Charitable Giving, Tax Reform, and Self-selection of Tax Relief: Evidence from South Korea

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Abstract

This paper investigates the price elasticity of charitable giving utilizing South Korean tax reform in 2014, when the tax relief on charitable giving changed from tax deduction to tax credit. Although many research on the price elasticity of charitable giving implicitly assume that all of tax payers declare their tax relief on charitable giving, this paper considers the existence of declaration cost for tax reliefs on charitable giving. By estimating the "intension-to-treat" effect (ITT) of tax reform, the analysis shows that the giving price elasticity is about -1 in terms of both intensive and extensive margins. Furthermore, considering the declaration of charitable giving and exploiting the different declaration cost between wage earners and self-employed workers as instrument variable (IV), we estimate the effect of "effective" giving price on the donation. As a result, we find that the estimation about the "effective" price elasticity is almost the same for the baseline one in terms of both intensive and extensive margins. This implies that the effect from the declaration cost of charitable giving may be small.

Key words: Charitable givingGiving priceTax reformSouth Korea
JEL Codes: D91I10I18

1 Introduction

In many countries, governments set a tax relief for charitable giving. This is because, if subsidizing charitable giving induces a large increase in donations, it is desirable for public good provision. As Saez (2004) shows, it is known that the price elasticity of charitable donations is a key parameter to evaluate the welfare implication. To evaluate the effect of tax relief, many empirical papers investigate the elasticity of charitable donations with respect to their tax price and find that the price elasticity is around -1 in terms of intensive margin, using the data from tax record (Almunia et al., 2020; Auten et al., 2002; Bakija and Heim, 2011; Fack and Landais, 2010; Randolph, 1995).

However, as Almunia et al. (2020) point out, the analysis based on tax record only captures the effect for tax payers who declare charitable tax deduction, while charitable donation may also

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be conducted by those who do not declare it. As Fack and Landais (2016) and Gillitzer and Skov (2018) suggest that tax payers incur some cost for the declaration of charitable tax deduction such as record-keeping costs and compliance cost, tax payers may not declare their charitable giving if the benefit of the declaration exceeds the cost of it. Therefore, Rehavi and Shack (2013) suggest that the estimated tax elasticity will be biased if the data used for the estimation only focuses on tax payers who declare charitable tax deduction.

Considering the issue of the declaration, this paper follows the literature of charitable donation and tax relief, and investigates the price elasticity of giving. To derive the elasticity, this paper utilize the South Korean (Korea hereafter) tax reform in 2014, from when the tax relief on charitable giving was conducted by tax credit, though tax deduction had been used before 2014.

The extant research mainly focuses on the tax reform within the regime of tax deduction (Almunia et al., 2020; Auten et al., 2002; Bakija and Heim, 2011; Randolph, 1995) or tax credit (Fack and Landais, 2010). However, there is no research which deal with the giving tax reform between the regime of tax deduction and tax credit as far as we know. Since the extant research focus on the tax reform within the scheme of tax deduction or tax credit, this paper firstly deals with the tax reform from tax deduction system to tax credit system.

The Korean tax reform in 2014 started to allow 15% of the total amount of charitable giving as a tax credit for all taxpayers, which means that the giving price for 1 KRW donation is 0.85 KRW.[1] Since the giving price was determined according to the marginal tax rate of progressive income tax before 2014, this tax reform reduced the giving price for low income taxpayers while it increased the price for high income tax payers. Since the variation of giving price can be considered to be exogenous for taxpayers, we exploit this reform and conduct the difference-in-difference (DID) analysis following the extant research about the giving price elasticity.

Moreover, to overcome the issue of tax declaration, we use the Korean survey panel data called the National Survey of Tax and Benefit (NaSTaB) and estimate intention-to-treat (ITT) of tax relief for giving as a baseline analysis. Since NaSTaB data contains the data of charitable giving irrespective of declarations, the baseline analysis examine the ITT of tax relief on the all charitable giving. As a result, our baseline estimation shows that the price elasticity of charitable giving in Korea is -0.59 ~ -1.01 for intensive margins and -1.17 ~ -1.48 for extensive margins.

However, the estimation of the ITT implicitly assumes that the donors can automatically enjoy tax relief although tax payers have to declare their charitable giving to receive tax relief. Therefore, as an alternative way, we calculate an "effective" giving price considering whether each tax payer

[1] 1 KRW is approximately 0.001 USD. In other words, 1 USD is about 1,000 KRW.

declare tax relief or not. Since whether tax payers declare or not may be endogenous with the amount of charitable giving, to overcome this issue, we focus on the fact that wage earners can easily declare tax relief in their company while self-employed workers have to declare tax relief via tax agency in Korea. By utilizing this difference of declaration costs between wage earners and self-employed workers as an instrument variable (IV), we estimate the price elasticity using the effective giving price, and compare the estimation with the baseline estimation. As a result, we find that the results using the effective price are -0.94 ~ -1.16 in terms of intensive margin and -0.92 ~ -1.46 in terms of extensive margin, which is almost the same for the baseline results. Since the estimated results are in line with the extant research, the result implies that the effect from the declaration cost may not so large.

This paper contributes the literature about the charitable giving tax system for the following points. Firstly, this paper considers the price elasticity of charitable giving using the effective giving price, although most of papers assume that the giving price applied for the charitable giving is the cheapest "applicable" giving price for each tax payer. As a result, although Rehavi and Shack (2013) suggest that the estimations using the effective price and the applicable price should be very different, our results suggest that the bias coming from the difference of the estimations may be small. Moreover, since our robustness checks to control the manipulations for giving price and intertemporal income shifting show more different results from the baseline ones than the results considering the declaration issue, the results implies that the bias from the declaration issue may be considerably small.

Secondly, by using the survey data, which cannot be manipulated, we could consider the sample of low-income household. The research in this literature typically use the tax return data, the main part of which is the data about wealthy people. Since our data is based on survey, which reflects the income distribution of population, we believe that we can estimate the giving price elasticity of population more precisely. Moreover, the usage of survey data is important for the estimation of the price elasticity in terms of the extensive margin since the propensity of donation by low-income households would be be less than high-income households.

Thirdly, this paper is the first paper to examine the giving price elasticity in a non-Western country. While the giving behavior may be affected by the cultural matter such as the religious belief, the estimated price elasticity in this paper is in line with the result of the extant papers.

This paper consist of seven sections. Section 2 and 3 respectively explain the institutional background and data. Section 4 explains the estimation method. Section 5 deals with the analysis of price elasticity using the applicable giving price and section 6 shows the analysis using the

effective giving price. Section 7 concludes.

2 Institutional background

In this section, we describe the income tax relief for charitable giving in Korea and used dataset.

2.1 Tax relief for charitable giving by tax deduction and tax credit

In the South Korea, the tax policy about charitable giving drastically changed in 2014. Before then, tax relief of charitable giving was provided by tax deduction while, from 2014, tax relief by tax credit was introduced instead of tax deduction.

The tax deduction and tax credit may have different effects on giving behavior. This subsection summarize the difference of tax deduction and tax credit. Consider that a household has a choice between private consumption (x_i) and charitable giving (g_i). Let y_i be pre-tax total income. Then, the budget constraint is

$$x_i + g_i = y_i - R_i K - R_i T_i(y_i, g_i) - (1 - R_i) T_i(y_i). \tag{1}$$

T_i is tax amount which depends on the pre-tax income and charitable giving. R_i is the dummy which takes 1 if i declares the tax relief and 0 otherwise. K is a cost for the declaration of charitable giving, which may not be monetary cost but is converted to pecuniary terms.

