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Tax-Price Elasticities of Charitable Giving and Selection of Declaration: Panel Study of South Korea

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Tax-Price Elasticities of Charitable Giving and Selection of Declaration: Panel Study of South Korea *

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Abstract

In this study, we estimate the tax-price elasticity of charitable giving and address the bias caused by the existence of unreported donations and self-selection to the declaration of giving. To eliminate this bias, we propose a simple estimation method based on intention-to-treat analysis. Using our proposed method and the exogenous variation in tax incentives in the 2014 South Korean tax reform, we estimate the price elasticity of donations to be -1.6 for the intensive margin and -2.6 for the extensive margin, which are more elastic than the standard results that do not account for unreported donations and self-selection. The result implies that the 2014 tax reform reduced the total amount of giving and that tax incentives should be expanded.

Keywords: Charitable giving, Tax incentives, Price elasticity, Selection, Declaration

JEL Codes: D64, H24, H31

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1 Introduction

In many countries, governments provide tax relief for charitable giving to encourage the private provision of goods considered beneficial for society. To evaluate this policy, many papers attempt to estimate the price elasticity of giving using tax record data (e.g. Almunia et al., 2020). However, not all donations are recorded and reported to the tax authorities. In the U.S., 35 percent of total individual giving is estimated to be undeclared giving (Giving USA Foundation, 2022, p.337). Therefore, the price elasticity of giving estimated using tax record data is actually the price elasticity of reported giving and differs from the price elasticity of total giving, which is considered a key measure for assessing the optimality of tax expenditure on giving (Saez, 2004; Fack and Landais, 2016).

Unfortunately, this problem cannot be solved by a simple regression using panel survey data with undeclared giving data because the decision to declare giving is self-selected by taxpayers and a simple regression will be affected by selection bias. Moreover, even if the self-selection problem is solved, changes in the price of giving may be endogenous without the exogenous policy change regarding the price of giving. Therefore, the price elasticity estimates will be biased in a simple regression.

In this paper, we estimate the price elasticity of total giving while recognizing that declaring giving is self-selected and exploiting an exogenous policy change in Korea. In Korea, the tax relief for charitable giving was changed from an income deduction to a tax credit in 2014, and this policy change exogenously creates variation in the price of giving.

To address the self-selection issue, we offer an estimation that mitigates selection bias by defining two prices of giving, depending on whether the giving declaration is considered: One is applicable for all taxpayers if declared, which we call "the applicable price"; the other is effective only for declarers, which we call "the effective price". They differ in that the effective price depends on taxpayers' self-selection, whereas the applicable price does not since the applicable price is calculated as if all taxpayers declared their giving.[1]

Because the 2014 tax reform generates exogenous variation in the applicable prices, the estimation of the applicable price elasticity of total giving should not suffer from self-selection bias and is equivalent to the estimand called intention-to-treat (ITT). However, it differs from the price elasticity of total giving because the applicable price is the price of giving that assumes

[1] For example, when reporting their giving allows taxpayers to reduce their giving price from 1 to $1-q$, the applicable price is always $1-q$ (because $1-q$ is applicable if the giving is declared), and the effective price is $1-q$ if the giving is declared and 1 if it is not declared (because the effective price depends on the reporting status).

that all taxpayers report their giving. Instead of the applicable price, the estimation based on the effective price will return the price elasticity of total giving, but the simple regression will fail since the effective price depends on the self-selection. Corresponding to this issue, we propose the two-stage least squares (2SLS) estimation where the effective price is the endogenous variable and the applicable price is an instrument. We theoretically predict that the effective price elasticity will be more elastic than the applicable price elasticity.

We use household survey panel data from Korea called the National Survey of Tax and Benefit (NaSTaB), which include the total amount of giving and whether a taxpayer declared the giving.[2] From this data, we obtain both applicable and effective prices of giving and estimate that the price elasticity of total giving is -1.599 on the intensive margin. This value is more elastic than -1, which is the standard result in the empirical literature on the elasticity of the price of giving. In addition to the intensive margin, we also estimate the elasticity of the price of total giving on the extensive margin following Almunia et al. (2020) and the estimate is -2.639, which is also more elastic than the standard result.

These elastic estimates may arise because that the standard results using tax records estimate the price elasticity of reported giving, which differs from the price elasticity of total giving. In theory, Fack and Landais (2016) suggest that, if some taxpayers do not declare their giving, "the elasticity of reported contributions may appear too small, and lead to an inefficiently low level of the subsidy." (Fack and Landais, 2016, p.27) Along with this prediction, we find that the price elasticities of reported giving estimated by our data are less elastic than the estimated price elasticities of total giving.[3] As existing theoretical studies recommend increasing the subsidy on giving when the price elasticity of total giving is greater than -1 (Saez, 2004; Fack and Landais, 2016; Almunia et al., 2020), we conclude that tax expenditure on charitable giving should be expanded in Korea. Moreover, our data imply that the effective price of giving increased and the amount of giving decreased due to the 2014 tax reform in Korea.

In addition, we present several robustness checks in line with the various estimation issues addressed in the literature, which include the change in the price of giving by manipulating the amount of giving and income and the announcement effect, while the baseline analyses already address some of these issues.

[2]"National Survey of Tax and Benefit," Korea Institute of Public Finance, `https://www.kipf.re.kr/panel/` (in Korean).

