999) studying U.S. income tax refunds (anticipated and transitory) over 1979-1990, Stephens (2003) studying the behavior of U.S. social security recipients and Stephens (2006) studying British families' consumption responses to (anticipated) paycheck dates. On the contrary, Browning and Collado (2001) find that anticipated (regular) bonus payments to Spanish workers do not change their consumption behavior.

Turning now to the strand of the literature estimating the MPC, Souleles (2002) analyzes U.S. consumers' responses to Reagan's pre-announced tax cuts in 1982 and 1983 and obtains an unusually high MPC of 0.9 though with large standard errors. Using credit card data, Gross and Souleles (2002) find that while those close to the limits (i.e., more likely to be liquidity constrained) respond

[2]For example, family members may pool together their shopping vouchers to purchase an expensive item, and children's shopping vouchers may have to be handed over to their parents.

more sensitively to credit supply, those well below the limits still have a significantly positive MPC, with the average MPC being about $10-14\%$. Hsieh (2003) shows that anticipated Alaska Permanent Fund payments (large and regular) do not affect Alaskans' consumption behavior, although income tax refunds (small and irregular) do. He therefore concludes that when an anticipated change in income is small and irregular, consumers are more likely to respond. Using the Consumer Expenditure Survey (CEX), Johnson, Souleles and Parker (2006) find that, in response to the U.S. tax rebates in 2001, households spent $20-40\%$ of their rebates on nondurables within 3 months and about 2/3 cumulatively within 6 months. By investigating consumers' responses to the U.S. tax rebates in 2001, Agarwal, Liu and Souleles (2007) utilize credit card data and find that consumers initially save the rebates by increasing their credit card payments, but afterward spend about 40% of the rebates cumulatively over 9 months, where the stimulated spendings are higher for those who are liquidity-constrained (although the estimates are mostly statistically insignificant, making it difficult for them to draw clear-cut inferences). By regressing personal consumption expenditure on its lag, the disposable personal income without tax rebates and the tax rebates, Taylor (2009) finds that the MPC is small and statistically insignificant.

The most closely related studies are Shapiro and Slemrod (2003, 2009) and Hori, Hsieh, Murata and Shimizutani (2002). While the former two are highly relevant because of the use of survey methodology, the last one is closely related due to similar types of natural experiment.

In their two research works, Shapiro and Slemrod investigate the response of consumers' spending to the U.S. tax rebates in 2001 and 2008, respectively, using survey techniques (the Survey of Consumers). They find that, in response to the U.S. tax rebates in 2001 ($300/$600 for single/married, or about 1.5% of median annual income), only 21.8% of households receiving the rebate would spend it. In response to the more recent 2008 U.S. tax rebates ($600/$1,200 for single/married), about 20%, 32%, and 48% of households receiving the rebate would consume, save and pay their debt, respectively.

Hori, Hsieh, Murata and Shimizutani (2002) study the effects of Japan's Shopping Coupon Program implemented in 1999, which is, to our knowledge, the only large scale (nation-wide) noncash consumption stimulating program other than the TSVP examined in this paper. In that program, about US$200 was distributed to each child and each senior citizen, which accounted for about 15% of the population. Using difference-in-difference estimation, their estimated MPC was about $20-30\%$ within a month, but dropped to 10% 3 to 4 months after the disbursement of the vouchers. As argued in their paper, there exists intertemporal substitution in that many consumers use coupons to make pre-purchases for future consumption.

Overall, the findings in previous studies suggest that at least some consumers do respond to changes in predictable changes in income, especially when such changes are irregular and small. Apart from the early study by Souleles (2002) and the recent work by Taylor (2009), the MPC estimates fall within the range of 10% to 40%. Our paper contributes to this important line of research by using a unique shopping voucher program in Taiwan that is universal to all citizens. While the program leads to an irregular, medium-sized change in income, it need not be cash-equivalent due to the endogenous vendors' response with various promotions.

# 3 Taiwan's Shopping Voucher Program

Taiwan's economy was hit hard by the financial tsunami that broke out in Fall 2007. In response to this global economic slowdown, which culminated in the bankruptcy of Lehman Brothers in September 2008, many countries introduced fiscal stimuli, in addition to interest rate reductions and financial liquidity injections. According to the IMF (2009), fiscal stimulus plans adopted by the G20 countries amounted to 0.5%, 1.5% and 1.1% of their GDP in 2009, 2010, and 2011, respectively.[3]

Taiwan, which depends heavily on exports, suffered severely from this world-wide recession: for example, its GDP during the fourth quarter of 2008 contracted by 8.36% year-on-year. To make up for the shortfall in aggregate demand, the Taiwan government launched a NT$500 billion (approximately US$15.38 billion) fiscal stimulus package, to be conducted during 2009–2012, which was about 1.01% (in terms of the annual average) of Taiwan's GDP in 2008. The Shopping Voucher Program was a major part of this stimulus package in its kickoff year: the total distribution of the program was NT$83.51 billion (roughly US$2.57 billion), which was about 0.68% of Taiwan's 2008 GDP.

The TSVP was approved and pre-announced on December 5, 2008, for implementation starting January 18, 2009. The program was universal, and applied to all citizens of the Republic of China born before March 31, 2009. Each citizen was eligible to receive shopping vouchers worth NT$3,600 (approximately US$110). The vouchers were in two denominations: 6 in NT$500 and 3 in NT$200 denominations – and no change was allowed for purchases smaller than the denomination. While the vouchers could not be cashed, they were fully transferable. The shopping vouchers expired after September 30, 2009. The vouchers could be used for the purchase of all kinds of goods and services, and at registered or non-registered businesses, except for payment of the following items: (i) public utilities (e.g., water and electricity), (ii) loan principal/interest, bank fees and credit card

[3]These figures represent the PPP weighted average.

bills, (iii) purchases of stocks, corporate bonds, warrants, beneficiary certificates, insurance policies, and other financial products, (iv) fines, statutory penalties, taxes, fees payable to the government, labor insurance premiums, health insurance premiums, and national pension premiums, and (v) purchases from non-registered businesses.[4]

The distribution of shopping vouchers was carried out in several waves. During the first wave, eligible recipients could collect their shopping vouchers at specific locations on January 18, 2009. In the second wave, shopping vouchers could be collected at any branch of the post office between Feb 7 and April 30. More than 91% of eligible recipients collected their shopping vouchers on the first day of issuance. By the time our survey was conducted, more than 99% of the vouchers had been distributed.

In response to this consumption stimulus, many Taiwanese vendors set forth various promotions to enhance the consumers' incentives to spend beyond the value of their vouchers and to go beyond their normally planned consumption items. To illustrate this interesting phenomenon, let us provide some concrete examples. Some famous hotels offered a 50% discount as long as a NT$500 voucher was used as part of the payment.[5] One of the top wedding management companies (wedding planning, gown-designing/renting, photo-shooting, catering, etc.) offered a 75% discount with the use of NT$3,600 in vouchers (i.e., the entire distribution to one citizen).[6] Many consumer durables could be purchased with shopping vouchers with a 20–50% discount, where the discount was particularly attractive for off-season goods (air conditioners in the early stages of the voucher distribution and heaters in the later stages of the distribution). Similar promotions were offered by many beauty shops, make-up stores, jewelry/watch companies, as well as by many entertainment businesses. It has been reported that, to take advantage of such voucher-tied promotions, some individuals paid a *premium* to exchange cash for vouchers, that is, the relative price of vouchers to currency exceeded one at times. These promotions broke the cash equivalence nature of shopping vouchers, making the TSVP a unique natural experiment for studying how consumers respond to such types of fiscal stimulus.

In Table 1, we summarize some key features of the TSVP and compare the program with the Japanese Consumption Coupon Program and the 2001 and 2008 U.S. Tax Rebate Programs. We see in Table 1 that the TSVP, under which all citizens were eligible to receive vouchers of the same

[4]That is, only merchants with valid business registration would be able to redeem the vouchers at banks. Nonetheless, in practice, non-registered businesses also accepted vouchers and used them to purchase goods or services from registered businesses.

[5]One of the co-authors, who was aware of the future tax implications, took advantage of such promotions, enjoying a two-day hot-spring vacation on the east coast of Taiwan that would not have been taken without the voucher-tied promotion.

[6]With the promotion, one of the co-authors decided to outsource her marriage to a top wedding management company rather than the niece of coordinate the event herself.

Table 1: Summary of Various Fiscal Stimulus Programs

| Program | % of Eligibility | Payment (US$) | Total Outlay | % of GDP | Restrictions |
|---|---|---|---|---|---|
| 2001 U.S. Tax Rebates | 7.2% (less than $600)<br>25.9% ($600) | $300–600 | 38 billion | 0.4% | — |
| 2008 U.S. Tax Rebates | 38.8%† | $600–1,200‡ | 95.7 billion | 1.3% | — |
| 1999 Japan Consumption Coupons | 25% | $200 | 6.21 billion | 0.12% | (a) minimum denomination: US$10<br>(b) expired in 7 months |
| 2009 Taiwan Shopping Vouchers | 100% | $110 | 2.57 billion | 0.68% | (a) minimum denomination: US$6.5<br>(b) expired in 8.5 months |

†This is calculated based on the number of individuals having received the 2008 rebates (120 million) reported by Sahm, Shapiro, and Slemrod (2009).

‡In addition to the $600–1,200 tax rebates, those with dependent children received an additional three hundred dollars per child.

value, has a much broader coverage than other stimulus programs. While the payments of the two U.S. tax rebates programs depended on tax-paying status and income, only children 15 or younger or adults 65 or above were eligible for the Japanese Consumption Coupons program. As the MPC crucially depends on the income and demographic composition of the household, full coverage of the TSVP enables us to estimate the MPC of the whole population.

In terms of total outlay as a percentage of GDP, compared with other programs, the scale of the TSVP, second only to the 2008 U.S. tax rebates program, is large. Moreover, while the U.S. tax rebate programs impose no restrictions on the use of the rebates, the TSVP imposes similar restrictions on the use of the vouchers to the 1999 Consumption Coupons Program in Japan. The contrast in restrictions between the TSVP and the U.S. tax rebates programs makes it interesting to contrast the estimated MPC generated by these programs. The MPC generated by these different programs has implications for the design of an effective stimulus policy.

# 4 The Survey

We collected data using a telephone interview survey which was conducted through the Center for Survey Research of Academia Sinica. For the survey, the unit of analysis was the individual. The sample frame of the survey consisted of all adults (i.e., 18 or above) who had a telephone in their residence. Our survey used a multistage sampling scheme, where a subsample was selected from a region (a county or a municipality). There were in total 23 counties and municipalities. The

proportion of individuals drawn from a region was proportional to its population size. Random subsamples for each region were drawn from the 2004–2005 version of the Chunghwa Telecom Inc. telephone directory, which covers all listed numbers.[7] Because some numbers were not listed and new numbers were not covered by the version of the telephone directory that we used, to improve the representativeness of the set of telephone numbers drawn, for each number drawn from the electronic telephone directory, we substituted the last two digits with a random number.[8]

The second stage of our multistage sampling scheme involved within-household sampling. That is, from all the individuals above 18 in a household we randomly selected one individual as an interviewee. For this purpose, we prepared a set of tables, and conditional on the number of male and female qualified individuals in a household, each table specifies which individual was to be selected as an interviewee. The selection of which table was to be used for the within-household sampling was based on the last two digits of a household's telephone number.

The targeted sample size was 4,000. The actual number of interviews completed was 3,832. Each interview took an average of 19 minutes and 17 seconds. All of these 3,832 respondents had collected their shopping vouchers. After deleting sample individuals with missing observations, we ended up with 3,792 individuals in our sample, and 3,291 (86.79%) of them had used shopping vouchers or had shopping vouchers at their disposal, and 2,552 (67.30%) of them had actually used their shopping vouchers. For reference purposes, our survey questionnaire is provided in Appendix A.

To solicit information about how an interviewee used his/her shopping vouchers, we asked what they had bought or how these shopping vouchers were used among 14 categories. That is,

⟨ 1⟩ groceries,
⟨ 2⟩ household necessities (e.g., personal care products, kitchen supplies and utensils),
⟨ 3⟩ consumer durables (e.g., consumer electronics, furniture, electric appliances, cookware, automobiles, bicycles),
⟨ 4⟩ apparel and accessories, jewelry, home decor,
⟨ 5⟩ toys, books, magazines, CDs, and DVDs,
⟨ 6⟩ services (consumption at restaurants, barber shops, beauty salons, traveling, etc),
⟨ 7⟩ drugs, health and fitness products,
⟨ 8⟩ tuition,
⟨ 9⟩ transportation fares,
⟨ 10⟩ rent,
⟨ 11⟩ donations,
⟨ 12⟩ as gifts to other people,
⟨ 13⟩ exchanging for cash with somebody else, and
⟨ 14⟩ other uses.

We excluded an individual from our sample if he/she indicated that his/her shopping vouchers

[7] Chunghwa Telecom Inc. is the sole provider of fixed-line local telephone services in Taiwan.
[8] This may yield telephone numbers which are not in service, thus increasing the cost of the survey.

were (a) donated, (b) given to other people, (c) exchanged for cash with somebody else, or (d) used in other ways. A total of 154 respondents were thus excluded.