Tax payers declare their charitable giving if its benefit exceeds its cost, which means

$$R_i = \begin{cases} 1 \text{ if } T_i(y_i, g_i) - T_i(y_i) > K \\ 0 \text{ if } T_i(y_i, g_i) - T_i(y_i) \leq K. \end{cases} \tag{2}$$

This means that the decision of declaration depends on y_i, g_i and K, where g_i is considered to be much easier for tax payers to adjust than the others.

On one hand, tax deduction reduces taxable income by giving. The amount of tax is

$$T_i(y_i, g_i) = \tau(y_i - g_i) \cdot (y_i - g_i), \tag{3}$$

or,

$$T_i(y_i) = \tau(y_i) \cdot (y_i), \tag{4}$$

where $\tau(\cdot)$ is the income tax rate which is determined by $y_i - g_i$ or y_i.[2] The budget constraint will be

$$x_i + [1 - R_i\tau(y_i - g_i)]g_i = [1 - R_i\tau(y_i - g_i) - (1 - R_i)\tau(y_i)]y_i - R_iK. \tag{5}$$

Thus, the giving price compared to the price of private consumption is $p_i^d \equiv 1 - R_i\tau(y_i - g_i)$ in tax deduction system. Since the giving price in tax deduction scheme varies depending on (1) the income level, (2) the amount of charitable giving, and (3) declaration of tax relief, it is endogenous to them, i.e. (1), (2), and (3).

On the other hand, tax credit reduces tax amount directly, that is,

$$T_i = \tau(y_i) \cdot y_i - R_img_i,$$

where $m \in [0, 1]$ is the tax credit rate. Under the tax credit system, the budget constraint is

$$x_i + (1 - R_im)g_i = [1 - \tau(y_i)]y_i - R_iK. \tag{6}$$

Thus, the giving price of tax credit system will be $p_i^c = 1 - R_im$, which is only dependent on the tax credit rate m, which is exogenously determined by the government, and declaration R_i. Therefore, the giving price in the tax credit system would not be manipulated by donors except the declaration.

In the literature of giving tax relief, many papers implicitly assume that $K = 0$ and all tax payers should enjoy tax relief for charitable giving, i.e. $R_i = 1$ for all i.[3] As a result, the observed amount of the charitable giving g_i may be different from the realized amount of the charitable giving g_i.

[2] $\tau(\cdot)$ here is a function which shows the average tax rate, which is determined progressively. Since the price elasticity of giving shows the marginal and additional increment for one unit of price reduction increase, we use not average but marginal tax rate to construct the giving price following the literature. Usage of the function of the average tax rate here is for explanatory simplicity.

[3] As an exception, Rehavi and Shack (2013) and Almunia et al. (2020) respectively consider the declaration by using the survey data and the stractural estimation.

Table 1: Marginal Income Tax Rate

<table>
<tr><th>Income/Year</th><th>2008</th><th>2009</th><th>2010 ~ 2011</th><th>2012 ~ 2013</th><th>2014 ~ 2016</th><th>2017</th><th>2018</th></tr>
<tr><td>(A) ~ 1200</td><td>8%</td><td>6%</td><td>6%</td><td>6%</td><td>6%</td><td>6%</td><td>6%</td></tr>
<tr><td>(B) 1200 ~ 4600</td><td>17%</td><td>16%</td><td>15%</td><td>15%</td><td>15%</td><td>15%</td><td>15%</td></tr>
<tr><td>(C) 4600 ~ 8800</td><td>26%</td><td>25%</td><td>24%</td><td>24%</td><td>24%</td><td>24%</td><td>24%</td></tr>
<tr><td>(D) 8800 ~ 15000</td><td rowspan="4">35%</td><td rowspan="4">35%</td><td rowspan="4">35%</td><td rowspan="2">35%</td><td>35%</td><td rowspan="2">35%</td><td>35%</td></tr>
<tr><td>(E) 15000 ~ 30000</td><td rowspan="3">38%</td><td>38%</td></tr>
<tr><td>(F) 30000 ~ 50000</td><td rowspan="2">38%</td><td>38%</td><td>40%</td></tr>
<tr><td>(G) 50000 ~</td><td>40%</td><td>42%</td></tr>
</table>

Notes: Marginal income tax rates applied from 2008 to 2018 are summarized. The income level is shown in terms of 10,000 KRW, which is approximately 10 United States dollars (USD) at an exchange rate of 1,000 KRW to one USD.

To overcome this issue, we use two ways of estimations. In section 5, we assume $R_i = 1$ for all i following the extant research and estimate ITT as a baseline result. The difference between this analysis and the extant research is that the observed charitable giving g_i in the former is not limited to declared one, but g_i in the latter is limited to declared one. In section 6, we remove the assumption, that is $R_i = 1$, and R_i can be 0 or 1 depending on each i, which is the difference from the extant research.

2.2 Korean tax reform in 2014

Korean tax system offers a tax relief for charitable giving in income tax. All tax payers have to declare their donation and submit the certificate of charitable giving to receive tax relief, while the taxiation method and the way of tax declaration are different for wage earners and self-employed workers. Wage earners pay income tax by withholding tax and declare tax relief for charitable giving via their company. Self-employed workers pay income tax by tax-return and declare tax relief when they submit tax return to the National Tax Service. Therefore, there is a difference of declaration cost of tax relief since self-employed workers have to retain the certificate until they submit tax return although wage earners can submit the certificate at any time.

In 2014, aiming at the relaxation of regressivity of giving price, the Korean government reformed tax system, where the tax credit was introduced instead of tax deduction. Since then, 15% of the total amount of charitable giving has been allowed as a tax credit, which means that the giving price from 2014 is 0.85 KRW for each 1 KRW of donation irrelevant to the income level.

Summarizing this, compared to tax credit system, the high income household, whose (average) income tax rate is more than 15%, get benefit from charitable giving under the tax deduction

	N	Mean	Std.Dev.	Min	Median	Max
Charitable Donations						
Annual chariatable giving (unit: 10,000KRW)	40064	36.64	153.72	0.00	0.00	10000.00
Dummary of donation > 0	40064	0.24	0.43	0.00	0.00	1.00
Income, giving price, and tax report						
Annual taxable labor income (unit: 10,000KRW)	40054	1674.04	2733.18	0.00	0.00	91772.00
First giving relative price	40063	0.86	0.04	0.62	0.85	0.94
Dummy of declaration of a tax relief	40064	0.11	0.31	0.00	0.00	1.00
Individual Characteristics						
Age	40064	54.20	16.31	24.00	52.00	104.00
Female dummy	40064	0.43	0.50	0.00	0.00	1.00
Employee dummy	29753	0.54	0.50	0.00	1.00	1.00
University graduate	40063	0.41	0.49	0.00	0.00	1.00
High school graduate dummy	40063	0.31	0.46	0.00	0.00	1.00
Junior high school graduate dummy	40063	0.28	0.45	0.00	0.00	1.00

system. However, middle or low income households would enjoy tax relief in tax credit system more than tax deduction system. We exploit this policy change as an identification strategy.