[3]In our data, the estimated price elasticities of reported giving are -1.147 on the intensive margin and -1.982 on the extensive margin. Note that, although Fack and Landais (2016) suggest a difference in the price elasticity of reported and total giving, their focus is not on the existence of unreported giving but on falsely overreported giving. Hence, they use tax record data rather than panel survey data.

Our paper relates to the literature on the price elasticity of giving, in particular some recent papers that use policy change as a source of identification using tax record data.[4] Almunia et al. (2020) utilize the change in income tax rates in the U.K..[5] Fack and Landais (2010) and Fack and Landais (2016) use the change in the tax credit rate and the cost of reporting in France, respectively.[6] We contribute to this strand by using panel survey data and capturing total giving, including undeclared giving without structural settings.[7]

In addition to studies using tax records, there is also a large body of work using panel survey data. Most extant studies in this strand use U.S. panel survey data and capture undeclared giving (Rehavi and Shack, 2013; Zampelli and Yen, 2017; Backus and Grant, 2019).[8] In particular, Rehavi and Shack (2013) and Backus and Grant (2019) are similar to this paper in that they each address the issue of declaration, although they do not utilize an exogenous price shock such as policy changes for identification.[9] Our paper contributes to this strand by considering the self-selection issue and a policy change as the identification strategy.

Our paper also closely relates to Duquette (2016), who exploits policy changes in state income tax rates in the U.S. and circumvents the issue of giving declarations by using charities' data. Our result is consistent with Duquette (2016) in that the estimated elasticity of the price of giving is more elastic than the standard result, -1.

Our novelty in the literature on the elasticity of the price of giving is that we consider the self-selection bias generated by the fact that the declaring giving is optional. Although some recent studies address this issue by modeling taxpayer behavior[10], we address the self-selection issue by proposing a simple 2SLS method. This method also contributes to the growing literature

[4]Note that our focus is on the price elasticity of giving. In the literature on giving behavior, Hong and Kang (2022) examine the effect of the 2014 Korean tax reform on giving behavior using NaSTaB data as we do, but they do not derive price elasticities of giving or address the self-selection problem.

[5]Note that Almunia et al. (2020) are aware that unreported giving is not captured in the tax record data and address this by using structural estimation, which is not required in our approach.

[6]In addition, Gillitzer and Skov (2018) focus on the policy changes in Denmark that change the cost of declaring giving. However, they do not estimate the price elasticity of giving.

[7]Related to this, many papers use the tax record data (e.g. Auten, Sieg and Clotfelter, 2002; Bakija and Heim, 2011; Randolph, 1995). Many of them use the change in the price of giving by income fluctuation as a source of identification.

[8]Using data from the U.S., Brown, Harris and Taylor (2012) and Brown et al. (2015) examine the determinant of donations for the 2004 Indian Ocean tsunami and the giving behavior of poor and wealthy taxpayers, respectively, by constructing structural models.

[9]Moreover, Rehavi and Shack (2013) uses a simple regression in which the effective price is a regressor on giving, which may introduce a self-selection problem. Backus and Grant (2019) focus on the problem in the US context that taxpayers cannot combine the standard deduction with other deductions.

[10]Almunia et al. (2020) construct a structural model with a self-selection process and estimate a fixed cost for declaring giving. Backus and Grant (2019) addresses the endogeneity issue generated by the fact that the giving declaration is selected depending on the amount of other tax relief measures in the U.S. tax system.

addressing the declaration costs of tax expenditures (Fack and Landais, 2016; Gillitzer and Skov, 2018; Tazhitdinova, 2018; Benzarti, 2020) and the choice to claim tax incentives (Zwick, 2021; Orihara and Suzuki, 2023), such as tax breaks for R&D investment, in that this method allows us to accurately estimate the price elasticity of tax expenditures given the presence of undeclared items.

This paper consists of six sections. Sections 2 and 3 explain the institutional background and data, respectively. Section 4 proposes a simple 2SLS model based on the ITT analysis. Section 5 examines the applicable and effective price elasticities based on 2SLS estimation, presents several robustness checks and discusses our results. Section 6 concludes the paper.

2 Institutional Background

In this section, we first describe the 2014 tax reform in Korea used as an identification strategy for estimating price elasticities. Next, we state that the application for tax incentives.

2.1 2014 Tax Reform

The Korean tax system offers tax incentives for charitable giving in the income tax. To explain how tax incentives determine the price of giving, we introduce a simple budget constraint. Assume that a taxpayer with pretax income, y_i, has a choice between private consumption, x_i, and charitable giving, g_i. When a taxpayer decides to declare charitable giving, the budget constraint that the taxpayer faces is $x_i + g_i = y_i - T(y_i, g_i)$, where T is the tax amount that depends on the pretax income and charitable giving. Since the marginal income tax rate is progressive in Korea, we assume that $T(\cdot, \cdot)$ satisfy $T_y(\cdot, \cdot) > 0$ and $T_{yy}(\cdot, \cdot) > 0$, where the subscript means partial differentiation.

[Table 1 about here.]