To understand the nature and value of the spending using shopping vouchers, we asked a respondent to indicate whether or not a purchase would have been made even without the shopping vouchers and the value. Ideally respondents should have been asked about the nature and value of spending for each of the categories $\langle\ 1\ \rangle$ to $\langle\ 10\ \rangle$. However, this is not practical for telephone interviews where respondents may hang up or may not respond seriously if the questions are too tedious or hard to answer. Thus, instead of asking the respondents about the nature and quantity of each categories $\langle\ 1\ \rangle$ to $\langle\ 10\ \rangle$, we grouped these categories into broader categories and asked about the nature and total value on the basis of these broader categories. The ten categories were grouped into four broader categories that were largely consistent with the *Family Income and Expenditure Survey* of the Directorate-General of Budget, Accounting and Statistics (DGBAS), Taiwan, R.O.C.[9]:

$\langle\ A\ \rangle$ household necessities (i.e., categories $\langle\ 1\ \rangle$ and $\langle\ 2\ \rangle$),
$\langle\ B\ \rangle$ durables and non-necessities (i.e., categories $\langle\ 3\ \rangle$, $\langle\ 4\ \rangle$, and $\langle\ 5\ \rangle$),
$\langle\ C\ \rangle$ services (i.e., category $\langle\ 6\ \rangle$),
$\langle\ D\ \rangle$ rent, tuition, drugs, and fares (i.e., categories $\langle\ 7\ \rangle$– $\langle\ 10\ \rangle$).

For the value of each category of spending and the total value of shopping vouchers used, instead of asking for the exact amount, we asked a respondent to select a range within which the actual amount fell.

As reported in Table 2, there is some inconsistency between the total amount of shopping vouchers received and used, and the amount spent on each category of $\langle\ A\ \rangle$– $\langle\ C\ \rangle$. For example, while no respondent indicated having received or used shopping vouchers worth more than NT$20,000, there were 19, 28 and 1 respondents, respectively, indicating they had used shopping vouchers worth more than NT$20,000 on categories $\langle\ A\ \rangle$, $\langle\ B\ \rangle$ and $\langle\ C\ \rangle$. It is likely that this was a recall error arising from the respondents' mixing up of the total amount of the purchase (shopping vouchers and cash) and the amount of the shopping vouchers used. However, there were not many such cases.

The nature of the purchases using shopping vouchers for spending categories $\langle\ A\ \rangle$– $\langle\ C\ \rangle$ is reported in Table 2. As expected, the purchase of household necessities including groceries had the highest rate of crowding out. For those having used shopping vouchers on household necessities, 81.41% indicated that they would have purchased the same things even without the shopping vouchers. For the purchase of consumer durables/nonnecessities and services, the rate of crowding

[9]The government used the *Family Income and Expenditure Survey* to construct the CPI and monitor income distribution across households.

Table 2: General Description of the Sample

| | | |
|---|---|---|
| **Sample size after deleting missing values** | 3615 | |
| **Number of sample individuals who:** | | |
| • used or had shopping vouchers at their disposal | 2985 | |
| • used shopping vouchers | 2887 | |
| • Frequency of use in different categories: | | |
| ◦ spent on $\langle A \rangle$ (i.e., groceries and household necessities) | 1915 | (66.33%) |
| · purchase would have been made even without shopping vouchers | 81.41% | |
| ◦ spent on $\langle B \rangle$ (i.e., durables) | 1601 | (55.46%) |
| · purchase would have been made even without shopping vouchers | 61.96% | |
| ◦ spent on $\langle C \rangle$ (i.e., services) | 651 | (22.55%) |
| · purchase would have been made even without shopping vouchers | 57.91% | |
| ◦ spent on $\langle D \rangle$ (i.e., rent, tuition, drug, or fares) | 452 | (15.66%) |
| · purchase would have been made even without shopping vouchers | 100% (assumed) | |

out was more moderate. In our sample, 61.96% and 57.91%, respectively, of respondents indicated that their purchase of consumer durables/nonnecessities and services would have been made irrespective of the receipt of shopping vouchers.

When making a purchase using shopping vouchers, an individual may also have spent some money out-of-pocket, particularly when responding to vendors' promotions or not being forward-looking. This could also have happened because shopping vouchers were only in two denominations, NT$200 and NT$500, and shops were not allowed to give change when shopping vouchers were used. In the survey, respondents were asked how much they spent out-of-pocket when using their shopping vouchers. The distribution of such spendings is exhibited in Table B1. As expected, the majority of our sample respondents (84.56%) spent an extra amount of money when using their shopping vouchers. However, the amount of such spending was not very large. Among those who spent out-of-pocket money, over twenty percent of them spent more than NT$4,000 out-of-pocket. We note that among respondents who indicated having used shopping vouchers, there was a nontrivial proportion (11.95%) where their out-of-pocket amounts were missing because they answered "don't know" to the question soliciting this. It is likely that "don't know" was due to the difficulty in recalling the exact amount and this was most likely when the amount was small. In our empirical analysis, we control for these missing values in order to prevent them from biasing our results.

In addition to the above questions and some standard questions concerning income, education and family demographics, our survey also included several specially designed questions to better understand the consumption behavior in response to the TSVP. We asked whether the respondent's

consumption expenditure exceeded his/her planned amount. While more than half responded negatively, 38.4% reported excessive spending. We then asked specifically whether the respondent's purchase was induced by shopping vouchers, or by the vendors' promotions (or by both). Interestingly, only 10.5% and 6.4% of household necessities were induced by shopping vouchers and vendors' promotions, respectively. By contrast, the corresponding figures for durables/nonnecessities were 25.7% and 9.8%, respectively, whereas those for services were 24.6% and 15.7%, respectively, which were much larger than the comparable figures for household necessities. To further assess the roles played by the income effect of shopping vouchers and vendors' promotions in stimulating private spending, we asked in the survey how the respondent would respond in a hypothetical scenario where shopping vouchers (NT$3,600 per person) were disbursed again in Fall 2009. Among all respondents with definite answers, 68.5% intended to purchase previously planned items, 4.0% to purchase unplanned goods/services, and 27.5% to purchase both types of items. We further asked hypothetically whether the respondent might increase consumption as the result of a reduction in the income tax rate or a hypothetical income tax rebate. Among all with definite answers, 22.7% replied positively in response to an income tax cut, whereas 77.3% responded negatively. Concerning a hypothetical tax rebates program, 55.0% of respondents with definite answers intended to use the tax rebates to purchase previously planned items, 5.7% to purchase unplanned goods/services, 14.1% to save or invest (which was not an option with shopping vouchers), and 25.2% to have a combination of all uses. By comparing these responses with those to the hypothetical question on a second shopping voucher program, it can be clearly seen that those who intended to purchase previously planned items with vouchers were now split between planned purchases and the saving/investment options.

To detect whether the respondent was currently financially constrained, we asked whether he/she had recently experienced any earning shortfall (the first quarter of 2009 relative to the last quarter of 2008). Among all respondents giving a definite response, 25.4% reported having experienced a severe shortfall and 11.9% reported a moderate one. We viewed those with positive earnings up to NT$20,000 monthly income (about 1/6 of the sampled respondents) who had recently experienced a severe shortfall as being financially constrained—they accounted for 14.8% of the respondents. The construction of this financially constrained group is useful as it is likely that they were more responsive to the TSVP.

To detect whether a respondent was currently pessimistic about the future, we asked whether he/she was generally pessimistic about the Taiwan economy in 2010 as well as more specifically whether he/she was pessimistic about the family's financial status. Among all definitive respondents, 12.2% were very optimistic about the future economy whereas 16.8% were very pessimistic,

with the remaining 71.0% not feeling strongly one way or the other. Concerning their next-year family financial status, 21.2% felt optimistic and 21.5% felt pessimistic, with the rest (57.3%) feeling indifferent based on their current status. From the two different sets of answers, we could categorize the respondents into optimistic, neutral and pessimistic groups. It was expected that a forward-looking rational consumer would have a lower MPC if he/she was pessimistic and a higher MPC if he/she was optimistic.

Finally, to detect whether the respondent was aware of the future tax implications of the TSVP, we asked whether he/she agreed that the implementation of the TSVP would widen the government budget deficit. While 45.7% of the respondents agreed or agreed strongly, 40.7% disagreed or disagreed strongly. This may indicate that not all but still a substantial fraction of the respondents were Ricardian consumers, being aware of the future tax implications of the fiscal stimulus. We further asked whether the respondent agreed with another round of shopping voucher disbursement. Somewhat surprisingly, 57.3% of the respondents agreed or agreed strongly whereas 36.6% disagreed or disagreed strongly. The lower number expressing disapproval than acknowledging the future tax implications (by about 9%) suggests that some individuals preferred to have the TSVP despite their being likely to know that their lifetime wealth was basically unchanged. By means of cross-group analysis, we found they were not necessarily financially constrained. Such responses, if they are behaviorally self-consistent, are likely to be caused by hyperbolic preferences with which individuals tend to discount heavily against the future.

# 5 Basic Statistical Analysis

Prior to formal, systematic econometric estimation, it is informative to conduct some basic statistical exercises. To begin, we provide the summary statistics of our survey data as follows.

Two observations based on the summary statistics are noteworthy. From Table 3, we see that the average family size of our respondents is about 4.10, slightly higher than the comparable figure based on the 2008 DGBAS data of 3.35. Moreover, while about 61.2% of our respondents are employed (the comparable DGBAS figure is 55.9%), about 15.4%, 58.5% and 26.1%, respectively, are elementary school or lower, high school (including vocational and junior college), and 4-year college or above (the comparable DGBAS figures are 10.2%, 66.8% and 23.0%, respectively). Thus, a slightly larger fraction of our respondents are employed and better-educated. Overall, we view the sample of our respondents as reasonably representative.

We then summarize in Table 4 the proportions of respondents spending on various categories

Table 3: Summary Statistics

| **Variable** | **Definition** | **Mean (Std. Dev.)** |
|---|---|---|
| age30 | Respondent's age below 31. | 0.212 (0.409) |
| age40 | Respondent's age 31–40. | 0.275 (0.447) |
| age50 | Respondent's age 41–50. | 0.198 (0.399) |
| age60 | Respondent's age 60 or above. | 0.178 (0.383) |
| shopper | Respondent is the main shopper of the household. | 0.646 (0.478) |
| female | Respondent is female | 0.532 (0.499) |
| nkid | Number of children in household. | 0.739 (1.001) |
| nparent | Number of respondent's parents or in-laws in household. | 0.527 (0.819) |
| married | Respondent is married. | 0.699 (0.459) |
| single | Respondent is single. | 0.189 (0.392) |
| nreceipt | Number of individuals eligible to receive shopping vouchers. | 4.098 (1.952) |
| work | Respondent has a job. | 0.612 (0.487) |
| swork | Respondent's spouse has a job. | 0.425 (0.494) |
| fincome | Respondent and spouse's total labor income. | 3.673 (6.126) |
| mfincome | fincome missing. | 0.095 (0.293) |
| incdec | Respondent experienced a drop in labor income. | 0.150 (0.358) |
| elem | Education of respondent: elementary school or less. | 0.154 (0.361) |
| college | Education of respondent: college. | 0.261 (0.439) |
| north | Respondent live in the northern part of Taiwan. | 0.457 (0.498) |
| central | Respondent live in the central part of Taiwan. | 0.259 (0.438) |
| south | Respondent live in the southern part of Taiwan. | 0.188 (0.391) |
| east | Respondent live in the eastern part of Taiwan. | 0.0888 (0.284) |
| economyvb | Expect Taiwan's economy to do very well. | 0.150 (0.357) |
| economyvg | Expect Taiwan's economy to be very bad. | 0.111 (0.314) |
| fiscal | The shopping voucher program will exacerbate Taiwan's fiscal problem. | 0.456 (0.498) |
| Observations | 3615 | |

Table 4: Proportion of Respondents Spending on Each Category and Out-of-pocket Spending*

| Subsample | Observations | Expenditure Category | | | Out-of-pocket spending |
|---|---|---|---|---|---|
| | | ⟨ *A* ⟩ | ⟨ *B* ⟩ | ⟨ *C* ⟩ | |
| | **By income Group** | | | | |
| No income | 818 | 0.7535 | 0.5354 | 0.1932 | 0.6737 |
| | | (0.4313) | (0.4991) | (0.3951) | (0.4692) |
| 1st quartile | 457 | 0.7700 | 0.6666 | 0.1862 | 0.7812 |
| | | (0.4214) | (0.4720) | (0.3897) | (0.4139) |
| 2nd and 3rd quartiles | 917 | 0.7561 | 0.7111 | 0.3016 | 0.8424 |
| | | (0.4297) | (0.4535) | (0.4592) | (0.3646) |
| 4th quartile | 420 | 0.6754 | 0.7259 | 0.3581 | 0.8495 |
| | | (0.4688) | (0.4466) | (0.4800) | (0.3580) |
| | **By expectations about the economy in 2010** | | | | |
| Optimistic | 1405 | 0.7366 | 0.6329 | 0.2349 | 0.7414 |
| | | (0.4407) | (0.4822) | (0.4241) | (0.4380) |
| Pessimistic | 1473 | 0.7362 | 0.6885 | 0.3034 | 0.8278 |
| | | (0.4408) | (0.4633) | (0.4599) | (0.3777) |

*Standard errors in parentheses.

of consumption items by (a) income groups and (b) expectations about the future of the Taiwan economy (see the discussion on constructing the two groups based on expectations regarding the future in Section 4 above). We can see that, by ignoring the no-income group (which includes the retired), the higher the respondent's income is, the more he/she spends on durables/non-necessities (category ⟨ *B* ⟩) and services (category ⟨ *C* ⟩). When the respondent is more optimistic about the future, he/she tends to spend more on durables/non-necessities and services. Moreover, we also report in Table 4 the amount of out-of-pocket spending based on income and expectations about the future. The results indicate that those with higher income or more optimistic expectations about the future incur larger out-of-pocket spending.