3 Data

The National Survey of Tax and Benefit (hereafter, NaSTab) is an annual financial panel survey implemented by The Korea Institute of Taxation and Finance to study the tax burden of households and the benefits that households receive from the government. The subjects of this survey are general households and household members living in 15 cities and provinces nationwide. This survey is based on a face-to-face interview. [4] The NaSTaB data is constructed as the subjects represent the population of Korean society. This enables us to derive giving price elasticity of population without re-weighting samples, which is used in the extant research. Moreover, note that subjects are not limited to the taxpayer or income earner reflecting the population.

In the analysis, we use data from 2013 to 2017 since we focus on the 2014 tax reform. This is because, as Table 1 shows, the giving price before 2014 was changed frequently and incorporating the data before 2012 captures the effects of another tax reform than the reform in 2014. Note that, since tax credit was introduced after 2014 and the credit rate was unchanged since 2014, the giving price does not depend on the income tax rate after 2014. In addition, we exclude the subject of the sample, whose age is under 23, since they are not likely to have income or assets.

Table **??** shows summary statistics of our data.[5] The first panel of this table shows variables

[4] If it is difficult for investigators to meet subjects, another family member answers on behalf of him.

[5] Respondents answer the amount of donation for seven specific purposes last year. Seven specific purposes are

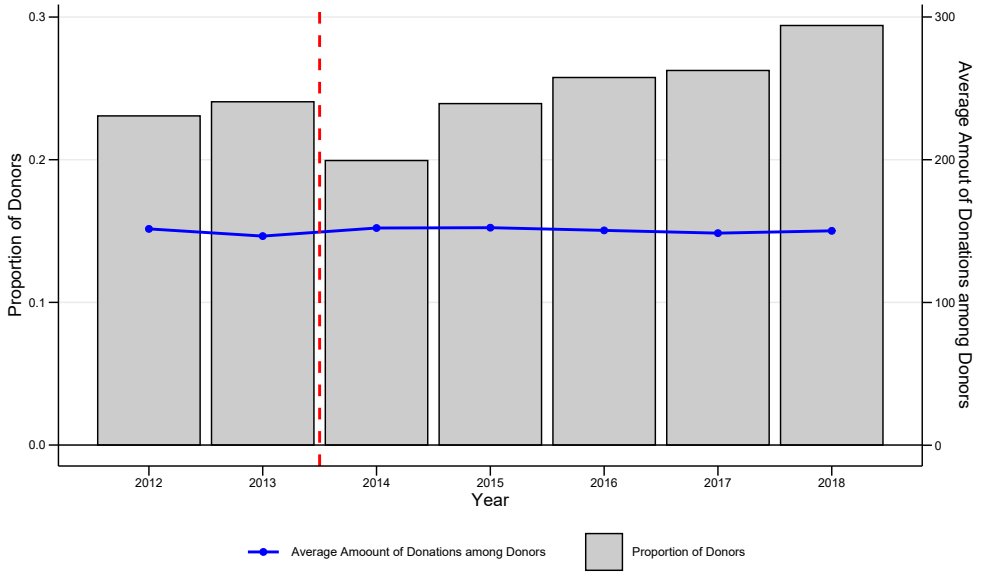


Figure 1: Time-Series of Outcome Variables

about charitable giving. The NaSTaB asks respondents to answer the amount of donation last year. This is the first outcome variables. Using this, we make a dummy taking 1 if respondent donated last year. This is the second outcome variables to estimate the price effect on the decision of donations. This table shows that the average amount of donation is almost 300,000 KRW (300 USD), and the proportion of donors is roughly 20%. Figure 1 shows the time-series of two variables. The blue line shows the average amount of donation among donors. In each year, its value is nearly 1.5 million KRW (1,500 USD), which is 7% of average annual taxable income. The gray bar shows the proportion of donors. After the tax reform, the proportion of donors decreases by 2 percentage points. After that, the proportion of donors is greter than 20%.

The second panel of Table **??** shows variables about income, tax report, and the giving price. NaSTaB asks respondents to answer the annual labor income last year. In our sample, the average annual taxable income is 18.76 million KRW (18,760 USD). According to the National Tax Statistical Yearbook published by Korean National Tax Service, the average annual taxable income is 32.77 million (32,770 USD) from 2012 to 2018 for employees who submitted the tax return. Since our sample includes subjects with no labor income, such as housewives, our sample mean of income is lower than the average income calculated by the public organizations. In Figure 2, the gray bars show the distribution of annual taxable income in 2013. The income distribution is right-skewed.

policitical parties, educational organizations, social welfare organizations, organizations for culutre and art, religious groups, charity activies organaized by religious group, other purposes. We sum up the amount of donations, and consider it as the annual charitable giving.

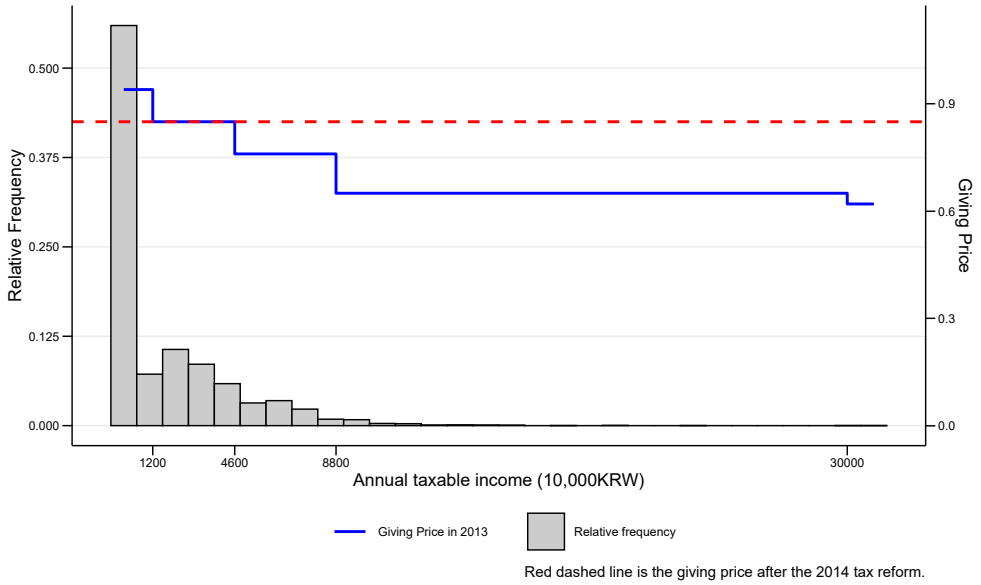


Figure 2: Income Distribution and Relative Giving Price

Using this variable, we construct the giving price under the tax deduction system (2012 and 2013).[6] After the tax reform (after 2014), the giving price is 0.85 regardless of labor income, as we explained in the section 2. In Figure 2, the blue line shows the giving price in 2012 and 2013, while the red dashed line shows the giving price after 2014. From this figure, those whose annual income is less than 120,000,000 KRW (120,000 USD) in 2013 could receive benefit from the 2014 tax reform because the tax reform decreases the giving price. On the other hand, those whose annual income is greater than 460,000,000 KRW (460,000 USD) in 2013 had a loss by the 2014 tax reform since the tax reform increases the giving price.