Before 2014, the tax relief system for charitable giving in Korea was an income deduction. This system reduced the amount of taxable income before determining the marginal income tax rate. Thus, the amount of tax is $T(y_i, g_i) = T(y_i - g_i)$ when taxpayers claim. The total differential of the budget constraint with respect to x_i and g_i is $dx_i + (1 - T'(y_i - g_i))dg_i = 0$. This leads to the price of giving (relative to private consumption), $1 - T'(y_i - g_i)$. Since the marginal income tax rate is progressively determined as shown in Table 1, taxpayers facing a higher marginal income tax rate can enjoy a lower giving price for each 1 KRW donation. In other words, the price of giving was regressive before 2014.[11]

In 2014, to relax the regressivity of the prices of giving, the Korean government reformed the tax system, where a tax credit was introduced instead of an income deduction. The new tax relief system directly reduces the amount of tax. That is, the amount of tax is $T(y_i, g_i) = T(y_i) - mg_i$, where m is the tax credit rate. Thus, the total differential of the budget constraint leads to the relative giving price, $1 - m$. The Korean government allows 15 percent of the total amount of declared charitable giving as a tax credit ($m = 0.15$), which means that the price of giving from 2014 was 0.85 KRW for each 1 KRW of donation regardless of income level.[12][13]

In short, the applicable price of giving, which is the price of giving that can be applied after the declaration, is $1-q$, where q represents tax incentives. The tax incentives were $q = T'(y_i - g_i)$ before 2014 and $q = m = 0.15$ after 2014. Therefore, high-income households, whose income tax rate was more than 15 percent before 2014 (income brackets (C)–(G) in Table 1 in 2013), face a higher price of giving due to the 2014 tax reform. On the other hand, low-income households, whose (average) income tax rate was less than 15 percent (income bracket (A) in Table 1 in 2013), faced lower prices of giving due to the 2014 tax reform. Finally, among middle-income households, whose income tax rate was equal to 15 percent (income bracket (B) in Table 1 in 2013), the 2014 tax reform does not affect the price of giving. We exploit the variation in the price of giving generated by the 2014 tax reform as our main identification source to estimate the elasticity of the price of giving.

2.2 Process of Declaration

In estimating the price elasticity of total giving, including unreported giving, an important but often ignored aspect is that receiving a tax incentive depends on the taxpayer's choice. If taxpayers donate but do not declare it, their tax amount is $T(y_i)$; thus, they cannot obtain the tax incentive. Then, given the optimal claiming status, the effective giving price, which is the

[11] In the income deduction regime, there was a limitation that no deduction was allowed for donations exceeding a certain percentage of income: it was 15% in 2008-2010; 20% in 2011; and 30% in 2012-2013. Similarly, tax relief for religious-related donations was allowed if it was within 10 % of income. To exclude the effect of the limitation, we omit claimants donating more than 10% of their income from the sample, which consists of approximately 3% of all taxpayers in the data.

[12] During the transition period, taxpayers were able to declare donations made prior to 2014 after 2014. In this case, the taxpayer would still be eligible for the income deduction system.

[13] Note that, with the introduction of the tax credit in 2014, the tax credit rate for donations exceeding KRW 30 million was set at 25 percent. We omit these data from the analysis sample, although such large donations are rarely observed in our sample (approximately 0.03%).

actual donation price the taxpayer faces, is $p = 1 - Rq$, where R is a dummy variable that takes one if taxpayers report their donations and zero otherwise.

We provide an overview of the process for declaring giving in Korea. In Korea, personal income tax is assessed for one year, from 1 January to 31 December. In principle, taxpayers submit their income tax returns and pay income taxes in May of the following year. Moreover, unlike the U.S., wage earners have additional chance to report their giving through the year-end settlements in January or February of the following year.

This complex process would impose significant costs on taxpayers. Indeed, Table 2 shows that only approximately half of all donors receive tax incentives. This means that reported giving may be a part of total giving. Thus, we would expect the price elasticity of total giving, which is considered an important parameter for assessing the optimality of the tax system, to differ from the price elasticity of reported giving.

In estimating the price elasticity of total giving, even if the 2014 tax reform creates an exogenous variation in tax incentives q, the effective price of giving p is endogenous due to the self-selection of declaration, R. Section 4 presents a way to solve this endogenous problem using only exogenous variation in q.

3 Data

This study uses the NaSTaB, conducted by the Korea Institute of Taxation and Finance since 2008, which is annual panel data on household tax burden and public assistance. The survey targets 5,634 households nationwide, with household heads and economically active household members aged 15 or older. The survey asks about income, charitable giving, demographics such as years of education, and attitudes toward the tax system.

3.1 Study Sample

To focus on an exogenous change in the price of giving due to the 2014 tax reform, we use 2010–2017 NaSTaB data, excluding observations in income brackets (F) and (G) shown in Table 1. This sample exclusion ensures that within-individual changes in the price of giving depend only on intertemporal income changes (before 2014) and the 2014 tax reform.

[Table 2 about here.]

[Figure 1 about here.]

In addition, to focus on taxable respondents who have sufficient income and assets, we use respondents aged 24 or older who are not unpaid family workers, housewives, or students.[14] We present descriptive statistics for the study sample in Table 2. The analysis sample consists primarily of older men. Approximately 70 percent of the analysis sample is male, and the average age is 51. The average pretax gross income is KRW 30 million, similar to the average income shown in the National Tax Statistical Yearbook 2012-2018 published by the Korean National Tax Service (KRW 32.77 million). Figure 1 shows the pretax gross income distribution for 2013.