# 6 Empirical Strategy and Estimation Results

In this section, we delineate the empirical strategy and present the econometric estimation results. We also attempt to provide economic theoretical reasoning toward understanding how consumers behave in response to a fiscal stimulus in the form of noncash distributions.

## 6.1 Empirical Strategy

The main purpose of our empirical analysis is to examine the consumers' responses to the TSVP in a systematic fashion. In particular, we estimate the increase in private consumption induced by the shopping voucher program that is non-crowded out and that features out-of-pocket spending.

Denote $v_{ji}$ as individual $i$'s total amount of shopping vouchers used on category $\langle\ j\ \rangle$ and $s_{ji}$ as the proportion of crowded out spending when using shopping vouchers to make the purchase.[10] Furthermore, denote $v_{\mathrm{X}i}$ as the amount of out-of-pocket spending incurred by individual $i$, $v_{\mathrm{U}i} \equiv \sum_{j\in\{\mathrm{A,\ B,\ C,\ D}\}} v_{ji}$ as the total value of shopping vouchers that $i$ has used, and $v_{\mathrm{T}i}$ as the total value of shopping vouchers at $i$'s disposal.

If we had information on $v_{ji}$ and $s_{ji}$, we could compute the ratio of non-crowded-out spending to the total value of his/her shopping vouchers as:[11]

$$n_i = \sum_j \frac{v_{ji}}{v_{\mathrm{U}i}}(1-s_j),\ \ j=\{\mathrm{A,\ B,\ C}\},$$

which is a weighted average of $(1-s_{ji})$. The estimated value of $n_i$, denoted by $\widehat{n}_i$, is a measure of the MPC. The sample average of $\widehat{n}_i$ is denoted by $\widehat{n}_\mu$.

In addition, due to the presence of voucher-tied promotions by vendors, a more accurate measure of the effect of shopping vouchers is the overall measure of consumption induced by one dollar's worth of shopping vouchers taking into account the amount of out-of-pocket spending, which is given by,

$$m_i = \frac{\sum_{j\in\{\mathrm{A,\ B,\ C}\}} (1-s_{ji})v_{ji} + n_i v_{\mathrm{X}i}}{v_{\mathrm{U}i}},$$

which is a better measure of the MPC. The sample average of the estimate $\widehat{m}_i$ is denoted by $\widehat{m}_\mu$. This more adequate overall measure will be referred to as the total MPC.

Below we explain how these MPC measures are estimated. The rate of overall induced consumption spending $m_i$ is a function of $v_{ji}$ and $s_{ji}$, where $j \in \{\mathrm{A,\ B,\ C,\ D,\ X,\ U,\ T}\}$. In the survey we asked our respondents to indicate the range of the value of the shopping vouchers that he/she had spent on a category of items. A respondent could select from 30 categories, the first indicating that the spending was 0, and the last indicating that the spending was NT\$20,001 or above (see Table B-1 in Appendix B). For our empirical analysis we needed to convert these categorical answers into a continuous variable. We could do that by using the mid-point of each range. However, this was

[10] This measures the spending that would have been undertaken even without the shopping voucher program.

[11] Recall that all purchases in category D feature 100% crowding-out.

not precise and could not handle cases when a respondent indicated that his/her spending was NT$20,001 or above.

In the current study, we converted these categorical answers into a variable by first fitting interval regressions to these categorical answers and then computed their expected values based on the estimation results. We assumed that the unobservable variable $v_{ji}$ was a linear function of controls summarized by the vector $\boldsymbol{x}_{ji}$:

$$v_{ji} = \boldsymbol{x}_i \boldsymbol{\beta}_j + e^v_{ji}, \tag{1}$$

where $e^v_{ji}$ is assumed to be a normally distributed error term with variance $\sigma^2_j$. Denoting the categorical variable $v^o_{ji}$ to indicate the shopping value of spending group $j$, we could then specify the relationship between $v_{ji}$ and $v^o_{ji}$ below:

$$v^o_{ji} = r \ \text{ if } \ \theta^{r-1}_i < v_{ji} < \theta^r_i \ \text{ or } \ \theta^{r-1}_i - e^v_{ji} < \boldsymbol{x}_i \boldsymbol{\beta}_j < \theta^r_i - e^v_{ji}. \tag{2}$$

where $r \in \{1,2,\ldots,31\}$ indicates the range where $v_{ji}$ falls, and $\{\theta^{r-1}_i, \theta^r_i\}$ denote the upper and lower limits of range $r$, with $\theta^0_i = 0$ and $\theta^{31}_i = \infty$ by construction.

In estimating $\boldsymbol{\beta}_j$ and $\sigma^2_j$, we took into account the zeros in $v_{ji}$ by means of a two-part specification, where the zero values of $v_{ji}$ were modeled by means of binary choice as follows:

$$d_{ji} = \begin{cases} 1, & \text{if } \boldsymbol{x}_i \boldsymbol{\alpha}_j + e^d_{ji} \geq 0 \\ 0, & \text{otherwise,} \end{cases} \tag{3}$$

where $e^d_{ji}$ is assumed to be standard normally distributed and $\boldsymbol{\alpha}_j$ is a vector of parameters to be estimated. It is noted that the error term in (3) is assumed to be independent of other error terms, implying that the specification of (3) does not have any statistical implications for the estimates of other parameters. The estimation of (3) is mainly for the purpose of understanding the consumers' behavior when using shopping vouchers.

Moreover, we attempted to control for missing values in $v_{\mathrm{X}i}$ by modeling the incidence of a missing value and allowing for a correlation between the incidence of a missing value and $v_{\mathrm{X}i}$. By letting $k_i$ be an indicator for the incidence of a missing value for $v_{\mathrm{X}i}$, we modeled $k_i$ as:

$$k_i = \begin{cases} 1, & \text{if } \boldsymbol{x}_i \boldsymbol{\delta}_j + e^k_i \geq 0 \\ 0, & \text{otherwise,} \end{cases} \tag{4}$$

where $e^k_i$ and $e^d_{\mathrm{D}i}$ are allowed to be correlated with their correlation coefficient being denoted by $\rho$.

The parameters $\left\{\boldsymbol{\beta}_j, \sigma_j\right\}$ can now be estimated by maximizing the likelihood function $\sum_i \log L^v_i$

with

$$
\begin{aligned}
L_i^v \;=\; & \left\{ \prod_{j\in\{\mathrm{A,B,C,X}\}} \left[ \Phi\left( \frac{\theta_j^r - \boldsymbol{x}_i\boldsymbol{\beta}_j}{\sigma_j} \right) - \Phi\left( \frac{\theta_j^{r-1} - \boldsymbol{x}_i\boldsymbol{\beta}_j}{\sigma_j} \right) \right]^{d_{ji}} \times \Phi\left( \boldsymbol{x}_i\boldsymbol{\alpha}_j \times (2v_{ji}^o\text{-}1) \right) \right\}^{d_{\mathrm{U}i}\times(1\text{-}k_i)} \\
& \times \left\{ \left[ \Phi_b\left( \frac{\theta_{\mathrm{U}}^r\text{-}\boldsymbol{x}_i\boldsymbol{\beta}_{\mathrm{U}}}{\sigma_{\mathrm{U}}}, -\boldsymbol{x}_i\boldsymbol{\delta}; \rho \right) - \Phi_b\left( \frac{\theta_j^{r\text{-}1}\text{-}\boldsymbol{x}_i\boldsymbol{\beta}_{\mathrm{U}}}{\sigma_j}, -\boldsymbol{x}_i\boldsymbol{\delta}; \rho \right) \right]^{d_{\mathrm{U}i}\times(1\text{-}k_i)} \right. \\
& \quad \left. \times \Phi\left( \boldsymbol{x}_i\boldsymbol{\delta} \right)^{k_i} \times \Phi\left( \boldsymbol{x}_i\boldsymbol{\delta}_j \right)^{k_i} \times \Phi\left( \boldsymbol{x}_i\boldsymbol{\alpha}_j \times (2d_{\mathrm{U}i}\text{-}1) \right) \right\}^{d_{\mathrm{T}i}} \\
& \times \left[ \Phi\left( \frac{\theta_{\mathrm{T}}^r\text{-}\boldsymbol{x}_i\boldsymbol{\beta}_{\mathrm{T}}}{\sigma_{\mathrm{T}}} \right) - \Phi\left( \frac{\theta_j^{r\text{-}1}\text{-}\boldsymbol{x}_i\boldsymbol{\beta}_{\mathrm{T}}}{\sigma_j} \right) \right]^{d_{\mathrm{T}i}} \times \Phi\left( \boldsymbol{x}_i\boldsymbol{\alpha}_j \times (2d_{\mathrm{T}i}\text{-}1) \right),
\end{aligned} \tag{5}
$$

where $\Phi(\cdot)$ and $\Phi_b(\cdot)$, respectively, denote the univariate and bivariate standard normal cumulative density functions. Conditional on the estimates $\left\{\boldsymbol{\beta}_j, \sigma_j\right\}$, $v_{ji}^o$, and $\boldsymbol{x}_i$, the predicted value of $v_{ji}$ can be computed as:

$$
\widehat{v}_{ji} = \boldsymbol{x}_i\widehat{\boldsymbol{\beta}}_j + \frac{\phi\left( \frac{\theta_{ij}^r - \boldsymbol{x}_i\widehat{\boldsymbol{\beta}}_j}{\widehat{\sigma}_j} \right) - \phi\left( \frac{\theta_{ij}^{r-1} - \boldsymbol{x}_i\widehat{\boldsymbol{\beta}}_j}{\widehat{\sigma}_j} \right)}{\Phi\left( \frac{\theta_{ij}^r - \boldsymbol{x}_i\widehat{\boldsymbol{\beta}}_j}{\widehat{\sigma}_j} \right) - \Phi\left( \frac{\theta_{ij}^{r-1} - \boldsymbol{x}_i\widehat{\boldsymbol{\beta}}_j}{\widehat{\sigma}_j} \right)}, \tag{6}
$$

where $\phi(\cdot)$ stands for the standard normal density function.

In the survey, we solicited information on whether the spending on a category of items using shopping vouchers would have been made even without the program. The answer to this question was binary (yes/no). This piece of information could have been utilized by assuming that respondents indicating "yes" would have undertaken 100% of the spending. Alternatively and more reasonably, a respondent indicating "yes" implies that over half of the spending on a category of items would have been undertaken irrespective of the shopping voucher program. The latter approach is adopted in our analysis. The main advantage of this approach is that it yields more efficient estimates of $\widehat{n}_i$ and $\widehat{m}_i$. This is because with some of the variation in $s_{ji}$ captured by $\boldsymbol{x}_i$, the variances of $\widehat{n}_i$ and $\widehat{m}_i$ are lower.

Assume that there is a latent variable $s_{ji}^*$ which indicates that the likelihood of spending the shopping vouchers on purchases, which would not have been made without receiving shopping vouchers, may be specified as a linear function of $\boldsymbol{x}_i$:

$$
s_{ji}^* = \boldsymbol{x}_i\boldsymbol{\gamma}_j + e_{ji}^s, \quad j = \{\mathrm{A,B,C}\}, \tag{7}
$$

$$
s_{ji} = \begin{cases} 1, & \text{if } s_{ji}^* \geq 0 \\ 0, & \text{otherwise,} \end{cases} \tag{8}
$$

where $s_{ji}$ denotes the variable pertaining to "whether the spending would have been undertaken even without the shopping voucher program", $e_{ji}^s$ is a standard normally random variable, and $\boldsymbol{\gamma}_j$ is a vector of coefficients to be estimated. The proportion of spending which would have been

undertaken even without the shopping voucher program is thus given by

$$\widehat{s}_{ji} = \Phi\left(\boldsymbol{x}_i \widehat{\boldsymbol{\gamma}}_j\right). \tag{9}$$

It is noted that, according to this specification, the proportion of out-of-pocket spending is greater than 50% if $s^*_{ji} > 0$, which implies that $s_{ji} = 1$ according to (8).

We estimated the parameters $\{\boldsymbol{\beta}_j, \sigma_j\}$ and $\boldsymbol{\alpha}_j$ jointly with $\boldsymbol{\gamma}_j$ by maximizing the log likelihood function:

$$\log L = \sum_i \log\left[L_i^v \times \prod_{j\in\{\mathrm{A,B,C}\}} \Phi\Big(\boldsymbol{x}_i \boldsymbol{\gamma}_j \times (2s_{ji} - 1)\Big)^{d_{ji}}\right]. \tag{10}$$

In the data there are cases where the estimate of a respondent's sum of spending for the three categories of consumption is greater than the estimate of the total shopping voucher spending reported by him/her. To rectify this inconsistency problem, in computing the MPC's we make the following adjustments when the sum of the estimates of spending on categories $\langle A \rangle$–$\langle C \rangle$ is greater than the estimate of total spending:

(i) We use the sum of the estimates of voucher spendings on categories $\langle A \rangle$–$\langle C \rangle$ i.e., $\sum^j_{\{\mathrm{A,B,C}\}} \widehat{v}_j$, as the total voucher spendings for respondents who reported having used no vouchers on category $\langle D \rangle$ (spending on rent, tuition, drugs, transportation fares, etc.).