The NaSTaB also asks respondents to answer whether they declared a tax relief of giving. Although this variable is unique, the sample size is relatively small due to unanswering. This survey investigates separately for the case of *total* income (for example, business income, dividend income, rental income) and the case of *labor* income. We make a dummy taking one if respondents applied for a total income deduction of giving or a labor income deduction of giving. Table **??** shows the proportion of declaration is about 24%.

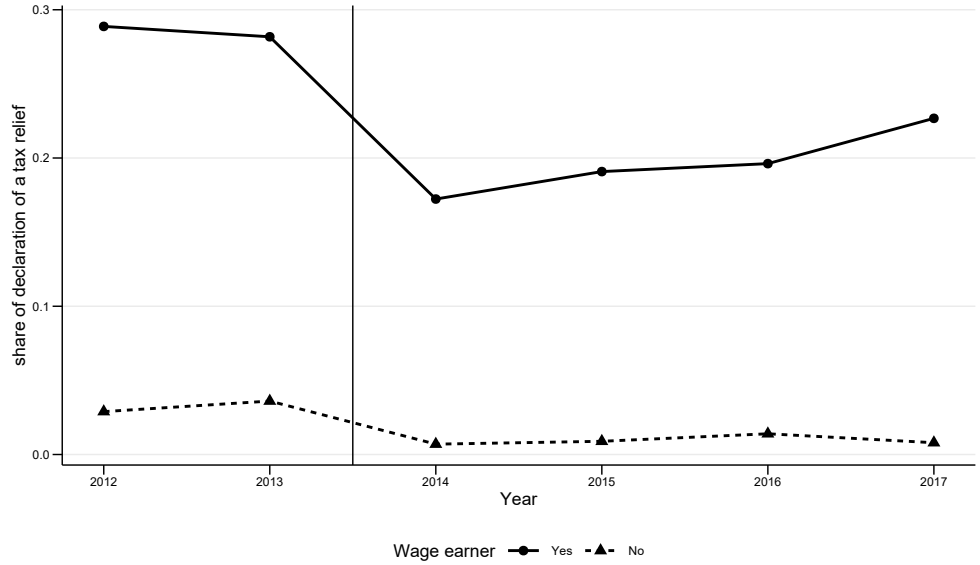


Figure 3: Share of Tax Relief

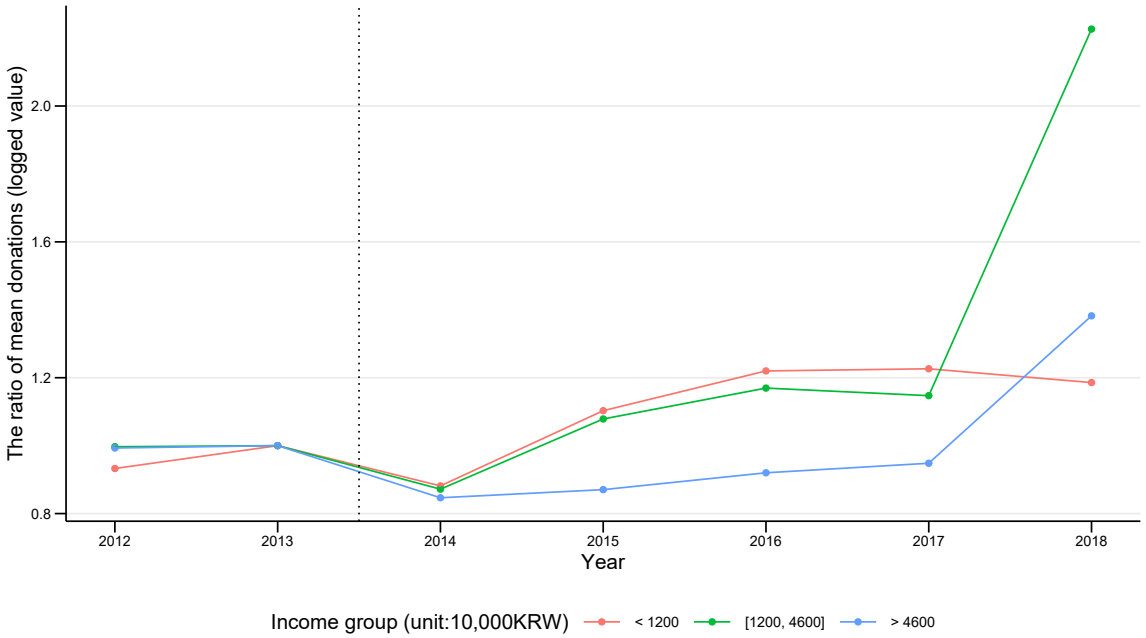
4 Statistical Model

To estimate the giving price elasticity, we use DID-like strategy which exploit the fact that the giving price was unified in 2014 while the price was different for tax payers with different incomes. Figure **??** the logarithmic average of donations for each year for each of the three income groups. We created three income groups, with the relative price of giving rising (lower than 12,000,000 KRW), unchanged (between 12,000,000 KRW and 46,000,000 KRW), and falling (higher than 46,000,000 KRW) between 2013 and 2014. In addition, the average logarithmic value of giving is standardized to be 1 in 2013.

We can observe two facts from this figure. First, before the tax reform, the amount of donations of income groups whose prices have increased or unchanged has remained the same, but since the 2014 tax reform, the amount of giving of income groups whose price has risen was lower than the group whose price has unchanged. Second, before the tax reform, the income group whose price decreased was lower than the group whose prices did not change, but after the 2014 tax reform, the average donations of the two groups have been about the same. In particular, since 2016, the average donation amount of income groups whose price has decreased is slightly higher than that of groups whose price has not changed. These facts in descriptive statistics suggest that the exogenous shock of giving price by the 2014 tax reform has produced a price effect for donations.

Using this exogenous change in price, we estimate the price elasticity of donations. Then, we

[6]The giving price shown in Table **??** is the *first* giving price. The giving price can be manipulated by an amount of donation. To avoid this endogeneity, we use the giving price where the amount of donation is zero. We will discuss this issue in the next section.



assume the following 2-way fixed effect model:

$$\ln g_{it} = \varepsilon_{pi} R_{it} \ln p_{it}(y_{it}, g_{it}) + \varepsilon_y \ln y_{it} + X_{it}\beta + \mu_i + \iota_t + u_{it}, \tag{7}$$

where g_{it}, p_{it} and y_{it} respectively indicates the amount of giving, the giving price (if they apply for a tax deduction/credit), and income of i in year t. R_{it} is a dummy taking one if individual i applies for a tax deduction/credit in year t. If s/he does not apply for a tax deduction/credit ($R_{it} = 0$), then the relative giving price is one ($p_{it} = 1$), and its logarithmic value is zero. μ_i, ι_t and u_{it} are individual fixed effect, year fixed effect, and the error term, respectively. X_{it} is a vector of covariates including square of age, industry dummy, and area dummy.

Our parameter of interest is the price elasticity of giving, denoted by ε_{pi}. We assume that this parameter varies from individual to individual. This model is called the random coefficient model, and especially when the deduction application and price elasticity are correlated, this model is called the correlated random coefficient model. When estimating this parameter, we need to address the issue of donation price endogenous and deduction application endogenous. In the following subsections, we discuss how to deal with each endogeneity.