3.2 Key Variables: Price of Giving, Giving Behavior, and Claiming Status

The solid stepwise line and the dashed horizontal line in Figure 1 are the prices of giving when taxpayers declare their giving (applicable prices of giving). The solid stepwise line shows the applicable prices of giving for the income deduction period (2010–2013), and the dashed horizontal line shows the applicable prices for the tax credit period (2014–2017). As stated in Section 2, the changes in tax incentives due to the 2014 tax reform differ for three income groups. The first income group is below KRW 12 million (Bracket (A)), for which the tax reform expanded tax incentives and decreased the applicable prices of giving. The second group is between KRW 12 million and KRW 46 million (Bracket (B)), for which the tax reform did not affect tax incentives and the applicable prices of giving. The last group is above KRW 46 million (Brackets (C), (D), and (E)), for which the tax reform reduced tax incentives and increased the applicable prices of giving. Exploiting this variation, we identify the price elasticity of donations based on DID analysis.

[Figure 2 about here.]

The two outcome variables that capture donation behavior are the amount of giving and a dummy variable indicating donors. Table 2 shows that the average donation amount is KRW 360,000 (equivalent to USD 300), approximately 1.1 percent of pretax gross income. In comparison, the amount in the United Kingdom is 0.5 percent (Almunia et al., 2020), and that in

[14] We also impose exclusion conditions on donations. First, we exclude observations where donations exceed total income. Second, we exclude claimants whose total donations exceed the limit for religious donations (10% of their income), recognizing that the price of giving for religious donations exceeding the limits differs from the standard price of giving explained in Section 2.1. See also footnote 11.

the United States is 1.5 percent (Backus and Grant, 2019). In addition, the proportion of donors is 23 percent.

Figure 2 divides the sample by income bracket based on gross income in 2013 and shows changes in average donation amounts (Panel A) and donor ratios (Panel B) in each group. The increase in average donation amounts and proportion of donors in Bracket (A), where the applicable price of giving decreased after the tax reform, was more significant than that in Bracket (B), where the applicable prices of giving remained unchanged after the tax reform. On the other hand, the increase in average donations and donor ratios in Brackets (C)–(E), where the applicable prices of giving increased following the tax reform, was smaller than that in Bracket (B). Thus, we expect a standard price effect on donation behavior.

[Figure 3 about here.]

In addition to income, the price of giving, and giving behavior, another important variable is declaration status. Since NaSTaB examines whether a taxpayer declared a charitable contribution in each year-end adjustment and tax return system, we create a dummy variable that takes value one if the taxpayer declared their giving in either system. We use this variable to identify the price that individuals actually face (effective price of giving). If taxpayers declare, the effective price will be equivalent to the applicable price shown in Figure 1; otherwise, the effective price is 1. Table 2 shows that the proportion of declaration is 11 percent, indicating that only approximately half of all donors declare their giving. Figure 3 shows the percentage of declaration in each income bracket. After the introduction of the tax credit system, the percentage of claims in Bracket (A) remained almost unchanged, while declaration in other brackets decreased. Note that this trend cannot be explained by changes in the donor ratio, as this trend is also observed in the declaration rates among donors (see Figure A1 in Appendix A).

4 Estimating Price Elasticities

4.1 Estimation Model and Parameter of Interest

Our aim is to obtain unbiased price elasticities of total giving. In this section, we provide a simple method to estimate them. To begin, we clarify the parameters of interest. As introduced in Section 2, the effective price of individual i in year t is $p_{it} = 1 - R_{it} q_{it}$, where R_{it} is a dummy variable indicating declaration of giving and q_{it} represents the tax incentives. Outcome variables, Y_{it}, are determined by the following two-way fixed effects model:

$$Y_{it} = \mu_i + \theta_t + \beta_e \ln p_{it} + \delta X_{it} + \epsilon_{it}, \tag{1}$$

where μ_i, θ_t, and X_{it} are individual fixed effects, year fixed effects, and a vector of covariates (including pretax income, y_{it}), respectively. The term ϵ_{it} is an idiosyncratic error.

Our parameter of interest is a coefficient β_e. Using this estimate, we obtain the *effective price elasticities* (price elasticities of total giving). As in previous studies (e.g. Backus and Grant, 2019; Almunia et al., 2020), we estimate two types of elasticities. The first is the intensive-margin price elasticity, which indicates the percentage by which a 1 percent price increase leads to an increase in the amount donors give. In this estimation, we restrict our sample to donors and use the log value of donations, $\ln g_{it}$, as the outcome variable. Then, the coefficient β_e indicates the price elasticity.

The second is the extensive-margin price elasticity, which indicates the percent by which the donor ratio increases with a 1 percent price increase. For estimation, we include donors and non-donors in our analysis sample and use a dummy variable $D_{it} = 1[g_{it} > 0]$ indicating donors as the outcome variable following Almunia et al. (2020). Because we have a binary outcome variable, we cannot interpret the coefficient β_e in this estimation as an elasticity. Therefore, using the estimate β_e, we obtain the implied extensive-margin price elasticity as $\hat{\beta}_e/\bar{D}$, where $\bar{D}$ is the sample mean of D_{it}.

Since declaration, R_{it}, depends on the taxpayer's decision, the effective price can be endogenous due to selection into declaration. Thus, standard fixed effects models (1) may estimate a biased β_e. In the next subsection, we propose a simple method to obtain an unbiased β_e, aided by ITT analysis.