(ii) We delete an observation when the respondent reported having spent on category $\langle D \rangle$ and the sum of the estimates of voucher spendings on categories $\langle A \rangle$–$\langle C \rangle$ is greater than the estimate of total voucher spending (i.e., $\sum^j_{\{\mathrm{A,B,C}\}} \widehat{v}_j > \widehat{v}_{\mathrm{U}}$) because the inconsistency cannot be resolved.

Thus, we take the estimate of the total voucher spending $\widehat{v}_{\mathrm{U}}$ as the total voucher spending in calculating our MPC's only when the estimate of total voucher spending is greater than the sum of the estimates of spendings on categories $\langle A \rangle$–$\langle C \rangle$. There are 627 cases among the 2,887 respondents in the sample requiring adjustments, among which 44 respondents are discarded because the inconsistency cannot be resolved.

We use $\widehat{v}_{\mathrm{T}i}$ as weights to compute the sample average of $\widehat{m}_i$ and $\widehat{n}_i$, which are our measures of the MPC:

$$\widehat{n}_\mu = \frac{\sum_i \widehat{v}_{\mathrm{T}i}\widehat{n}_i}{\sum_i \widehat{v}_{\mathrm{T}i}}, \quad \widehat{m}_\mu = \frac{\sum_i \widehat{v}_{\mathrm{T}i}\widehat{m}_i}{\sum_i \widehat{v}_{\mathrm{T}i}}. \tag{11}$$

It is worth emphasizing that while $\widehat{m}_\mu$ is an overall measure of MPC because it takes into account out-of-pocket spending, $\widehat{n}_\mu$ is a more conventional narrow measure since it only accounts for spending using shopping vouchers.

To measure the precision of the estimates $\widehat{n}_\mu$ and $\widehat{m}_\mu$, we compute their variances $\sigma^2_{\widehat{n}}$ and $\sigma^2_{\widehat{m}}$. We do that by means of the delta method. We note that $\widehat{n}_\mu = N\left(\widehat{\boldsymbol{\theta}}\right)$ and $\widehat{m}_\mu = M\left(\widehat{\boldsymbol{\theta}}\right)$ are functions of the parameter estimates:

$$\widehat{\boldsymbol{\theta}} \equiv \left\{\widehat{\boldsymbol{\beta}}_{\mathrm{A}},\ \ldots,\ \widehat{\boldsymbol{\beta}}_{\mathrm{T}},\ \widehat{\boldsymbol{\alpha}}_{\mathrm{A}},\ \ldots,\ \widehat{\boldsymbol{\alpha}}_{\mathrm{T}},\ \widehat{\boldsymbol{\delta}},\ \widehat{\boldsymbol{\gamma}}_{\mathrm{A}},\ \ldots,\ \widehat{\boldsymbol{\gamma}}_{\mathrm{C}},\ \sigma_{\mathrm{A}},\ \ldots,\ \sigma_{\mathrm{T}},\ \widehat{\rho}\right\}.$$

Let $\boldsymbol{V}\left(\widehat{\boldsymbol{\theta}}\right)$ denote the variance-covariance matrix of $\widehat{\boldsymbol{\theta}}$. The variances $\sigma^2_{\widehat{n}}$ and $\sigma^2_{\widehat{m}}$ are therefore obtained by

$$\sigma^2_{\widehat{n}} = \left[\frac{\partial N\left(\widehat{\boldsymbol{\theta}}\right)}{\partial \widehat{\boldsymbol{\theta}}}\right]' \boldsymbol{V}\left(\widehat{\boldsymbol{\theta}}\right) \left[\frac{\partial N\left(\widehat{\boldsymbol{\theta}}\right)}{\partial \widehat{\boldsymbol{\theta}}}\right],\ \ \sigma^2_{\widehat{m}} = \left[\frac{\partial M\left(\widehat{\boldsymbol{\theta}}\right)}{\partial \widehat{\boldsymbol{\theta}}}\right]' \boldsymbol{V}\left(\widehat{\boldsymbol{\theta}}\right) \left[\frac{\partial M\left(\widehat{\boldsymbol{\theta}}\right)}{\partial \widehat{\boldsymbol{\theta}}}\right]. \tag{12}$$

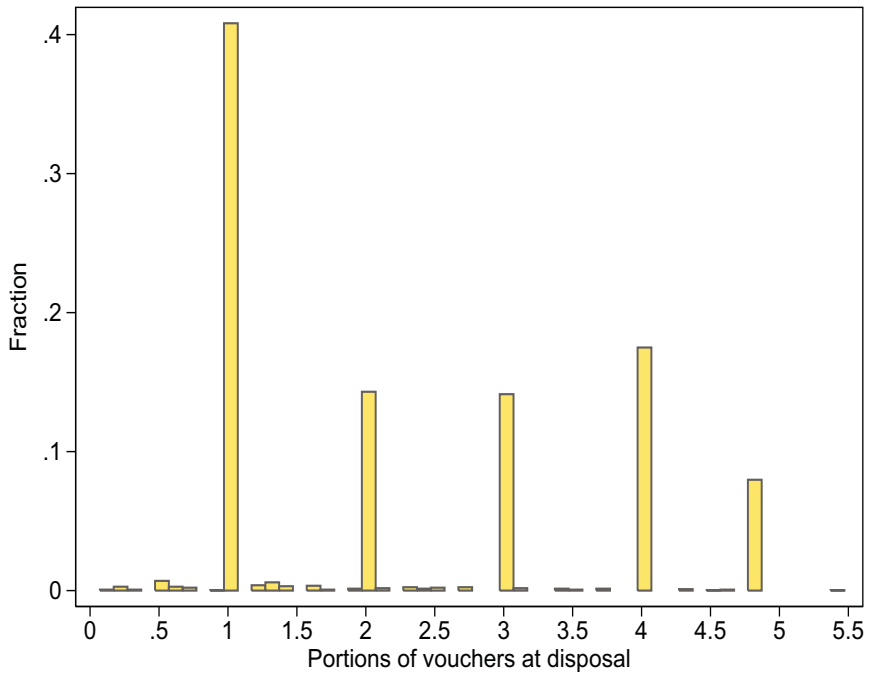
## 6.2 Estimation Results

We relegate the detailed econometric estimates $\widehat{\boldsymbol{\theta}}$ to an appendix (Table B2 in Appendix B). We focus in the main text on presenting only the key results concerning the estimates of $\{\widehat{n}_\mu, \widehat{m}_\mu\}$, that is, the average MPC measure based on non-crowded-out consumption spending using shopping vouchers ($\widehat{n}_\mu$) and the overall average MPC inclusive of out-of-pocket spending ($\widehat{m}_\mu$). Because a respondent might have had more than NT\$3,600 worth of vouchers at his/her disposal and such a respondent should be given a higher weight in computing the MPC's, we use the weighted estimates, with the total value of shopping vouchers at a respondent's disposal being the weight, as the baseline results. The importance of using the total value of shopping vouchers at a respondent's disposal can be best illustrated by Figure 1, which displays the estimated portions of shopping vouchers at the respondent's disposal (i.e., the value of shopping vouchers at his/her disposal divided by 3,600) among respondents with some shopping vouchers on hand. Figure 1 shows that about 40% of our respondents have exactly one portion of shopping vouchers (i.e., worth NT\$3,600) on hand, while more than 50% of them have more than one portion.

Before examining the estimates $\{\widehat{n}_\mu, \widehat{m}_\mu\}$, we explore the estimation results visually by looking at the distributional features of the estimated out-of-pocket spendings and MPC's, which are depicted in Figures 2–4. In Figure 2, we plot the distributions of weighted and unweighted estimates of out-of-pocket spendings. It shows that a large proportion of our respondents spent extra money out-of-pocket when using shopping vouchers. When looking at the weighted estimates, more than 50% of our respondents incurred expenditure out-of-pocket. Moreover, while about 50% of them spent NT\$1 – 500 out-of-pocket, over 40% spent more than NT\$500.

We next turn to the distribution of our MPC estimates. Figure 3 exhibits different estimates of the MPC out of vouchers. The unweighted MPC out of vouchers should be within the unit interval. However, this is not the case without adjustment to rectify the inconsistency problem

Figure 1: Portion of Shopping Vouchers at Disposal




in the voucher spending amount reported by respondents (see panel (d)). After adjustment of the reported spending amounts, the MPC estimates are within the unit interval (see panel (c)), as expected. After applying weights to the estimates, the adjusted MPC estimates (see panel (a)) become more skewed and dispersed.

Figure 4 summarizes our estimates of the total MPC. The graphs suggest that adjusted and unadjusted estimates have very similar distributions, while the distributions of the unadjusted estimates have a slightly heavier right tail. Moreover, as in the case of MPC out of vouchers, the distributions of the weighted total MPC's estimates are more dispersed.

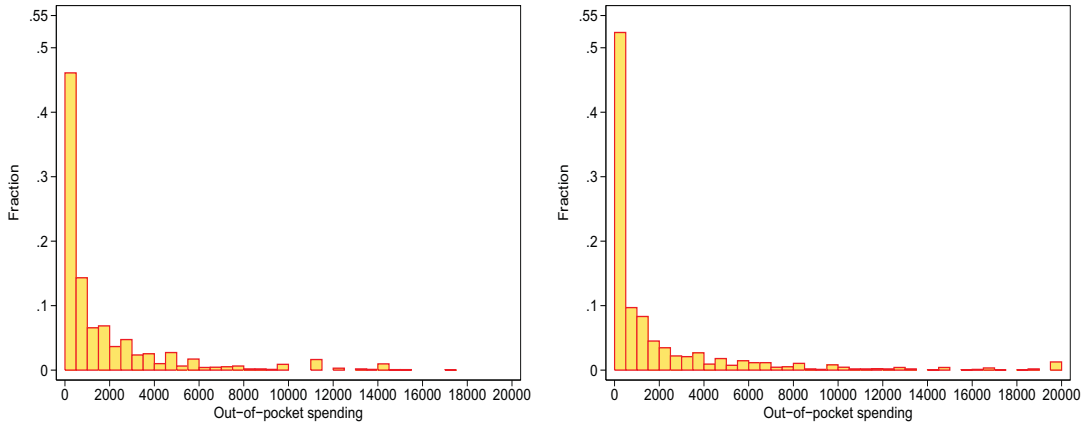
The estimation results are reported in Table 5 below. Based on the adjusted estimates (see column 1), the results show a significant private-spending crowding-out effect: our estimate of the MPC out of vouchers $\widehat{n}_\mu$ suggests that the vouchers crowd out 74.33% of previously planned private spending. Moreover, our estimates point to a sizable out-of-pocket spending effect: according to our estimate of the total MPC $\widehat{m}_\mu$, for each dollar of shopping voucher received, there are 0.3249 dollars of out-of-pocket spending generated. As shown in Table 5, the unadjusted estimates show similar results.[12]

Taiwan's shopping voucher program was well publicized, and in response to the programs both

[12]We note that the unweighted estimates are comparable to the weighted ones: while the vouchers crowd out 74.06% of previously planned spending, the out-of-pocket spending for each dollar of shopping voucher received is about 0.3436 dollars.

Figure 2: Density of Out-of-Pocket Spending

(a) Weighted (b) Not weighted




vendors and shops launched various promotion programs for users of shopping vouchers. This implies that individuals' consumption behavior in using shopping vouchers may be affected by these promotions. Thus, our MPC estimates in Table 5 may reflect the stimulus brought about by shopping vouchers and the effect of vendors' promotions of them.

Table 5: Marginal Propensity to Consume*

| | | **Baseline Estimates**‡ | | **Counterfactual**§ (Assuming no discounts) | |
|---|---|---|---|---|---|
| | | Adjusted† | Unadjusted | Adjusted | Unadjusted |
| Total MPC (vouchers plus out of pocket spending) | $\widehat{m}_\mu$ | 0.3249<br>(5.64) | 0.3171<br>(3.39) | 0.2230<br>(3.75) | 0.2161<br>(2.19) |
| MPC out of vouchers | $\widehat{n}_\mu$ | 0.2567<br>(3.49) | 0.2499<br>(3.74) | 0.1755<br>(2.21) | 0.1701<br>(2.37) |

*$t$-statistics in parentheses.

†Adjustment for the situation where the sum of the three categories of spending is greater than the total shopping voucher values used as reported by the respondent. There are 627 such cases among the 2,887 respondents in the sample and 44 of the 627 respondents are discarded because the inconsistency cannot be resolved.

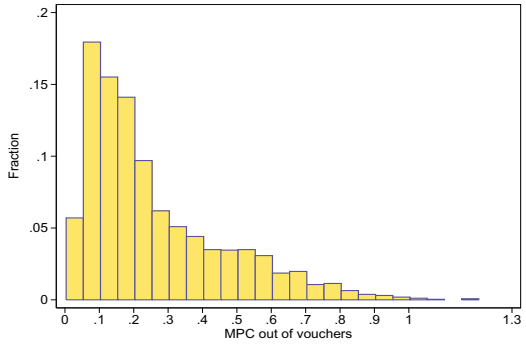
‡Weighted by the total value of shopping vouchers that a respondent has.