4.1 Endogenity of Giving Price p_{it}

Our identification strategy is price changes due to the 2014 tax reform. However, the relative price of donations is endogenous because it is necessary to use donation data under the income deduction

system (before the 2014 tax reform). To formally show this issue, the relative price of donations p_{it} is defined as:

$$p_{it}(y_{it}, g_{it}) = \begin{cases} 1 - \tau_t(y_{it} - g_{it}) & \text{if} \quad t < 2014 \\ 1 - m & \text{if} \quad t \geq 2014 \end{cases}, \tag{8}$$

where $\tau_t(\cdot)$ is average tax rate in year t. As is clear from the above formula, the (within) variation in giving price depends not only on the 2014 tax reform but also on the amount of donations and income before 2014, which are factors in the endogenous nature of the giving price.

In the tax deduction system, the giving price is endogenous because taxpayers can reduce the amount of donations and lower their tax brackets by one level to lower the relative price of giving. To address this endogeneity, consider the price faced in the first unit of donation denoted by p_{it}^f. This is called the first-price of giving and is obtained by $p_{it}^f(y_{it}) = p_{it}(y_{it}, 0)$. In contrast, $p_{it}(y_{it}, g_{it})$ is called the last-price of giving[7]. The first-price of giving is unaffected by the manipulation of giving, so the first-price is exogenous to the donation amount. Therefore, assuming that the income is exogenous, we replace $\ln p_{it}(y_{it}, g_{it})$ in the Equation (7) with $\ln p_{it}^f(y_{it})$ to estimate the first-price elasticity of giving. Also, using the first-price of giving as the instrumental variable for that last-price, we estimate the Equation (7) with 2SLS with fixed effects.

4.2 Endogenity of Applying for Tax Relief R_{it}

We use instrumental variable method to address the endogeneity caused by self-selection of tax deductions. If there is no (physical or psychological) cost to declare a tax relief, then all individuals should declare a tax relief. However, as shown in Table **??**, declaring a tax relief may incur some costs because some respondents did not declare a tax relief. Employment status is one dimension of variation of applied cost. For the declaration, self-employed workers have to retain the certificate until they submit tax return although wage earners can declare tax relief and submit the certificate through their company at any time. Figure 3 shows that the proportion of declaring a tax relief among employees is higher than the others. Thus, we use the wage earner dummy as an instrument of a declaration.

We take three approaches using this instrumental variable. First, we estimate the following

[7]Under the tax credit system, the relative price of donations does not depend on the donation amount. Thus, the first-price of giving is equal to the last-price of giving.

Table 2: Probit Estimation of Selection Equation

	Pool	2012	2013	2014	2015	2016	
(Intercept)	-212.784	-195.672***	-181.767	-219.403***	-228.677***	-209.380***	-24
	(235.327)	(34.012)	(238.432)	(15.571)	(73.558)	(78.437)	(
1 = Wage earner	0.426***	0.412***	0.215**	0.603***	0.534***	0.430***	0
	(0.041)	(0.095)	(0.094)	(0.132)	(0.122)	(0.106)	
log(first giving price)	-1.274***	-1.276	-2.167**				
	(0.248)	(0.883)	(0.868)				
log(income)	17.905***	16.730***	15.219***	18.930***	19.304***	17.638***	20
	(0.541)	(2.958)	(2.896)	(1.349)	(1.263)	(1.206)	
Square of age	-0.002	-0.002	-0.001	-0.002	-0.007*	0.000	
	(0.001)	(0.003)	(0.003)	(0.004)	(0.004)	(0.003)	
Num.Obs.	26922	4261	4391	4383	4550	4611	
Log.Lik.	-7660.954	-1391.073	-1441.344	-981.075	-1118.238	-1183.661	-1
Std. Errors	Standard	Standard	Standard	Standard	Standard	Standard	S
Dummy of area	X	X	X	X	X	X	
Dummy of industry	X	X	X	X	X	X	

outcome equation with 2SLS with fixed effects:

$$\ln g_{it} = \varepsilon_{pi}(R_{it} \ln p_{it}^{f}(y_{it})) + \varepsilon_{y} \ln y_{it} + X_{it}\beta + \mu_i + \iota_t + u_{it}, \tag{9}$$

where $R_{it} \ln p_{it}^{f}(y_{it})$ is instrumented by $\text{WageEarner}_{it} \times \ln p_{it}^{f}(y_{it})$. Note that WageEarner_{it} is a wage earner dummy.

5 Results

In this section, we report the price elasticity of intensive-margin and extensive-margin, respectively. Note that we provide an appendix with the first-stage estimation results used to calculate the propensity score. As a basic result, even if we control covariates such as income, giving price, and industry dummy, the wage earner dummy is strongly and positively correlated with the application of donation deduction/credit. However, when the sample is divided by year, the partial correlation between the wage earner dummy and the application of donation deduction/credit in 2013 is statistically insignificant.

5.1 Intensive Margin

Table 3 shows the estimation results of price elasticity of intensive-margin. Model (1) uses the intersection of the wage earner dummy and the giving (first) price as an instrumental variable.

Table 3: First-Price Elasticities (Intenstive Margin)

	2SLS			OLS	
	(1)	(2)	(3)	(4)	(5)
Applying tax relief x log(first price)	-1.429***	-1.506***	-1.598***		
	(0.398)	(0.354)	(0.361)		
PS of applying tax relief x log(first price)				-1.584***	-1.564***
				(0.371)	(0.353)
log(income)	1.162	1.102	1.030	1.037	1.013
	(1.112)	(1.084)	(1.085)	(1.110)	(1.116)
Num.Obs.	7080	7080	7080	7080	7080
R2	0.820	0.820	0.820	0.820	0.820
R2 Adj.	0.693	0.693	0.693	0.693	0.694
FE: area	X	X	X	X	X
FE: industry	X	X	X	X	X
FE: panelid	X	X	X	X	X
FE: year	X	X	X	X	X
Square of age	X	X	X	X	X
Instrument	Wage earner x Price	PS x Price	PS x Price		
Method of PS		Pool	Separate	Pool	Separate

Models (2) and (3) use the intersection of the propensity score of application and the giving (first) price as an instrumental variable. We use pooled model and separate model to calculate propensity scores, respectively. In models (4) and (5), we add the intersection between the propensity score of application and the giving (first) price directly to the explanatory variables. The estimated value varies slightly depending on the estimation method, but it is in the range of -1.5 to -1.8. Therefore, a 1% price reduction will increase the donation amount by 1.5-1.8% for those who apply for a donation deduction.

We performed some analyzes for the robustness of this result. The regression table is shown in the appendix, but we will briefly describe the results. We show the results of estimating elasticity excluding 2013 and 2014 data in Table 4 of the Appendix A to eliminate the effects of tax reform announcements. If individuals are aware of the 2014 tax reform in advance, those who make the relative price of giving higher (cheaper) by the reform should increase (decrease) donations before the reform. Therefore, the price elasticity is under-biased due to the announcement effect of tax reform. As a result, as we expected, the price elasticity ranges from -1.7 to -1.9, which is a statistically significant result.