4.2 Recovering Effective Price Elasticities

ITT analysis recognizes that some people assigned to treatment will not actually receive treatment and examines the effect of providing the opportunity to receive treatment. We can estimate this effect using an estimation model that assumes that all people assigned to treatment receive treatment. In our context, we recognize that some taxpayers who are eligible for tax benefits do not actually receive them. Then, assuming that all taxpayers receive tax incentives ($R_{it} = 1$ for all i, t), we estimate the following model:

$$Y_{it} = \mu_i + \theta_t + \beta_a \ln(1 - q_{it}) + \delta_a X_{it} + \eta_{it}. \tag{2}$$

The variable $\ln(1 - q_{it})$ is the log value of applicable prices. We refer to the price elasticity using the coefficient β_a estimated in Equation (2) as an *applicable price elasticity*. For estimation of the applicable price elasticities, our identification strategy is a DID model exploiting the exogenous change in tax incentives q_{it} due to the 2014 tax reform. Thus, the standard fixed effects model (2) obtains unbiased applicable price elasticities.

The applicable price elasticity may be a valuable measure for the policy evaluation of tax reform because policymakers cannot directly manipulate individual declaration choices. When policymakers implement a reduction in tax incentives equivalent to a 1 percent increase in donation prices, the amount of donors' giving changes by $\hat{\beta}_a$ percent (intensive margin), and the donor ratio changes by $(\hat{\beta}_a/\bar{D})$ percent (extensive margin).

However, the applicable price elasticity differs from our parameter of interest, β_e, the effective price elasticity, since the ITT analysis assumes that even non-applicants for tax incentives receive tax incentives. To illustrate this point, we derive the estimator of β_a. By the regression anatomy theorem (Angrist and Pischke, 2008), the estimator of β_a is

$$\hat{\beta_a} = \frac{\text{Cov}(Y_{it}, \hat{r}_{it})}{\text{Var}(\hat{r}_{it})}, \tag{3}$$

where $\hat{r}_{it}$ is a residual of the following auxiliary regression model:

$$\ln(1 - q_{it}) = \mu_i + \theta_t + \lambda X_{it} + r_{it}. \tag{4}$$

Since the residual is a linear combination of all explanatory variables and fixed effects in Equation (4), the residual $\hat{r}_{it}$ should be uncorrelated with the explanatory variables and fixed effects in Equation (4). In addition, since the covariate vector includes gross income, which determines the income tax rate, the change in the residual should depend only on the 2014 tax reform. Therefore, we assume that the residual $\hat{r}_{it}$ is uncorrelated with the error term ϵ_{it} in Equation (1).

The ITT analysis estimates Equation (2), but the outcome variable Y_{it} is determined by

Equation (1). Thus, substituting Equation (1) into Equation (3) yields

$$\hat{\beta}_a = \frac{\text{Cov}(Y_{it}, \hat{r}_{it})}{\text{Var}(\hat{r}_{it})} = \frac{\text{Cov}(\beta_e \ln p_{it}, \hat{r}_{it})}{\text{Var}(\hat{r}_{it})} = \beta_e \cdot \frac{\text{Cov}(\ln p_{it}, \hat{r}_{it})}{\text{Var}(\hat{r}_{it})}. \tag{5}$$

Furthermore, since $\hat{r}_{it}$ is a residual of auxiliary regression (4), the regression anatomy theorem implies that the parameter $\text{Cov}(\ln p_{it}, \hat{r}_{it})/\text{Var}(\hat{r}_{it})$ is a coefficient γ_1 in the following model:

$$\ln p_{it} = \mu_i + \theta_t + \gamma_1 \ln(1 - q_{it}) + \gamma_2 X_{it} + u_{it}. \tag{6}$$

Thus, the applicable price elasticity is the product of two effects: (i) an effective price elasticity (parameter β_e) and (ii) the partial correlation between effective and applicable prices (parameter γ_1).

If the residual $\hat{r}_{it}$ and declaration of giving, R_{it}, are mean independent, then the parameter γ_1 will always be in the range from 0 to 1 (see Appendix B for the proof). In this case, the applicable price elasticity is more inelastic than the effective price elasticity. Furthermore, the fewer non-claimants there are, the stronger the correlation between effective and applicable prices, and the closer the values of the two elasticities. As an extreme example, when all taxpayers donate and declare, $\gamma_1 = 1$ because the effective price is equal to the applicable price. Therefore, Equation (5) implies that $\hat{\beta}_a = \beta_e$. Conversely, when no taxpayers declare, the logarithm of the effective price must be 0, and Equation (5) implies that $\hat{\beta}_a = 0$. In our data, half of the donors declare giving (Table 2), and non-donors cannot claim the deduction. Therefore, in our estimation of price elasticities, β_a should not be equal to β_e.

Equation (5) presents a way to recover the effective price elasticity from the applicable price elasticity. Since we can estimate Equations (2) and (6), we can obtain an estimate of the parameter β_a and γ_1. Thus, by computing β_a/γ_1, we can recover the coefficient β_e used to estimate the effective price elasticity. The parameter β_a/γ_1 is also a Wald estimator of β_e in the following two-stage model with fixed effects (FE-2SLS):

$$\begin{aligned} Y_{it} &= \mu_i + \theta_t + \beta_e \ln p_{it} + \delta X_{it} + \epsilon_{it}, \\ \ln p_{it} &= \mu_i + \theta_t + \gamma_1 \ln(1 - q_{it}) + \lambda X_{it} + u_{it}, \end{aligned} \tag{7}$$

Here, the logarithm of the applicable price, $\ln(1 - q_{it})$, is the instrumental variable for the endogenous variable, the logarithm of the effective price, $\ln p_{it}$. Again, once we control for income, $\ln(1 - q_{it})$ is independent of ϵ_{it}. Thus, $\ln(1 - q_{it})$ is a valid instrument for $\ln p_{it}$. We use Equation (7) as the main model to estimate the parameter β_e and obtain the effective price elasticity.