§In the counterfactual analysis, we re-estimate the model assuming that all respondents who indicated that a purchase using shopping vouchers was made because of discounts when using shopping vouchers would have spent their shopping vouchers on items that they would have purchased even without shopping vouchers. The MPC's are computed based on this new set of parameter estimates.

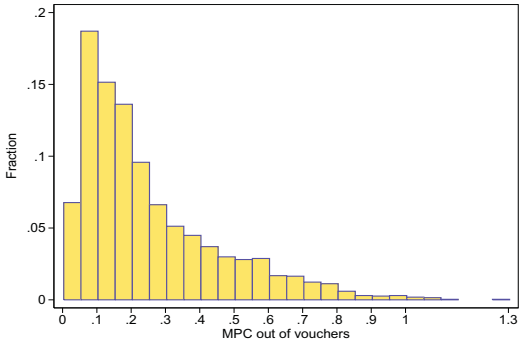
One may be curious about just how important vendors' promotions are to mitigate consumption crowding out, or what the net effect of shopping vouchers *per se* is. To address this issue, we carry out a counterfactual analysis. In the counterfactual analysis, we re-estimate the model under a hypothetical scenario as if there were no discounts by vendors or shops. That is, for all respondents who indicated that a purchase using shopping vouchers was made because of discounts, we assume that they would have spent their shopping vouchers on items that they would have purchased even without shopping vouchers. The MPC's are computed based on this new set of parameter estimates.

Figure 3: MPC out of Vouchers

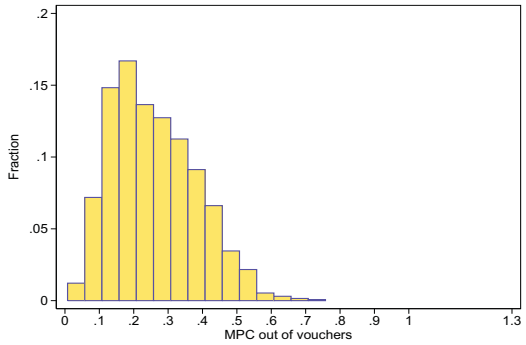
(a) Weighted, adjusted



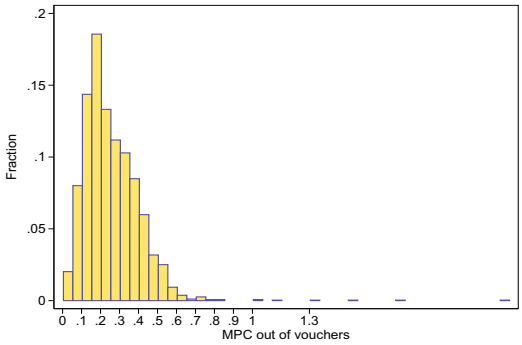

(b) Weighted, unadjusted




(c) Not weighted, adjusted




(d) Not weighted, unadjusted



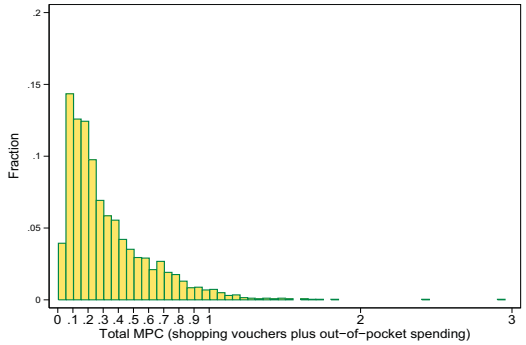

We report the results in columns 3 and 4 of Table 5. It is clear that, in the absence of vendors' promotions, both estimates are lower: for the MPC out of shopping vouchers $\widehat{n}_\mu$ the crowding out effect rises by about 8.1 percentage points to 82.45%, implying an MPC out of shopping vouchers of 0.1755, whereas the total MPC $\widehat{m}_\mu$ (inclusive of out-of-pocket spendings) declines sharply to 0.2230. Interestingly, our counterfactual estimate of MPC out of shopping vouchers (0.1755) is not far from Shapiro and Slemrod's (2003, 2009) MPC estimates, which are around 20%, based on the 2001 and 2008 U.S. tax rebates.

It is informative to compare the overall average MPC estimates $\widehat{m}_\mu$ (inclusive of out-of-pocket spending) based on income and on expectations about the future. The results are reported in Table 6. Evidentally, by ignoring the no-income category (column 1), those with higher income or more optimistic expectations regarding the future have slightly higher MPC estimates.

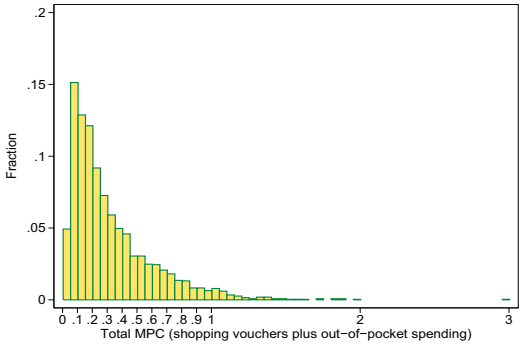
Moreover, we can compare the consumption patterns using shopping vouchers with those in 2006, 2007 and 2008, which are based on the *Survey of Family Income and Expenditure*, DGBAS (2006, 2007, 2008). We present the results in Table 7. Obviously, our sampling may not precisely represent the national distribution, and the consumption behavior for Spring 2009 without shopping vouchers need not be identical to that in 2006–2008. Yet, the fraction of consumption on household necessities estimated based on our survey and econometric model is quite consistent

Figure 4: Total MPC (inclusive of out-of-pocket spendings)

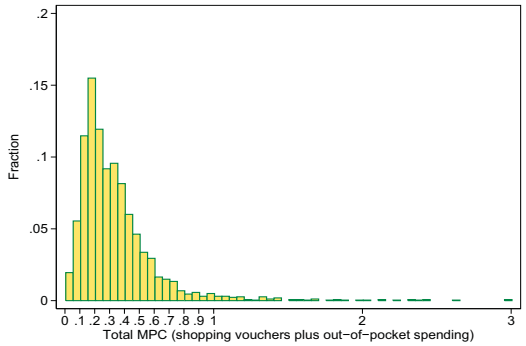
(a) Weighted, adjusted



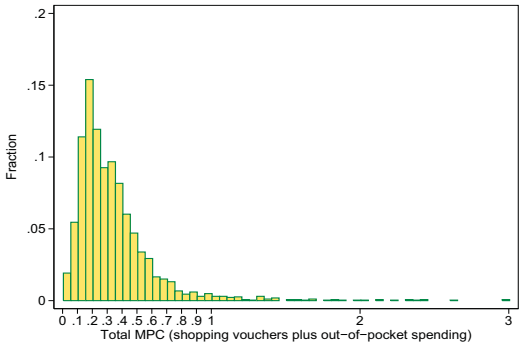

(b) Weighted, unadjusted




(c) Not weighted, adjusted




(d) Not weighted, unadjusted




with the DGBAS data. While the fraction of consumption on durables/nonnecessities obtained in our paper is higher, that on services is lower. The former is due in part to the presence of vendors' promotions and the indivisibility of the denomination of shopping vouchers (both encouraging the usage of shopping vouchers for durables), whereas the latter is due primarily to the inability to use vouchers to pay for maid and professional services.

Generally speaking, the aforementioned empirical findings based on the unique natural experiment of the TSVP suggest that most of the Taiwanese consumers did intertemporally substitute, using their shopping vouchers to purchase previously planned consumption items. These consumers behaved as suggested by the LCPIH. However, a nonnegligible proportion (about a quarter) of private spending incurred in response to the TSVP is non-crowding-out, that is, at least some consumers respond to the temporary and anticipated income by consuming more, with many even disposing of out-of-pocket money in excess of the value of vouchers received. Our estimation indicates that only part of such less-than-fully-crowding-out and extra money out-of-pocket outcomes can be attributed to vendors' promotions.

There are three possible explanations for these intriguing findings that are concerned with individual consumption behavior.

Table 6: MPC Estimates by Income and by Expectations about the Economy in 2010*

| | By income group | | | |
|---|---|---|---|---|
| | No income | 1st quartile | 2nd & 3rd quartiles | 4th quartile |
| Total MPC $\widehat{m}_\mu$ | 0.3084 | 0.3106 | 0.3260 | 0.3341 |
| | (1.76) | (2.95) | (3.09) | (1.25) |
| | **By expectations about the 2010 economy** | | | |
| | Optimistic | | Pessimistic | |
| Total MPC $\widehat{m}_\mu$ | 0.2936 | | 0.3382 | |
| | (2.74) | | (2.93) | |

*$t$-statistics in parentheses.

Table 7: Expenditure Patterns Compared

| | | Category (%) | | |
|---|---|---|---|---|
| | | $\langle A \rangle$ | $\langle B \rangle$ | $\langle C \rangle$ |
| Our Survey | | 50.7 | 39.5 | 9.8 |
| DGBAS-1 | 2006 | 46.6 | 13.4 | 40.0 |
| | 2007 | 48.7 | 13.5 | 37.9 |
| | 2008 | 49.7 | 13.5 | 36.8 |
| DGBAS-2 | 2006 | 54.5 | 15.7 | 29.8 |
| | 2007 | 55.7 | 15.4 | 28.8 |
| | 2008 | 56.2 | 15.3 | 28.5 |

Notes:
1. Figures in DGBAS-1 and DGBAS-2 exhibit expenditure patterns based on the *Survey of Family Income and Expenditure* conducted by the DGBAS11
2. DGBAS-1: Category $C$ includes Recreation, entertainment, education, cultural service, and Miscellaneous.
3. DGBAS-2: Category $C$ only includes Recreation, entertainment, education, cultural service.

First, it is foreseeable that some consumers may be initially financially constrained, especially during such serious economic downturns. When their constraints are temporarily relaxed by the TSVP, they will have a positive MPC in response to even a temporary and anticipated income increase.

Second, it is plausible that some consumers may have mental accounts, setting some saving targets based on behavioral rules of thumb. Under such decision rules, consumers would lower their nonnecessity consumption to build up their savings in economic downturns in order to achieve their targets. Since the TSVP relaxes their saving building requirements for achieving their targets, it will induce nontrivial MPC.

Third, one cannot exclude the possibility that some consumers may not be forward-looking. For

example, some may fail to recognize that the implementation of the TSVP will cause future taxes to increase and hence believe that such a program yields a positive wealth effect. As a result, they will behave accordingly by consuming more. Some consumers may even have temporal income illusion in the sense that they feel richer when they have the vouchers in hand. As a consequence, the TSVP generates a positive "Pigou effect" that will cause elated consumers to spend temporarily more than they are used to spending.

Finally, it may be interesting to examine the consumption behavior based on two hypothetical questions: one concerning a repeated issuance of shopping vouchers in the future (see Table 8) and another concerning a tax rebate in the future (see Table 9). This analysis also serves as a robustness check of our MPC estimates.

In our interviews, respondents were asked two questions regarding their response to a hypothetical shopping vouchers program and another about their response to a hypothetical tax refund program. In these questions, we asked how the respondents would use their vouchers and tax refunds. In the hypothetical shopping vouchers question (i.e., Q21 in Appendix A), we asked whether they would spend on items that would have been purchased even without receiving shopping vouchers or on items that would not have been purchased without receiving shopping vouchers, where we allowed our respondents to answer "spending on both types of items" (i.e., option 3). Likewise, in the hypothetical tax refunds question (i.e., Q22), we asked whether they would save, invest, spend on items that would have been purchased even without the refund, or spend on items that would have been purchased without the tax refund, allowing them to answer "use some of it on shopping, and savings or investment" (i.e., option 4).

In order to obtain a clear cut pattern of our respondents' reactions to these two programs, we assume that respondents choosing option 3 of Q21 and option 4 of Q22 use a certain proportion of their receipts (i.e., vouchers or tax refunds) for a certain type of usage. We have considered two alternative ways to assign these proportions. One way is to assume that respondents choosing option 3 in Q21 spend half of their vouchers on items that would have been purchased even without shopping vouchers and the other half on the other type of items. Similarly, it is assumed that respondents choosing option 4 in Q22 use half of their tax refunds on purchasing items that would have been purchased even without the tax refunds and the other half on the other type. The consumption pattern under this assumption, presented in column (2) in Tables 8 and column (3) in Table 9, suggest that the MPC estimates are approximately 17.5% and 20.2% for the hypothetical shopping vouchers and tax refunds programs, respectively. The first figure is remarkably close to our MPC out-of-vouchers estimate and the second one is close to the total MPC (inclusive of out-of-pocket spendings) estimates. (See Table 5.)