Table 5 of the Appendix A shows the estimation results of the last-price elasticity. Under the income deduction system, the relative price of giving that an individual does not face the first

Table 4: Robustness of First-Price Elasticities (Intenstive Margin)

	2SLS			OLS	
	(1)	(2)	(3)	(4)	(5)
Applying tax relief x log(first price)	-1.703***	-1.626***	-1.673***		
	(0.587)	(0.468)	(0.483)		
PS of applying tax relief x log(first price)				-1.927***	-1.857***
				(0.561)	(0.540)
log(income)	-0.326	-0.287	-0.311	-0.813	-0.764
	(1.417)	(1.401)	(1.397)	(1.458)	(1.453)
Num.Obs.	4908	4908	4908	4908	4908
R2	0.851	0.851	0.851	0.852	0.852
R2 Adj.	0.685	0.685	0.685	0.686	0.686
FE: area	X	X	X	X	X
FE: industry	X	X	X	X	X
FE: panelid	X	X	X	X	X
FE: year	X	X	X	X	X
Square of age	X	X	X	X	X
Instrument	Wage earner x Price	PS x Price	PS x Price		
Method of PS		Pool	Separate	Pool	Separate

Table 5: Last-Price Elasticities (Intensive Margin)

	(1)	(2)	(3)
Applying tax relief x log(last price)	-1.627***	-1.781***	-1.901***
	(0.527)	(0.448)	(0.458)
log(income)	1.012	0.899	0.812
	(1.175)	(1.141)	(1.142)
Num.Obs.	6492	6492	6492
R2	0.820	0.820	0.820
R2 Adj.	0.688	0.688	0.687
FE: area	X	X	X
FE: industry	X	X	X
FE: panelid	X	X	X
FE: year	X	X	X
Square of age	X	X	X
Instrument	Wage earner x Price	PS x Price	PS x Price
Method of PS		Pool	Separate

price, but the last price. Therefore, it is more realistic to estimate the elasticity using the last price. However, the last price is an endogenous variable because it depends on the donation amount. Therefore, 2SLS estimation was performed using the instrumental variables used in Table 3 as the instruments of the intersection of application dummy and the last price. As a result, the price elasticity of donations ranges from -1.7 to -2.1, which is statistically significant.

In addition, we estimated price elasticity using a sample limited to those who applied for tax relief. In this section, we only outline and provide detailed results in Appendix B. Correcting the bias due to sample selection by adding the inverse Mills ratio calculated in the model shown in Table 1 of Appendix A directly to the explanatory variables, the estimated price elasticity ranges from -1.3 to -1.6, which is similar to the main result. We also confirmed that this result is robust even if the announcement effect of tax reform is eliminated and that the last-price elasticity takes a similar value.

This approach also solves the endogenous nature of the application by correcting the sample selection bias, making it simpler to perform two further robustness tests on the relative price of giving. First, the first-price depends only on income. Therefore, if income is endogenous, the first-price is also an endogenous variable. A and B proposed to deal with it by k-th order difference estimation. In this model, the k-th lagged variable of the giving price, $\ln p^f_{it}(y_{it}) - \ln p^f_{it-k}(y_{it-k})$, depends on the income for two periods. Using the income for $t-k$ year, we calculate the giving price for t year and $t-k$ year, that is, $\ln p^f_{it}(y_{it-k}) - \ln p^f_{it-k}(y_{it-k})$, and use it as an instrumental variable. This avoids the endogenous problem of income manipulation because the variation described by the instrumental variable is independent of income. As a result, the price elasticity by the 1-year and 2-year difference estimation i statistically insignificant, but the price elasticity by the 3-year difference estimation is in the range of -1.5 to -1.7, which is statistically significant.

Second, to directly control the dynamic effects of price and income changes on donations, C proposes to add lagged and future changes of these variables to the explanatory variables. As a result, price elasticity is statistically insignificant. However, because our data is unbalanced panel data, the sample size is quite small. In that respect, the results of this analysis are unreliable.

5.2 Extensive Margin

By changing the outcome variable from the logarithmic value of giving to a dummy variable that takes one when donated, we estimate the extensive-margin price elasticity with a linear probability model. The estimated price coefficient value does not directly reflect the price elasticity, but we can obtain the price elasticity by dividing the estimated coefficient value by the average of the

Table 6: First-Price Elasticities (Extenstive Margin)

	2SLS			OLS	
	(1)	(2)	(3)	(4)	(5)
Applying tax relief x log(first price)	-0.445***	-0.509***	-0.710***		
	(0.172)	(0.124)	(0.113)		
PS of applying tax relief x log(first price)				-0.416***	-0.546***
				(0.111)	(0.097)
log(income)	2.105***	2.074***	1.975***	1.955***	1.832***
	(0.280)	(0.263)	(0.257)	(0.281)	(0.279)
Implied price elasticity	-0.445***	-0.509***	-0.710***	-0.416***	-0.546***
	(0.172)	(0.124)	(0.113)	(0.111)	(0.097)
Num.Obs.	26922	26922	26922	26922	26922
R2	0.679	0.681	0.687	0.663	0.663
R2 Adj.	0.569	0.572	0.580	0.547	0.547
FE: area	X	X	X	X	X
FE: industry	X	X	X	X	X
FE: panelid	X	X	X	X	X
FE: year	X	X	X	X	X
Square of age	X	X	X	X	X
Instrument	Wage earner x Price	PS x Price	PS x Price		
Method of PS		Pool	Separate	Pool	Separate

outcome variables. Also, we focus only on the first-price elasticity since the decision to donate is the same as the decision to donate the first unit.

Table 6 shows the estimation results of extensive-margin price elasticity. Similar to Table 3, model (1) uses the intersection of the wage earner dummy and giving price as an instrumental variable. Models (2) and (3) use the intersection of propensity score of application and giving price as an instrumental variable. Models (4) and (5) use OLS to estimate a model that uses the intersection of propensity score of application and giving price as an explanatory variable.

As a result, the estimated coefficients are in the range of -0.54 to -0.74. The extensive-margin price elasticity, obtained by dividing this factor by the percentage of donors, ranges from -0.76 to -1.04. In other words, a 1% reduction in relative price due to tax incentives increases the probability of donation by 0.7% to 1% for those who apply for tax relief. This result is robust against the effects of the 2014 tax reform announcement (See Table 7 in Appendix A, which shows the results of the same exercise using subsamples that exclude 2013 and 2014 data). Therefore, those who apply for tax relief are sensitive to tax incentives when deciding on how much to donate rather than whether or not to donate.

Table 7: Robustness of First-Price Elasticities (Extenstive Margin)

	2SLS			OLS	
	(1)	(2)	(3)	(4)	(5)
Applying tax relief x log(first price)	-0.203	-0.505***	-0.704***		
	(0.257)	(0.170)	(0.159)		
PS of applying tax relief x log(first price)				-0.430***	-0.562***
				(0.162)	(0.145)
log(income)	2.233***	2.108***	2.026***	1.934***	1.814***
	(0.322)	(0.298)	(0.293)	(0.331)	(0.328)
Implied price elasticity	-0.203	-0.505***	-0.704***	-0.430***	-0.562***
	(0.257)	(0.170)	(0.159)	(0.162)	(0.145)
Num.Obs.	18148	18148	18148	18148	18148
R2	0.716	0.725	0.730	0.709	0.710
R2 Adj.	0.553	0.567	0.576	0.543	0.543
FE: area	X	X	X	X	X
FE: industry	X	X	X	X	X
FE: panelid	X	X	X	X	X
FE: year	X	X	X	X	X
Square of age	X	X	X	X	X
Instrument	Wage earner x Price	PS x Price	PS x Price		
Method of PS		Pool	Separate	Pool	Separate

6 Conclusions

In this paper, we investigate the giving price elasticity using South Korean panel data. As a result, we obtain the following findings.