4.3 Other Issues

In addition to the issue of self-selection bias that has been discussed thus far, the estimation biases that have been highlighted in existing studies should be addressed. First, extant studies indicate that taxpayers may manipulate their marginal income tax rate, $T'(y_{it} - g_{it})$, by changing the amount of giving, g_{it}, and moving the tax bracket and the price of giving called the "last-won" price of giving (*last* price, hereafter) may be endogenous in the income deduction regime (e.g. Almunia et al., 2020). To avoid this, we calculate the "first-won" price of giving (*first* price, hereafter) using the marginal income tax rate $T'(y_{it})$ where the donation amount is set to zero and estimate the price elasticities using the first price in the baseline analysis. We also estimate the price elasticities using the last price by a FE-2SLS with the first price as an instrumental variable.

Second, we address the issue of tax bracket change by the manipulation of the pretax income. We exclude samples with a pretax income of KRW 1 million (equivalent to approximately USD 1,000) around the threshold for each bracket. This enables us to remove price changes due to income manipulation around the threshold of each tax bracket.

Third, although our primary focus is on the price effect of charitable giving, the (indirect) income effect may confound the estimate even when controlling for pretax income. This is because the change in the price of giving is driven by the change in the income level in the income deduction period, considering that the observed income is the synthesis of transitory and permanent incomes, and their effects on the price of giving may be different (Randolph, 1995; Auten, Sieg and Clotfelter, 2002; Bakija and Heim, 2011). Since the change in prices of giving in our estimate is driven by the 2014 tax reform, our identification strategy allows us to largely isolate the change in the price of giving from the change in income level. However, given that the price of giving might be changed by the income level under the income deduction system in 2010-2013, we perform two additional estimations as robustness checks. First, we exclude samples whose applicable prices of giving changed during the income deduction period. Second, we use only two periods, before and after the policy change. By construction, the price elasticity estimates in these analyses should not be affected by income fluctuations.

We summarize the results of the analyses addressing these issues in Section 5.2.

5 Results

5.1 Estimation Results

[Table 3 about here.]

Table 3 presents the estimation results for first-price elasticities. Columns (1)–(3) report the estimation results for the intensive-margin price elasticities. In this case, we estimate models using only donors as the sample, with the log value of donations as the outcome variable. Columns (4)–(6) present the estimation results for the extensive-margin price elasticities. We estimate models with donor dummies as the outcome variable, using donors and non-donors as the sample.

Columns (1) and (4) estimate the applicable price elasticities on the intensive and extensive margin, respectively. In Column (1), the estimated intensive-margin price elasticity is -1.082, which is statistically significant. In Column (4), the estimated value of the coefficient on the applicable price is -0.182, which is statistically significant. Since the outcome variable is binary, we cannot directly interpret this coefficient estimate as an extensive-margin price elasticity. Therefore, we calculate the implied price elasticity by dividing the coefficient value by the sample proportion of donors. As a result, the applicable price elasticity is $-0.783(= -0.182/0.23)$, which is also statistically significant. This implies that a reduction in tax incentives equivalent to a 1 percent increase in donation prices, the amount of donors' giving decreases by 1 percent and the donor ratio decreases by 0.8 percent.

Actually, only donors can declare, and only half of all donors declare, but in estimating the applicable price elasticity, we assume that everyone declares their giving, regardless of whether they donate. Thus, while the applicable price elasticity may be useful in discussing policy effects, it should be distinguished from the price elasticity of total giving, which is an important parameter in the welfare evaluation of tax policies.

Table A1 in Appendix A shows the estimation results of Equation (6) (equivalent to the first-stage equation of the FE-2SLS model (7)) for the intensive-margin price elasticity and the extensive-margin price elasticity. The results suggest that the applicable price elasticity is 0.7 times the effective price elasticity for the intensive-margin price elasticity. For the extensive-margin price elasticity, the applicable price elasticity is 0.3 times the effective price elasticity. Thus, we expect that effective price elasticities are more elastic than the applicable price elasticities. This motivates us to estimate the unbiased effective price elasticities by the

FE-2SLS model (7).

Columns (3) and (6) of Table 3 estimate the effective price elasticities for the intensive and extensive margin, respectively. In Column (3), the estimated intensive-margin price elasticity is -1.559, which is statistically significant. Thus, a 1 percent increase in the price of giving decreases the donor's contribution by 1.6 percent. This value is consistent with the ratio of the applicable price elasticity estimated in Column (1) to the estimated value of the parameter γ_1 in Equation (6) presented in Column (1) of Table A1 of Appendix A ($-1.072/0.688 = -1.558$). In addition, there is no weak instrumental variable problem in this estimation because the F-value of the instrument is sufficiently high. Therefore, the effective price elasticity estimated in Column (3) is reliable.

Column (6) indicates that the estimated coefficient on the effective price is -0.615, which is statistically significant. Dividing this value by the sample proportion of donors yields $-2.639(= -0.615/0.23)$. Thus, a 1 percent increase in the donation price decreases the donor ratio by 2.6 percent. This elasticity is quantitatively consistent with the ratio of the applicable price elasticity to the estimated value of the parameter γ_1 in Equation (6) presented in Column (2) of Table A1 of Appendix A ($-0.783/0.297 = -2.636$). In addition, there is no weak instrumental variable problem in this estimation because the F-value of the instrument is sufficiently high. Thus, the effective price elasticity estimated in Column (6) is reliable.