Table 8: Hypothetical Question 1–Second Shopping Vouchers Program*

| *Q21. If the government were to have a second voucher program, how would you use your shopping vouchers from the second shopping voucher program?* | Percentage | | |
|---|---|---|---|
| | (1) | (2)† | (3)‡ |
| 1 Spend on items that I would have purchased even without receiving shopping vouchers | 67.4 | 67.4+13.5=80.9 | 67.4+25.49=92.89 |
| 2 Spend on items that I would not have purchased without receiving shopping vouchers | 4.0 | 4.0+13.5=17.5 | 4.0+1.51=5.51 |
| 3 Spend some on each category of items | 27.0 | | |
| 4 Other (i.e., donations) | 1.7 | 1.7 | 1.7 |
| Total | 100.0 | 100 | 100 |

*Wording of the question: *Suppose the government were to hand out shopping vouchers worth $3600 per person in the second half of 2009 again, how would you use them if there were no discount for using shopping vouchers?*

†In column (2), we assume that half of those respondents answering response C ("Spend some on each category of items") will spend their shopping vouchers on items in response A, and the other half on those in response B.

‡In column (3), we assume that 94.40% of those respondents answering response C ("Spend some on each category of items") will spend their shopping vouchers on items in response A, and 5.60% on those in response B, in proportion to the percentage of respondents providing responses A and B.

Table 9: Hypothetical Question 2–Tax Refund*

| *Q22. If the government were to refund part of your income tax, how would you use your tax refund?* | | Percentage | | | |
|---|---|---|---|---|---|
| | | (1) | (2) | (3)† | (4)‡ |
| 1 | Spend on items that I would have purchased even without receiving the tax refund | 54.0 | 67.8 | 67.8+12.4=80.2 | 67.8+22.91=90.71 |
| 2 | Savings or investment | 13.8 | | | |
| 3 | Spend on items that I would not have purchased without receiving the tax refund | 5.6 | 5.6 | 5.6+12.4=18.0 | 5.6+1.89 = 7.49 |
| 4 | Use some of it on shopping, and savings or investment | 24.8 | 24.8 | | |
| 5 | Other (i.e., donations) | 1.8 | 1.8 | 1.8 | 1.8 |
| Total | | 100 | 100 | 100 | 100 |

*Wording of the question: *Suppose the government decides to refund your 2008 personal income tax, and the amount is roughly $3600 per person (the same amount as the value of the shopping vouchers received by your household) in the second half of 2009, how would you use the income tax refund?*

†In column (3), we assume that half of those respondents answering response D ("Use some of it on shopping, and savings or investment") will spend their shopping vouchers on items in responses A and B, and the other half on those in response C.

‡In column (4), we assume that 92.37% of those respondents answering response D ("Use some of it on shopping, and savings or investment") will spend their shopping vouchers on items in responses A and B, and 7.63% on those in response C, in proportion to the percentage of respondents providing responses A and B.

An alternative way of inferring the consumption pattern of respondents choosing options 3 of Q21 and options 4 of Q22 is to assume that the proportion of receipts from spending on an option is equal to the proportion of respondents choosing that option relative to the proportion of respondents choosing the other option. For example, in the case of hypothetical tax refunds, we assume that for respondents choosing option 4, the proportion of refunds being used for savings, investments, and purchasing items that would have been purchased even without receiving tax refunds

is proportional to the proportion of respondents choosing these options relative to those choosing to spend the refunds on purchasing items that would not have been purchased without receiving the refunds. The consumption pattern under this assumption, reported in column (3) in Table 8 and column (4) in Table 9, suggests that the MPC's generated by the hypothetical shopping vouchers program and tax refunds program are 5.51% and 7.48%, respectively. These are substantially lower than the MPC's computed under the alternative assumption. Nonetheless, these two figures are by no means trivial.

Overall, the results in Tables 8 and 9 suggest that shopping vouchers and tax refunds are both effective in generating non-crowded-out consumption and their effects are largely similar in magnitude. These exercises also reconfirm that some consumers are likely to deviate from the behavior predicted by the life cycle-permanent income hypothesis.

# 7 Conclusion

This paper has investigated consumers' responses to a medium-sized, anticipated change in income based on a natural experiment, namely Taiwan's shopping voucher program, using survey techniques. Our analysis has been specially designed to enable precise estimation, with statistical inferences, of the consumers' non-crowded-out marginal propensity to consume inclusive of out-of-pocket spending, as well as to obtain estimates based on a counterfactual exercise that assumes the absence of vendors' promotional offers. Our results indicate that about three quarters of the consumers' private spending is crowded out when using shopping vouchers. Inclusive of out-of-pocket spending, the marginal propensity to consume is estimated at about 0.325. According to our counterfactual analysis in the absence of vendors' promotion programs, the estimate of the marginal propensity to consume falls sharply to 0.223.

There are several implications of our empirical results. First of all, the LCPIH is not fully supported by our results as some consumers do react to temporary and anticipated rises in income by spending more. However, it does capture the spirit of the LCPIH in that consumers do exhibit intertemporal substitution behavior, thereby yielding a sizable private-spending crowding-out effect of shopping vouchers and a temporary shift in consumption composition. Such a less-than-full-crowding-out outcome and the presence of out-of-pocket spending are only partly due to vendors' promotions. Thus, these findings may be attributed to the fact that: (i) some consumers may be financially constrained and the TSVP relaxes such constraints at least partially, (ii) some consumers may have mental accounts which set some spending or saving targets (rules of thumb), and (iii) some consumers may not be forward-looking, either not accounting for future tax increases or

feeling richer when they receive the vouchers (temporal income illusion). While our estimates of the average marginal propensity to consume are generally in line with those obtained by previous studies, the result that one dollar of voucher disbursed can create out-of-pocket spending may deliver a useful message to policy-makers if the temporary boost in domestic spending to mitigate the detrimental outcomes during economic downturns is the objective of the fiscal stimulus.

We would like to acknowlege that our study does have some limitations. First, in the absence of a precise measure of the amount of non-crowded-out expenditure including the use of vouchers and out-of-pocket spendings, we have used discrete indicators of the nature of the respondent's spendings. Thus, our estimation is an approximation. Second, while we have tried to investigate the effect of financial constraints on consumption behavior based on expected earning shortfalls, without knowing the consumers' financial constraint status we are unable to provide precise estimates of their differential responses. Third, based on the nature of shopping vouchers which are to be spent within a certain time limit, consumers cannot use them for saving or debt payment purposes directly. Although consumers may intertemporally substitute, they can do so only in a very subtle manner. As a consequence, to design a questionnaire to detect such behaviors is very difficult if not impossible. For example, without being able to fully quantify the consumer's intertemporal substitution behavior, it is difficult to test alternative consumption theories such as the rule-of-thumb hypothesis under this current setting. Clever designs to address these aforementioned issues would be interesting avenues for future research.

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# Appendix A: Survey Questionnaire

(To be posted on the authors' websites, not intended for publication)

**Selected Questions from the Survey Questionnaire**

Q4. Did anyone in your household give you his/her shopping vouchers to you or use his/her vouchers jointly with yours?

(1) Yes (Go to Q4_1)
(2) No (Go to Q5)
(8) Refuse to answer (Go to Q5)

Q5. Was there anyone who does not live with you giving you his/her shopping vouchers to you or using his/her vouchers jointly with you?

(1) Yes, _____persons
(2) No
(8) Refuse to answer

Q7. What was the total value of the shopping vouchers that were at your disposal?

| | | |
|---|---|---|
| (01) $0 (go to Q18) | (02) $1–500 | (03) $501–1000 |
| (04) $1001–1500 | (05) $1501–2000 | (06) $2001–2500 |
| (07) $2501–3000 | (08) $3001–3500 | (09) $3501–4000 |
| (10) $4001–4500 | (11) $4501–5000 | (12) $5001–5500 |
| (13) $5501–6000 | (14) $6001–6500 | (15) $6501–7000 |
| (16) $7001–7500 | (17) $7501–8000 | (18) $8001–8500 |
| (19) $8501–9000 | (20) $9001–9500 | (21) $9501–10000 |
| (22) $10001–12000 | (23) $12001–13000 | (24) $13001–14000 |
| (25) $14001–15000 | (26) $15001–16000 | (27) $16001–17000 |
| (28) $17001–18000 | (29) $18001–19000 | (30) $19001–20000 |
| (31) 20001 and Over | (97) Don't know | (98) Refuse to answer |

Q8. Did you use any of the shopping vouchers that were at your disposal?

(1) Yes, I used all of them (Please go to Q10)
(2) Yes, I used some of them
(3) No, I did not use any of them (Please go to Q18)
(7) Don't know
(8) Refuse to answer

Q9. How much was the amount of the shopping vouchers that you used?

| | | |
|---|---|---|
| (01) $1-500 | (02) $501-1000 | (03) $1001-1500 |
| (04) $1501-2000 | (05) $2001-2500 | (06) $2501-3000 |
| (07) $3001-3500 | (08) $3501-4000 | (09) $4001-4500 |
| (10) $4501-5000 | (11) $5001-5500 | (12) $5501-6000 |
| (13) $6001-6500 | (14) $6501-7000 | (15) $7001-7500 |
| (16) $7501-8000 | (17) $8001-8500 | (18) $8501-9000 |
| (19) $9001-9500 | (20) $9501-10000 | (21) $10001-12000 |
| (22) $12001-13000 | (23) $13001-14000 | (24) $14001-15000 |
| (25) $15001-16000 | (26) $16001-17000 | (27) $17001-18000 |
| (28) $18001-19000 | (29) $19001-20000 | (30) $20001 or more |
| (97) Don't know | (98) Refuse to answer | |

Q10. What kinds of goods did you use shopping vouchers to pay for?

(01) Food and drinks (i.e., groceries, alcohol and tobacco) (Answer Q12)

(02) Household necessities (e.g., personal care products, kitchen supplies and utensils) (Answer Q12)

(03) Consumer durables (e.g., consumer electronics, furniture, electric appliances, cookware, automobiles, bicycles) (Answer Q13)

(04) Apparel and accessories, jewelry, home decor (Answer Q13)

(05) Toys, books, stationery, magazines, CDs, and DVDs (Answer Q13)

(06) Services (meals at restaurants, barber shops, beauty salons, leisure travel, etc.) (Answer Q14)

(07) Drugs, health and fitness products (Go to Q15 after answering Q11)

(08) Tuition or tutoring fees (Go to Q15 after answering Q11)

(09) Transportation fares (i.e., taxi fare, train tickets) (Go to Q15 after answering Q11)

(10) Rent (i.e., rent for apartment or shop) (Go to Q15 after answering Q11)

(11) Donations (Go to Q15 after answering Q11)

(12) Given away as gifts (Go to Q15 after answering Q11)

(13) Sold to others (Go to Q15 after answering Q11)

(14) Other use _____ (Go to Q15 after answering Q11)

(97) Don't know

(98) Refuse to answer

Q12. How much of the shopping vouchers at your disposal was spent on food and drinks or household necessities (items in (01) and (02) of Q10)?

| | | |
|---|---|---|
| (01) $500 or Less | (02) $501–1000 | (03) $1001–1500 |
| (04) $1501–2000 | (05) $2001–2500 | (06) $2501–3000 |
| (07) $3001–3500 | (08) $3501–4000 | (09) $4001–4500 |
| (10) $4501–5000 | (11) $5001–5500 | (12) $5501–6000 |
| (13) $6001–6500 | (14) $6501–7000 | (15) $7001–7500 |
| (16) $7501–8000 | (17) $8001–8500 | (18) $8501–9000 |
| (19) $9001–9500 | (20) $9501–10000 | (21) $10001–12000 |
| (22) $12001–13000 | (23) $13001–14000 | (24) $14001–15000 |
| (25) $15001–16000 | (26) $16001–17000 | (27) $17001–18000 |
| (28) $18001–19000 | (29) $19001–20000 | (30) $20001 or more |
| (97) Don't know | (98) Refuse to answer | |

Q12_1. What was the nature of those purchases?

(1) I would have made the purchases even without receiving shopping vouchers (Go to Q12_2)
(2) I made the purchases only because of receiving shopping vouchers (Go to Q15)
(3) The purchases were made because of discounts when using shopping vouchers (Go to Q15)
(4) All of the above are true to some extent (Go to Q12_2)
(8) Refuse to answer (Go to Q15)

Q12_2. Were the items that you bought more or less expensive than, or almost the same price as, you originally planned?

(1) More expensive
(2) Less expensive
(3) Almost the same price
(6) Other _____
(7) Don't know
(8) Refuse to answer

Q13. How much of the shopping vouchers at your disposal was spent on consumer durables, apparel and accessories, toys, books, stationery, magazines, CDs, and DVDs (items in (03)–(05) of Q10)?

| | | |
|---|---|---|
| (01) $500 or Less | (02) $501–1000 | (03) $1001–1500 |
| (04) $1501–2000 | (05) $2001–2500 | (06) $2501–3000 |
| (07) $3001–3500 | (08) $3501–4000 | (09) $4001–4500 |
| (10) $4501–5000 | (11) $5001–5500 | (12) $5501–6000 |
| (13) $6001–6500 | (14) $6501–7000 | (15) $7001–7500 |
| (16) $7501–8000 | (17) $8001–8500 | (18) $8501–9000 |
| (19) $9001–9500 | (20) $9501–10000 | (21) $10001–12000 |
| (22) $12001–13000 | (23) $13001–14000 | (24) $14001–15000 |
| (25) $15001–16000 | (26) $16001–17000 | (27) $17001–18000 |
| (28) $18001–19000 | (29) $19001–20000 | (30) $20001 or more |
| (97) Don't know | (98) Refuse to answer | |

Q13_1. What was the nature of these purchases?