Firstly, our baseline estimation shows that the giving price elasticity in Korea is around -1 even if we take into account the existence of the undeclared charitable giving. Since the literature of the tax expenditure for charitable giving suggests that the price elasticity is around -1, the result suggests that the effect coming from the existence of the undeclared charitable giving cost may be limited.

Secondly, we find that the estimated price elasticity using the effective giving price takes the similar values from the estimated elasticity in the extant research. It implies that the effect from the declaration cost, which has been ignored, is not so large. Moreover, as well as the baseline result, this result shows that the price elasticity is around -1, which derives the same conclusions as the baseline result.

From the results, we firstly show the giving price elasticity in Korea. However, many things to be considered are remaining. To understand the giving behavior and to contribute the policy making, more sophisticated research is needed.

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A Additional Figures and Tables

B Appendix B: Estimate Elasiticity Using Subsample

B.1 Sample Selection Bias Correction

This supplement estimates price elasticity using data from only those who have applied for tax relief. If there is both a year in which the same individual applied for tax relief and a year when it did not, we use only the year when the person applied for the relief.

Since deduction applications are endogenous as described in this paper, subsample estimation involves a sample selection bias. To formally demonstrate this bias, consider the following model:

$$Y_{it} = \beta X_{it} + \mu_{i1} + \lambda_{t1} + e_{it1}, \tag{10}$$

$$R_{it} = 1[\gamma_1 Z_{it} + \gamma_2 X_{it} + \mu_{i2} + \lambda_{t2} + e_{it2} > 0]. \tag{11}$$

where Y_{it} is the logged value of giving amount ($\ln g_{it}$), X_{it} is the logged value of first giving price ($\ln p^f(y_{it})$), and R_{it} is the application dummy. Thus, β represents the price elasticity of giving, which is our parameter of interest. Z_{it} is the wage earner dummy, an instrument that allows arbitrary corrleation with μ_{i1} and λ_{i1} but holds that exogeneity with respect to u_{i1}. μ_i and η_t is individual and time fixed effect, respectively. e_{it} is error term. Assume that $E(e_{it1}|Z_{it}, X_{it}, \mu_{i1}, \lambda_{i1}) = 0$. Note that, to clarify the problem, we intentionally do not model covariates such as income.

Since we estimate the model only for those who applied for the deduction, the conditional expectation of the outcome equation is as follows:

$$E(Y_{it}|Z_{it}, X_{it}, \mu_{i1}, \lambda_{i1}, R_{it} = 1) = \beta X_{it} + \mu_{i1} + \lambda_{t1} + E(e_{it1}|Z_{it}, X_{it}, \mu_{i1}, \lambda_{i1}, R_{it} = 1). \tag{12}$$

The fixed effect estimator of β is unbiased only if $E(e_{it1}|Z_{it}, X_{it}, \mu_{i1}, \lambda_{i1}, R_{it} = 1) = 0$. However, it is difficult to assume that the idiosyncratic error of the donation amount is independent of the tax deduction application due to the simultaneous determination of the tax deduction application and the donation amount. Therefore, using the control function approach, we eliminate this selection bias.

This approach makes the following assumptions about the error term of the outcome variable:

$$E(e_{it1}|Z_{it}, X_{it}, \mu_{i1}, \lambda_{t1}, e_{it2}) = E(e_{it1}|e_{it2}) = \rho e_{it2}. \tag{13}$$

This equation suggests two assumptions. First, the two fixed effects, μ_{i1} and λ_{t1}, and observables,

Table 8: First Price Elasiticities for Those Who Apply to Tax Relief

	(1)	(2)	(3)	(4)	(5)
log(first price)	-1.325***	-1.603***	-1.437***	-1.304***	-1.501***
	(0.386)	(0.422)	(0.522)	(0.384)	(0.542)
log(annual taxable income)	2.030	4.814**	4.898**	1.575	1.554
	(1.515)	(2.333)	(2.355)	(1.863)	(1.857)
log(first price) x IMR			-0.254		0.333
			(0.645)		(0.714)
IMR		0.320	0.286	-0.044	0.012
		(0.202)	(0.186)	(0.137)	(0.183)
Num.Obs.	3646	3643	3643	3643	3643
R2 Adj.	0.726	0.726	0.726	0.725	0.725
FE: area	X	X	X	X	X
FE: industry	X	X	X	X	X
FE: panelid	X	X	X	X	X
FE: year	X	X	X	X	X
Square age	X	X	X	X	X
Method of IMR		Pooled	Pooled	Separate	Separate

(X_{it}, Z_{it}) are independent of the two error terms, (e_{it1}, e_{it2}). Second, e_{it1} is linearly correlated with e_{it2}, the degree of which is constant with respect to time.

Under this assumption, we can write the conditional expectation of the error term, e_{it1}, as follows:

$$E(e_{it1}|Z_{it}, X_{it}, \mu_{i1}, \lambda_{t1}, R_{it} = 1) = \rho E(e_{it2}|Z_{it}, X_{it}, R_{it} = 1). \tag{14}$$

Thus, the estimation model that eliminates the selection bias is as follows:

$$Y_{it} = \beta X_{it} + \mu_{i1} + \lambda_{t1} + \rho E(e_{it2}|Z_{it}, X_{it}, R_{it} = 1) + u_{it1}, \tag{15}$$

where, by construction, $E(u_{it1}|Z_{it}, X_{it}, R_{it} = 1) = 0$. If we knew $E(e_{it2}|Z_{it}, X_{it}, R_{it} = 1)$, then we can obtaine unbiased estimator of β. The correction term $E(e_{it2}|Z_{it}, X_{it}, R_{it} = 1)$ can be obtained by the inverse Mills ratio. To calculate the inverse Mills ratio, we use the probit estimation shown in 2 in Appendix A (pooled model and separate model).

B.2 Results

Table 8 shows the estimation results of price elasticity. Model (1) does not add a selection correction term, while models (2) and (4) add it to the explanatory variables. We obtain the inverse

mills ratio from the pooled probit model and the separated probit model, respectively. Since the coefficient of the correction term is statistically insignificant, the selection bias of the application of tax relief is not severe. Therefore, the estimated elasticity is in the range of -1.3 to -1.6 with or without the correction term. The estimated value is very close to the result of this paper.

Models (3) and (5) considered the heterogeneity of price elasticity among individuals. Based on the model in the previous subsection, we can write a (correlated) random coefficient model that allows this heterogeneity as follows:

$$Y_{it} = \bar{\beta} X_{it} + \mu_{i1} + \lambda_{t1} + \rho E(e_{it2}|Z_{it}, X_{it}, R_{it} = 1) + \{(\beta_i - \bar{\beta}) X_{it} + u_{it1}\}, \tag{16}$$

where $\bar{\beta} = E(\beta_i | R_i = 1)$. Then, since $(\beta_i - \bar{\beta}) X_{it}$ is included in the error term, we cannot obtain unbiased estimator of $\bar{\beta}$, which is a parameter of our interest, by controlling only the selection correction term.