Columns (2) and (5) of Table 3 estimate the effective price elasticities using the standard FE model (1). The significant Wu-Hausman test results shown in Table 3 imply that these estimation results are affected by endogeneity. Given that the standard FE model does not consider selection bias in the declaration of giving, by comparing these FE results with that of the FE-2SLS model (7), we can discuss the direction of the selection bias in the effective price elasticity on the intensive and extensive margin, respectively. The estimate obtained in Column (2) is more inelastic than the unbiased effective price elasticity on the intensive margin in Column (3). This upward bias for the results in Column (2) suggests that the logarithm of the effective price, $\ln(1 - R_{it}q_{it})$, is positively correlated with the error term, ϵ_{it}, in Equation (1). Since the error term captures unobservable factors in giving behavior given Equation (1), Columns (2) and (3) suggest that self-selection into declaring giving and the unobservable factors of giving behavior are negatively correlated.[15]

The estimated price elasticity in Column (5) is more elastic than the unbiased effective price

[15]Note that, since the endogenous variable in $\ln(1 - R_{it}q_{it})$ is R_{it}, the positive correlation between $\ln(1 - R_{it}q_{it})$ and the error term means the negative correlation between R_{it} and the error term here.

elasticity for the extensive margin in Column (6). Given the similar discussion for the intensive margin, this suggests that the decision to declare is positively correlated with the unobservable factors of whether to donate. In fact, the positive correlation in the extensive margins may be natural, since only those who make the decision to donate can report their donations, and such a decision is partly driven by the unobservables. However, since further discussion is needed for the estimation bias of effective price elasticities and its implications for the intensive margin, we discuss them in Section 6.

5.2 Robustness

Last-Price Elasticities. As discussed in Section 4.3, the tax incentive in the income deduction period is the marginal income tax rate, which varies with the amount of the donation. The analysis thus far has used the marginal income tax rate in the case when the amount of giving is zero, $T'(y_{it})$, to calculate the price of giving (first prices). However, the actual effective and applicable prices (last prices) are calculated from the marginal income tax rate considering the actual amount of giving, $T'(y_{it} - g_{it})$. Thus, we estimate applicable and effective last-price elasticities. Since the last price depends on the amount of giving, we estimate an FE-2SLS model with the applicable first price as the instrumental variable. The results are quantitatively similar to the elasticities estimated in Table 3 (see Appendix C.1 for the results).

Excluding Announcement Effect. Since the Korean government announced the 2014 tax reform in 2013, intertemporal substitution may have occurred. Individuals who anticipated that the 2014 tax reform would result in higher donation prices may have reduced their donations after 2014 and increased their giving in 2013. Since this would introduce positive bias in the elasticity, the results in Table 3 show the lower bound of the elasticity in absolute value. To rule out these announcement effects, we exclude observations from 2013 and 2014 by assuming that intertemporal substitution occurs only in that period and estimate elasticities. While the estimated elasticities are somewhat elastic when we exclude the announcement effect, as expected, the results are in line with the baseline result when the standard error is taken into account (see Appendix C.2 for the results).

Remove price variation in income deduction period. The baseline analysis exploits within-individual price variation due to income changes in the income deduction period as well as the 2014 tax reform. Since the transitory or permanent nature of income changes can have different effects on price, the former price variation cannot isolate the effect on price from the (indirect) income effect. Since the latter price variation does not depend on income changes, this problem does not arise. To exploit only the price variation due to the 2014 tax reform, we conduct two subsample analyses. First, we exclude those whose prices changed during the income deduction period. Second, we use only data from 2012 and 2015. These methods yield similar baseline results (see Appendix C.3 for the results). However, the second method is marginally statistically significant due to the small sample.

5.3 Comparison with Price Elasticities of Reported Giving

Given that our panel data include undeclared contributions, our estimation of the effective price elasticities of total giving should differ from the price elasticities of declared giving, which is estimated in the previous papers using tax record data. To confirm this point, we estimated intensive-margin price elasticities for those who declared their giving (see Appendix C.4 for the results). This is equivalent to the price elasticity of declared giving, which previous papers have estimated.[16] We find that this elasticity is approximately -1, which is less elastic than our baseline estimation of the effective price elasticity of total giving. Moreover, this result is consistent with the fact that the previous papers using tax record data report that their estimates of the price elasticity are approximately -1 (e.g., Bakija and Heim, 2011; Fack and Landais, 2016; Almunia et al., 2020).

Our estimation of extensive-margin effective price elasticity, estimated by using the panel data, shows the price effect on the decision to donate. In contrast, the extensive-margin price elasticity estimated using tax record data shows the price effect on the decision to declare giving since the tax record data do not record undeclared giving. Thus, these elasticities should differ. To test this point, we estimate the price elasticity of the declaration (see Appendix C.5 for the results). We find that this elasticity is approximately -2, which is less elastic than the extensive-margin effective price elasticity of giving.

These results are consistent with the prediction of Fack and Landais (2016) that if contributions are underreported due to costs of declaration and other factors, the price elasticity of total giving will be more elastic than the price elasticity of declared giving.

5.4 Policy Implications

[Table 4 about here.]

[16] We implicitly assume that claimants report all contributions on their tax returns (no partial reporting).