(1) I would have made the purchases even without receiving shopping vouchers (Go to Q13_2)
(2) I made the purchases only because of receiving shopping vouchers (Go to Q15)
(3) The purchases were made because of discounts when using shopping vouchers (Go to Q15)
(4) All of the above are true to some extent (Go to Q13_2)
(8) Refuse to answer (Go to Q15)

Q13_2. Were the items that you bought more or less expensive than, or almost the same price as, you originally planned?

(1) More expensive
(2) Less expensive
(3) Almost the same price
(6) Other _____
(7) Don't know
(8) Refuse to answer

Q14. How much of the shopping vouchers at your disposal were spent on meals at restaurants, barber shops, beauty salons, leisure travel, etc. (items in (06) of Q10)?

| | | |
|---|---|---|
| (01) $500 or Less | (02) $501–1000 | (03) $1001–1500 |
| (04) $1501–2000 | (05) $2001–2500 | (06) $2501–3000 |
| (07) $3001–3500 | (08) $3501–4000 | (09) $4001–4500 |
| (10) $4501–5000 | (11) $5001–5500 | (12) $5501–6000 |
| (13) $6001–6500 | (14) $6501–7000 | (15) $7001–7500 |
| (16) $7501–8000 | (17) $8001–8500 | (18) $8501–9000 |
| (19) $9001–9500 | (20) $9501–10000 | (21) $10001–12000 |
| (22) $12001–13000 | (23) $13001–14000 | (24) $14001–15000 |
| (25) $15001–16000 | (26) $16001–17000 | (27) $17001–18000 |
| (28) $18001–19000 | (29) $19001–20000 | (30) $20001 or more |
| (97) Don't know | (98) Refuse to answer | |

Q14_1. What was the nature of those purchases?

(1) I would have made the purchases even without receiving shopping vouchers (Go to Q14_2)
(2) I made the purchases only because of receiving shopping vouchers (Go to Q15)
(3) The purchases were made because of discounts when using shopping vouchers (Go to Q15)
(4) All of the above are true to some extent (Go to Q14_2)
(8) Refuse to answer (Go to Q15)

Q14_2. Were the items that you bought more or less expensive than, or almost the same price as, you originally planned?

(1) More expensive
(2) Less expensive
(3) Almost the same price
(6) Other _____
(7) Don't know
(8) Refuse to answer

Q15. When using shopping vouchers, did you use cash or credit cards because the total purchase amount exceeded the value of your shopping vouchers?

(1) Yes
(2) No (Go to Q16)

(8) Refuse to answer (Go to Q16)

Q15_1. How much more did you spend?

| | | |
|---|---|---|
| (01) $500 or Less | (02) $501–1000 | (03) $1001–1500 |
| (04) $1501–2000 | (05) $2001–2500 | (06) $2501–3000 |
| (07) $3001–3500 | (08) $3501–4000 | (09) $4001–4500 |
| (10) $4501–5000 | (11) $5001–5500 | (12) $5501–6000 |
| (13) $6001–6500 | (14) $6501–7000 | (15) $7001–7500 |
| (16) $7501–8000 | (17) $8001–8500 | (18) $8501–9000 |
| (19) $9001–9500 | (20) $9501–10000 | (21) $10001–12000 |
| (22) $12001–13000 | (23) $13001–14000 | (24) $14001–15000 |
| (25) $15001–16000 | (26) $16001–17000 | (27) $17001–18000 |
| (28) $18001–19000 | (29) $19001–20000 | (30) $20001 or more |
| (97) Don't know | (98) Refuse to answer | |

Q19_2. Do you agree with the following claim:
*The shopping vouchers program has worsened Taiwan's fiscal situation?*

(1) Strongly agree
(2) Agree
(3) Somewhat agree
(4) Disagree
(5) Strongly Disagree
(7) Don't know
(8) Refuse to answer

Q21. Supposing the government hands out shopping vouchers worth $3,600 per person in the second half of 2009 again, how will you use them if there is no discount for using shopping vouchers?

(1) Spend them on items that I would have purchased even without receiving shopping vouchers
(2) Spend them on items that I would not have purchased without receiving shopping vouchers
(3) Half and half
(4) Other (e.g., donations) _____
(7) Don't know
(8) Refuse to answer

Q22. Supposing the government decides to refund part of your 2008 personal income tax, and the amount is roughly $3,600 per person (the same amount as the value of shopping vouchers received by your household) in the second half of 2009, how will you use the income tax refund?

(1) I will spend it on items that I would have purchased even without receiving the tax refund
(2) I will spend it on items that I would not have purchased without receiving the tax refund

(3) Savings or investment
(4) I will use some on shopping, and savings or investment
(5) Other (i.e., donations) _____
(7) Don't know
(8) Refuse to answer

Q32. Are you optimistic about Taiwan's economy next year (2010)?

(1) Very optimistic
(2) Somewhat optimistic
(3) Somewhat pessimistic
(4) Very pessimistic
(7) Don't know
(8) Refuse to answer

# Appendix B

Table B1: Pattern of Shopping Vouchers Received and Used

| **Amount** | **Frequency (Percentage)** | | | | | |
|---|---|---|---|---|---|---|
| | Amount Received | Amount Used | Household Necessities | Consumer Durable | Services | Out-of-Pocket Spending* |
| $0 | 630 (17.43%) | 728 (20.14%) | 972 (33.67%) | 1,286 (44.54%) | 2,236 (77.45%) | 395 (15.54%) |
| $1– 500 | 2 (0.06%) | 19 (0.53%) | 56 ( 1.94%) | 73 ( 2.53%) | 68 ( 2.36%) | 572 (22.50%) |
| $501–1000 | 10 (0.28%) | 26 (0.72%) | 98 ( 3.39%) | 123 ( 4.26%) | 98 ( 3.39%) | 395 (15.54%) |
| $1001–1500 | 2 (0.06%) | 33 (0.91%) | 84 ( 2.91%) | 115 ( 3.98%) | 72 ( 2.49%) | 180 ( 7.08%) |
| $1501–2000 | 21 (0.58%) | 40 (1.11%) | 134 ( 4.64%) | 136 ( 4.71%) | 74 ( 2.56%) | 187 ( 7.36%) |
| $2001–2500 | 8 (0.22%) | 39 (1.08%) | 108 ( 3.74%) | 98 ( 3.39%) | 57 ( 1.97%) | 105 ( 4.13%) |
| $2501–3000 | 6 (0.17%) | 37 (1.02%) | 108 ( 3.74%) | 115 ( 3.98%) | 41 ( 1.42%) | 131 ( 5.15%) |
| $3001–3500 | 1 (0.03%) | 33 (0.91%) | 73 ( 2.53%) | 61 ( 2.11%) | 30 ( 1.04%) | 63 ( 2.48%) |
| $3501–4000 | 1,248 (34.52%) | 1,063 (29.41%) | 459 (15.90%) | 308 (10.67%) | 93 ( 3.22%) | 70 ( 2.75%) |
| $4001–4500 | 11 (0.30%) | 36 (1.00%) | 46 ( 1.59%) | 31 ( 1.07%) | 11 ( 0.38%) | 27 ( 1.06%) |
| $4501–5000 | 18 (0.50%) | 23 (0.64%) | 57 ( 1.97%) | 54 ( 1.87%) | 17 ( 0.59%) | 76 ( 2.99%) |
| $5001–5500 | 9 (0.25%) | 19 (0.53%) | 56 ( 1.94%) | 34 ( 1.18%) | 5 ( 0.17%) | 17 ( 0.67%) |
| $5501–6000 | 10 (0.28%) | 17 (0.47%) | 60 ( 2.08%) | 39 ( 1.35%) | 13 ( 0.45%) | 48 ( 1.89%) |
| $6001–6500 | 2 (0.06%) | 22 (0.61%) | 25 ( 0.87%) | 11 ( 0.38%) | 2 ( 0.07%) | 12 ( 0.47%) |
| $6501–7000 | 4 (0.11%) | 40 (1.11%) | 40 ( 1.39%) | 30 ( 1.04%) | 5 ( 0.17%) | 13 ( 0.51%) |
| $7001–7500 | 425 (11.76%) | 353 (9.76%) | 147 ( 5.09%) | 83 ( 2.87%) | 21 ( 0.73%) | 14 ( 0.55%) |
| $7501–8000 | 6 (0.17%) | 10 (0.28%) | 41 ( 1.42%) | 22 ( 0.76%) | 6 ( 0.21%) | 17 ( 0.67%) |
| $8001–8500 | 7 (0.19%) | 24 (0.66%) | 16 ( 0.55%) | 12 ( 0.42%) | 4 ( 0.14%) | 5 ( 0.20%) |
| $8501–9000 | 4 (0.11%) | 8 (0.22%) | 35 ( 1.21%) | 15 ( 0.52%) | 1 ( 0.03%) | 5 ( 0.20%) |
| $9001–9500 | 6 (0.17%) | 23 (0.64%) | 13 ( 0.45%) | 4 ( 0.14%) | 1 ( 0.03%) | 3 ( 0.12%) |
| $9501–10000 | 7 (0.19%) | 51 (1.41%) | 51 ( 1.77%) | 30 ( 1.04%) | 6 ( 0.21%) | 25 ( 0.98%) |
| $10001–12000 | 419 (11.59%) | 340 (9.41%) | 87 ( 3.01%) | 86 ( 2.98%) | 15 ( 0.52%) | 45 ( 1.77%) |
| $12001–13000 | 6 (0.17%) | 23 (0.64%) | 19 ( 0.66%) | 10 ( 0.35%) | 1 ( 0.03%) | 8 ( 0.31%) |
| $13001–14000 | 4 (0.11%) | 20 (0.55%) | 11 ( 0.38%) | 11 ( 0.38%) | 2 ( 0.07%) | 5 ( 0.20%) |
| $14001–15000 | 510 (14.11%) | 390 (10.79%) | 53 ( 1.84%) | 63 ( 2.18%) | 6 ( 0.21%) | 32 ( 1.26%) |
| $15001–16000 | 3 (0.08%) | 8 (0.22%) | 3 ( 0.10%) | 4 ( 0.14%) | 1 ( 0.03%) | 10 ( 0.39%) |
| $16001–17000 | 3 (0.08%) | 11 (0.30%) | 5 ( 0.17%) | 2 ( 0.07%) | 1 ( 0.03%) | 2 ( 0.08%) |
| $17001–18000 | 232 (6.42%) | 168 (4.65%) | 30 ( 1.04%) | 30 ( 1.04%) | 0 (0.00%) | 5 ( 0.20%) |
| $18001–19000 | 0 (0.00%) | 1 (0.03%) | 0 (0.00%) | 0 ( 0.00%) | 0 (0%) | 1 ( 0.04%) |
| $19001–20000 | 1 (0.03%) | 10 (0.28%) | 0 (0.00%) | 0 (0.00%) | 1 (0.03%) | 6 ( 0.24%) |
| $20001 or above | 0 (0%) | 0 (0%) | 0 (0.00%) | 1 (0.3%) | 1 (0.03%) | 68 ( 2.68%) |
| Observations | 2985 | 2887 | 2887 | 2887 | 2887 | 2542 |

*There were 345 respondents who answered "don't know" to the question pertaining to the amount of their out-of-pocket spending.