Wooldridge (2015) proposes an estimation method that solves this problem by making the following assumptions in the elements of this new error term:

$$E(\beta_i - \bar{\beta} | Z_{it}, X_{it}, \mu_{i1}, \lambda_{t1}, e_{it2}) = E(\beta_i - \bar{\beta} | e_{it2}) = \eta e_{it2}. \tag{17}$$

Thus, the estimation model that eliminates both the selection bias and the bias from random coefficient is as follows:

$$\begin{aligned} Y_{it} =& \beta X_{it} + \mu_{i1} + \lambda_{t1} && (18) \\ &+ \rho \lambda(Z_{it}, X_{it}) + \eta \lambda(Z_{it}, X_{it}) \times X_{it} + \tilde{u}_{it1}, && (19) \end{aligned}$$

where $\lambda(Z_{it}, X_{it})$ is the inverse Mills ratio. Note that $E(\tilde{u}_{it1} | Z_{it}, X_{it}, R_{it} = 1) = 0$ by construction. Therefore, by simply adding an intersection between the correction term and the giving price to models (3) and (4), we can eliminate the bias resulting from the heterogeneous elasticity and estimate the unbiased average elasticity.

The average elasticity estimated by models (3) and (5) is about -1.5, which is consistent with the results of this paper. Also, since the coefficients of the intersection term between the correction term and the giving price are statistically insignificant, the price elasticity is unlikely to vary significantly among individuals.

We show the results of the same robustness test as in this paper in Tables 9 and 10. To eliminate the announcement effect of the 2014 tax reform, Table 9 shows estimates excluding 2013 and 2014

Table 9: First Price Elasiticities for Those Who Apply to Tax Relief (Exclude sample observed in 2013 and 2014)

	(1)	(2)	(3)	(4)	(5)
log(first price)	-1.451**	-1.296**	-1.203	-1.406**	-1.457*
	(0.587)	(0.649)	(0.804)	(0.588)	(0.873)
log(annual taxable income)	1.399	0.215	0.346	1.087	1.072
	(1.979)	(2.780)	(2.884)	(2.463)	(2.450)
log(first price) x IMR			-0.158		0.089
			(1.025)		(1.293)
IMR		-0.122	-0.135	-0.024	-0.010
		(0.290)	(0.299)	(0.196)	(0.294)
Num.Obs.	2443	2441	2441	2441	2441
R2 Adj.	0.732	0.733	0.733	0.733	0.733
FE: area	X	X	X	X	X
FE: industry	X	X	X	X	X
FE: panelid	X	X	X	X	X
FE: year	X	X	X	X	X
Square age	X	X	X	X	X
Method of IMR		Pooled	Pooled	Separate	Separate

Table 10: Last Price Elasiticities for Those Who Apply to Tax Relief

	(1)	(2)	(3)
log(last price)	-1.454***	-1.790***	-1.429***
	(0.446)	(0.500)	(0.443)
log(annual taxable income)	1.914	5.181*	1.489
	(1.528)	(2.765)	(1.878)
IMR		0.382	-0.042
		(0.267)	(0.144)
Num.Obs.	3539	3536	3536
R2 Adj.	0.721	0.721	0.721
FE: area	X	X	X
FE: industry	X	X	X
FE: panelid	X	X	X
FE: year	X	X	X
Square age	X	X	X
Method of IMR		Pool	Separate

Table 11: k-th difference model

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8
Difference of first price	-1.923*	-0.324	-0.256	-2.416***	-1.004	-0.936	-3.987***	-1.56
	(1.101)	(0.682)	(0.663)	(0.915)	(0.645)	(0.636)	(0.745)	(0.5
Difference of annual income	1.232	3.929	3.528	7.614*	4.249	4.744	5.051*	0.2
	(3.628)	(2.982)	(2.932)	(4.540)	(2.979)	(3.353)	(3.012)	(2.1
IMR		0.086	0.031		0.090	0.121		-0.2
		(0.141)	(0.128)		(0.149)	(0.184)		(0.1
Num.Obs.	3551	1700	1700	3440	1134	1134	3325	81
R2 Adj.	0.022	-0.005	-0.006	0.030	-0.014	-0.014	0.032	0.0
FE: area	X	X	X	X	X	X	X	X
FE: industry	X	X	X	X	X	X	X	X
FE: year	X	X	X	X	X	X	X	X
Difference of square age	X	X	X	X	X	X	X	X
Lag	1-year	1-year	1-year	2-year	2-year	2-year	3-year	3-y
Method of IMR		Pool	Separate		Pool	Separate		Po

data. As a result, the selection bias and the bias from the heterogeneous elasticity are not large. Using the inverse mills ratio by the pooled probit model, the price elasticity is about -1.2. Given the heterogeneity of elasticity, this price elasticity is statistically insignificant. Moreover, when we use the inverse mills ratio by the separated probit model, the price elasticity is about -1.4, which is statistically significant. Table 10 shows the estimation results of the last-price elasticity. As a result, the elasticity is in the range of -1.4 to -1.8, which is similar to the result shown in this paper.

In addition to the same robustness test as in this paper, the results of the other two robustness tests are shown in Tables 11 and **??**. Table 11 is an analysis dealing with the endogeneity of first-price by income manipulation. Since income is generally endogenous, the first-price of giving is also an endogenous variable. Under the income deduction system, changes in income affect donations through the income effect and the giving price through marginal tax rates (Auten et al., 2002; Bakija and Heim, 2011; Randolph, 1995). Therefore, following Almunia et al. (2020) and Bakija and Heim (2011), we estimate the following k-th difference model:

$$\Delta^k \ln g_{it} = \varepsilon_p \Delta^k \ln p^f_{it}(y_{it}) + \varepsilon_y \Delta^k \ln y_{it} + \Delta^k X_{it}\beta + \mu_i + \iota_t + v_{it}, \tag{20}$$

where $\Delta^k \ln g_{it} = \ln(g_{it}/g_{it-k})$, and $\Delta^k \ln y_{it} = \ln(y_{it}/y_{it-k})$. The variable $\Delta^k p^f_{it}(y_{it}) = \ln(p^f_{it}(y_{it})/p^f_{it-k}(y_{it-k}))$ is instumented by $\ln(p^f_{it}(y_{it-k})/p^f_{it-k}(y_{it-k}))$.

As a result, the price elasticity changes greatly depending on the correction term of the selection, but the degree of the selection bias is not large. In addition, when we add the correction term,

Table 12: First Price Elasiticities for Those Who Apply to Tax Relief

	(1)	(2)
log(first giving price)	-0.235	-0.377
	(0.872)	(1.191)
log(annual taxable income)	-0.200	2.353
	(5.532)	(16.995)
Num.Obs.	849	849
R2 Adj.	0.784	0.783
FE: area	X	X
FE: industry	X	X
FE: panelid	X	X
FE: year	X	X
Square age	X	X

the price elasticity is about -1.5 in the 3-year difference model, which is similar to the result of this paper. However, in the 1-year difference model and 2-year difference model, the absolute value of price elasticity is less than 1, which is statistically insignificant. Therefore, the value of price elasticity is unstable for the number of years of lag.

Table 12 adds lagged and future changes of giving price and income to the explanatory variables to directly control the dynamic effects of price and income changes on donations (proposed by Bakija and Heim (2011)). As a result, price elasticity is statistically insignificant. However, because our data is unbalanced panel data, the sample size is quite small. In that respect, the results of this analysis are unreliable.