Table B2: Parameter Estimates

| | (1) $\boldsymbol{\beta}_A$ | (2) $\boldsymbol{\beta}_B$ | (3) $\boldsymbol{\beta}_C$ | (4) $\boldsymbol{\beta}_D$ | (5) $\boldsymbol{\delta}$ | (6) $\boldsymbol{\beta}_U$ | (7) $\boldsymbol{\beta}_T$ | (8) $\boldsymbol{\alpha}_A$ | (9) $\boldsymbol{\alpha}_B$ | (10) $\boldsymbol{\alpha}_C$ | (11) $\boldsymbol{\alpha}_D$ | (12) $\boldsymbol{\alpha}_U$ | (13) $\boldsymbol{\alpha}_T$ | (14) $\boldsymbol{\pi}_A$ | (15) $\boldsymbol{\pi}_B$ | (16) $\boldsymbol{\pi}_C$ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| age30 | 493.5769 | -53.8280 | -10.8337 | 91.9371 | 0.0267 | 745.2147*** | 871.3631*** | 0.2131** | -0.0680 | 0.0382 | 0.2120* | 0.0974 | -0.2463** | 0.2635* | 0.3017** | 0.4334* |
| | (1.54) | (-0.15) | (-0.03) | (0.59) | (0.17) | (2.58) | (3.08) | (2.07) | (-0.66) | (0.32) | (1.76) | (0.59) | (-2.27) | (1.79) | (2.19) | (1.66) |
| age40 | 672.4497** | 84.6887 | -12.3177 | 272.1720* | 0.1237 | 650.7719** | 884.3964*** | 0.2152** | -0.1164 | -0.1676 | 0.2720** | 0.0262 | -0.2835** | 0.5110*** | 0.4159*** | 0.5361* |
| | (2.04) | (0.22) | (-0.03) | (1.66) | (0.78) | (2.13) | (2.95) | (1.97) | (-1.08) | (-1.31) | (2.13) | (0.15) | (-2.35) | (3.35) | (2.81) | (1.90) |
| age50 | 926.5611** | -480.4958 | -125.8721 | 115.6593 | 0.0087 | 428.3025 | 1101.4216*** | 0.1926 | -0.1861 | -0.1632 | 0.2165 | 0.1034 | 0.0273 | 0.5794*** | 0.5642*** | 0.4901 |
| | (2.57) | (-1.07) | (-0.27) | (0.63) | (0.05) | (1.27) | (3.31) | (1.60) | (-1.57) | (-1.14) | (1.55) | (0.53) | (0.22) | (3.39) | (3.21) | (1.54) |
| age60 | 785.7575** | -564.1372 | 451.5762 | -28.5742 | 0.1908 | -29.4644 | 809.7958** | 0.1323 | -0.3316** | -0.1726 | -0.0157 | 0.1592 | -0.0065 | 0.5144*** | 0.5857*** | 0.2688 |
| | (2.04) | (-1.06) | (0.83) | (-0.14) | (1.07) | (-0.08) | (2.25) | (1.00) | (-2.53) | (-1.06) | (-0.11) | (0.74) | (-0.05) | (2.84) | (2.79) | (0.74) |
| shopper | -4.3544 | 240.8790 | -204.6422 | 127.4909 | -0.1924** | -184.8011 | -333.7255* | 0.1374** | -0.0955 | -0.0775 | -0.2072*** | -0.0039 | -0.0024 | 0.1011 | -0.0122 | -0.0810 |
| | (-0.02) | (1.05) | (-0.82) | (1.30) | (-2.28) | (-1.03) | (-1.89) | (2.17) | (-1.52) | (-1.03) | (-2.69) | (-0.04) | (-0.04) | (1.08) | (-0.14) | (-0.49) |
| female | 385.2468** | 158.9698 | -66.3317 | -96.6817 | 0.2902*** | 767.2447*** | 1002.0605*** | 0.1984*** | 0.0983* | 0.1194* | 0.0591 | 0.0723 | -0.6654*** | 0.0393 | 0.0884 | 0.2326 |
| | (2.17) | (0.73) | (-0.29) | (-1.07) | (3.43) | (4.60) | (6.10) | (3.34) | (1.67) | (1.67) | (0.84) | (0.74) | (-10.60) | (0.45) | (1.04) | (1.51) |
| nkid | 1526.4671*** | 809.2647*** | 334.3004** | 5.3793 | 0.1510*** | 2324.1434*** | 2612.0036*** | 0.0204 | 0.1454*** | 0.0027 | 0.1086** | 0.3088*** | 0.0046 | 0.0317 | 0.0420 | -0.0591 |
| | (12.34) | (5.51) | (2.19) | (0.09) | (2.74) | (18.83) | (21.41) | (0.49) | (3.59) | (0.05) | (2.09) | (3.90) | (0.10) | (0.52) | (0.74) | (-0.57) |
| nparent | 50.6129 | -117.6950 | -19.6493 | 35.3600 | -0.1120 | -241.4453* | -165.2081 | -0.0105 | 0.0206 | -0.0336 | -0.0805 | 0.0331 | 0.0641 | 0.0125 | -0.0863 | 0.1547 |
| | (0.36) | (-0.72) | (-0.11) | (0.50) | (-1.63) | (-1.84) | (-1.28) | (-0.22) | (0.45) | (-0.62) | (-1.46) | (0.42) | (1.30) | (0.18) | (-1.36) | (1.29) |
| married | 1002.7246*** | 393.2503 | 1170.1428*** | 109.0734 | 0.0891 | 1332.9497*** | 1484.6410*** | -0.0258 | -0.0553 | 0.1640 | -0.1174 | 0.0698 | -0.0576 | 0.0130 | 0.1107 | -0.5395 |
| | (3.63) | (1.01) | (2.68) | (0.71) | (0.73) | (4.93) | (5.53) | (-0.26) | (-0.57) | (1.29) | (-1.03) | (0.41) | (-0.57) | (0.10) | (0.74) | (-1.61) |
| single | -56.1740 | -511.8364 | 1.5683 | -323.3970* | -0.0270 | -248.6431 | -109.0671 | -0.2232* | 0.1909 | -0.0599 | -0.2446 | 0.1824 | -0.1040 | -0.0708 | 0.3781** | -0.7404* |
| | (-0.15) | (-1.08) | (0.00) | (-1.67) | (-0.15) | (-0.70) | (-0.31) | (-1.76) | (1.53) | (-0.38) | (-1.63) | (0.89) | (-0.78) | (-0.39) | (2.03) | (-1.81) |
| nreceipt | 1.9613 | 12.3585 | 62.5158 | 22.2205 | 0.0353 | 54.9544 | 39.7654 | -0.0002 | 0.0042 | -0.0069 | -0.0248 | 0.0160 | 0.0227 | -0.0003 | 0.0055 | 0.0156 |
| | (0.04) | (0.18) | (0.86) | (0.78) | (1.54) | (1.14) | (0.84) | (-0.01) | (0.24) | (-0.32) | (-1.29) | (0.54) | (1.30) | (-0.01) | (0.20) | (0.30) |
| work | -89.5691 | -161.4081 | -88.3046 | 74.4092 | -0.5198*** | -393.2171** | -532.3758*** | 0.0597 | 0.0011 | 0.0534 | 0.0821 | -0.1525 | 0.1966*** | 0.0328 | 0.0142 | -0.2780 |
| | (-0.42) | (-0.65) | (-0.32) | (0.67) | (-5.34) | (-2.01) | (-2.75) | (0.83) | (0.02) | (0.65) | (0.99) | (-1.30) | (2.62) | (0.31) | (0.15) | (-1.50) |
| swork | -34.7472 | -74.0510 | -750.0372** | -61.7803 | -0.3689*** | -115.5453 | -227.2740 | 0.0613 | 0.0816 | -0.0457 | -0.0181 | 0.0181 | -0.2701*** | 0.0478 | -0.0727 | -0.4113* |
| | (-0.14) | (-0.23) | (-2.30) | (-0.47) | (-3.27) | (-0.49) | (-0.98) | (0.72) | (0.99) | (-0.46) | (-0.18) | (0.13) | (-3.26) | (0.38) | (-0.59) | (-1.88) |
| fincome | -51.0052 | 44.4209* | 75.7272** | 34.5841** | 0.0244** | -11.4521 | 37.5813* | -0.0238*** | 0.0104 | 0.0162** | -0.0067 | -0.0145 | 0.0093 | 0.0002 | 0.0016 | 0.0279 |
| | (-1.63) | (1.84) | (2.44) | (2.39) | (1.99) | (-0.52) | (1.73) | (-2.65) | (1.26) | (2.04) | (-0.80) | (-1.49) | (1.61) | (0.01) | (0.17) | (1.28) |
| mfincome | -308.1260 | 181.6505 | 792.8610** | 515.0779*** | 0.6592*** | -301.0413 | -82.8985 | -0.3687*** | -0.1609 | 0.1818 | -0.0420 | -0.1986 | 0.1006 | -0.0362 | 0.0893 | 0.2551 |
| | (-0.89) | (0.47) | (2.11) | (3.00) | (4.99) | (-1.00) | (-0.28) | (-3.48) | (-1.54) | (1.54) | (-0.32) | (-1.22) | (0.90) | (-0.21) | (0.58) | (1.01) |
| incdec | -390.5285 | 527.0254* | -655.1569** | 262.2819** | 0.0615 | 130.7484 | 200.5710 | 0.0327 | 0.1055 | -0.1285 | -0.0295 | 0.1601 | -0.0436 | -0.0535 | 0.0593 | 0.5031** |
| | (-1.53) | (1.79) | (-2.00) | (2.10) | (0.50) | (0.54) | (0.83) | (0.38) | (1.26) | (-1.26) | (-0.28) | (1.07) | (-0.50) | (-0.43) | (0.52) | (2.15) |
| elem | 241.7289 | -352.2363 | 25.9121 | -86.6524 | 0.5998*** | -281.8016 | -601.3561** | 0.0844 | -0.3865*** | -0.5485*** | -0.3185*** | 0.1415 | 0.0952 | -0.0555 | -0.2526 | 0.1292 |
| | (0.93) | (-0.88) | (0.05) | (-0.56) | (5.47) | (-1.11) | (-2.39) | (0.91) | (-4.22) | (-4.15) | (-3.17) | (0.89) | (1.00) | (-0.44) | (-1.63) | (0.36) |
| college | -333.1297 | 174.7880 | -1.6205 | 112.2432 | -0.2935*** | -380.6877* | -116.6576 | -0.0504 | 0.0713 | 0.1978** | 0.0237 | -0.2426** | 0.0490 | 0.0809 | 0.0206 | 0.1719 |
| | (-1.53) | (0.72) | (-0.01) | (1.04) | (-2.65) | (-1.89) | (-0.59) | (-0.70) | (1.01) | (2.48) | (0.27) | (-2.21) | (0.67) | (0.74) | (0.22) | (1.04) |
| north | 234.4518 | -359.7111 | 561.0951 | 64.7164 | -0.0954 | -71.6001 | 89.2244 | -0.0705 | -0.1669* | 0.5004*** | 0.2977*** | -0.3669** | 0.0270 | -0.0979 | -0.0293 | 0.0388 |
| | (0.86) | (-1.08) | (1.19) | (0.44) | (-0.75) | (-0.27) | (0.34) | (-0.73) | (-1.77) | (3.72) | (2.83) | (-1.97) | (0.27) | (-0.71) | (-0.22) | (0.12) |
| central | 221.4046 | -540.4465 | 419.8384 | 22.8174 | -0.0933 | 92.1868 | 31.3338 | -0.0861 | -0.2036** | 0.2056 | 0.3072*** | -0.1713 | -0.0946 | -0.0701 | -0.2199 | -0.1728 |
| | (0.77) | (-1.51) | (0.82) | (0.15) | (-0.69) | (0.33) | (0.11) | (-0.84) | (-2.04) | (1.43) | (2.73) | (-0.86) | (-0.89) | (-0.48) | (-1.57) | (-0.50) |
| south | 132.6930 | -363.0328 | 361.5972 | 54.5685 | 0.0110 | 34.4866 | -203.1905 | -0.1719 | -0.1371 | 0.5064*** | 0.2227* | -0.1878 | -0.1014 | -0.0121 | -0.1024 | -0.1843 |
| | (0.43) | (-0.97) | (0.71) | (0.33) | (0.08) | (0.12) | (-0.69) | (-1.60) | (-1.31) | (3.48) | (1.89) | (-0.91) | (-0.90) | (-0.08) | (-0.69) | (-0.53) |
| economyvb | -212.1419 | 345.9429 | -229.1458 | 98.4722 | -0.0513 | 72.1167 | -193.4578 | 0.0741 | -0.1234 | -0.0599 | -0.0253 | 0.0420 | -0.0549 | -0.0273 | 0.0356 | 0.5522** |
| | (-0.93) | (1.18) | (-0.74) | (0.81) | (-0.48) | (0.33) | (-0.89) | (0.93) | (-1.59) | (-0.62) | (-0.27) | (0.31) | (-0.65) | (-0.24) | (0.31) | (2.41) |
| economyvg | 587.3191** | -334.3150 | 50.1676 | -31.3684 | -0.0876 | 395.3506 | 260.1609 | 0.0189 | 0.0523 | -0.0110 | 0.0258 | 0.2173 | -0.0840 | -0.1472 | 0.1403 | -0.2837 |
| | (2.15) | (-1.02) | (0.14) | (-0.23) | (-0.70) | (1.55) | (1.03) | (0.21) | (0.58) | (-0.10) | (0.24) | (1.32) | (-0.88) | (-1.16) | (1.08) | (-1.23) |
| fiscal | 165.7286 | -166.8642 | 226.4213 | -163.7374* | -0.1396* | -70.3191 | 132.6161 | 0.0420 | 0.0417 | 0.0469 | -0.0630 | -0.0455 | -0.0137 | 0.2261*** | 0.1782** | 0.1247 |
| | (0.98) | (-0.82) | (1.07) | (-1.90) | (-1.78) | (-0.44) | (0.84) | (0.73) | (0.74) | (0.70) | (-0.93) | (-0.48) | (-0.23) | (2.70) | (2.27) | (0.89) |
| Constant | 2274.7284*** | 3663.6231*** | 956.2979 | 1203.2759*** | -1.0523*** | 4252.2672*** | 4082.4348*** | 0.2282 | 0.1593 | -1.3507*** | 0.9996*** | 1.6932*** | -0.6695*** | 0.4066 | -0.2665 | 0.3371 |
| | (4.27) | (5.32) | (1.21) | (4.30) | (-4.31) | (8.33) | (8.09) | (1.24) | (0.88) | (-5.79) | (4.71) | (5.42) | (-3.55) | (1.58) | (-1.00) | (0.60) |
| $\sigma_j$ | 8.0197*** | 8.0926*** | 7.5755*** | 7.3856*** | | 8.1702*** | 8.1791*** | | | | | | | | | |
| | (404.61) | (359.63) | (189.07) | (304.98) | | (494.79) | (502.26) | | | | | | | | | |
| $\rho$ | | | | -0.2160*** | | | | | | | | | | | | |
| | | | | (-2.85) | | | | | | | | | | | | |
| log likelihood | | | | | | | -52823.108 | | | | | | | | | |