We discuss policy implications, particularly the policy effects of the 2014 tax reform. Our estimates show that the amount of donations in South Korea decreased due to the 2014 tax reform, which is consistent with Hong and Kang (2022). Columns (2)–(6) of Table 4 show declaration rates and effective prices by income groups calculated from our data. In Bracket (A), the 2014 tax reform reduced the applicable price from 0.94 to 0.85 (−9.57% change). However, the effective price only decreased by 0.1% because the rate of declaration increased slightly from 2013 to 2014 but was too low (approximately 1%). In contrast, in Brackets (C) and (D)–(E), the 2014 tax reform increased the applicable price from 0.76 and 0.65 to 0.85 (11.84% and 30.77% change, respectively). Since claiming rates remain low in these brackets, the change in the effective price is smaller than the change in the applicable price. Overall, the effective price increased as a result of the 2014 tax reform.

The overall average increase in effective price suggests that the 2014 tax reform reduced giving behavior. We quantify the decline in charitable giving. By multiplying the effective price change by the effective price elasticities, we can estimate the percentage changes in giving among donors and donor ratio by income bracket. Columns (8) and (10) of Table 4 show that the high-income groups (Brackets (B), (C), and (D)–(E)) decreased their giving in terms of both intensive and extensive margins, while the lowest income group (Bracket (A)) increased their giving in terms of both the intensive and extensive margins. As a result, Table 4 shows that the total giving was reduced 3.53% on the intensive margin and 5.99% on the extensive margin due to the 2014 tax reform.

Related to the policy evaluation, Saez (2004) and Fack and Landais (2016) show that the government should expand tax incentives if the elasticity of the price of giving is more than -1, and Almunia et al. (2020) use the sum of the elasticities of the intensive and extensive margins as an estimate of the price elasticity.[17] Following them, we can conclude that the Korean government should expand tax incentives for charitable donation, as our estimation shows that the sum of the elasticity of the price of giving in terms of the intensive margin and the elasticity of the price of giving in terms of the extensive margin is greater than -1.

In terms of future policy, given that our estimates suggest that the expansion of tax incentives for charitable giving is desirable, the Korean government should set the tax credit rate for donations higher than 15%, or policies equal to or better than this should be adopted. Reducing

[17] In Equation (15) in Almunia et al. (2020), they write $\varepsilon = |\varepsilon_{INT}| + |\varepsilon_{EXT}|$, where ε is the elasticity of the price of giving, ε_{INT} is the estimated price elasticity in terms of intensive margins, and ε_{EXT} is the estimated price elasticity in terms of intensive margins.

the declaration costs of giving would also be important in reducing the effective price of giving as a way to expand the substantial tax incentives for giving.[18]

6 Discussion and Conclusions

Considering unreported donations, panel data, rather than tax records, are more appropriate for estimating the price elasticity of total giving needed to assess the optimality of tax policy. However, since the declaration of giving depends on taxpayer decisions, even if we exploit exogenous variation in the applicable price of donations, standard fixed effect models would estimate effective price elasticities with bias. Therefore, we proposed a simple FE-2SLS using exogenous variation in tax incentives as the instrumental variable. The estimation results show that a 1 percent increase in the donation price reduces donor contributions by 1.5 percent and the donor share by 2.6 percent. Using these estimates, we derive the policy implication that tax incentives should be expanded.

One limitation of this study is that we could not accurately measure taxable income. In this study, we determined income tax rates based on gross pretax income. Therefore, if the income bracket into which pretax income falls differs from the bracket into which taxable income falls due to deductions and other factors, then there will be measurement error in the income tax rate, which will also bias the donation price. We dropped observations whose pretax income falls around the bracket thresholds to eliminate as much of the bracket-shifting effect as possible.

Our estimation can also shed light on understanding the unobservable factors of giving and selection to declare giving by considering the direction of estimation bias. As discussed at the end of Section 5.1, given Equation (1) and that the error term captures unobservable factors of giving behavior, we can consider that the direction of self-selection bias reflects the correlation between the unobservable factors of giving behavior and the choice to declare giving.[19]

In particular, the self-selection bias observed in the estimation of the intensive-margin effective price elasticity suggests that the declaration of giving and the unobservable factors that increase giving are negatively correlated. This implies that taxpayers with a preference for donation, which cannot be explained by the covariates, are unlikely to declare their giving.[20] Given

[18]In this context, Gillitzer and Skov (2018) show that reducing the reporting costs of giving led to an increase in total tax expenditure on giving in Denmark.

[19]This idea is important in papers interested in the characteristics of those who self-select. For example, Ma, Abdulai and Ma (2018) discuss the characteristics of those who self-select into participating in off-farm work by examining the direction of bias. For a related discussion, see Wooldridge (2015).

[20]This cannot be explained solely by the financial incentive that large donations generate tax savings.

that prosocial behaviors such as giving are motivated in part by the utility of social reputation and praise, i.e., the image motive (e.g., Ariely, Bracha and Meier, 2009), this implication is quite natural since image-motivated donors gain utility by sending an altruistic signal to others and receiving financial incentives, such as tax incentives, will be noise for them when sending altruistic signals (Bénabou and Tirole, 2006).[21]

While our study focused on the self-selection behavior of tax incentives for charitable giving, the methodology used in this study may be valid for other tax expenditures, such as tax breaks for R&D investment in the corporate tax. To understand self-selection in taxation in greater detail, including issues such as the characteristics of taxpayers who self-select and the direction of the self-selection bias, more research is needed in the future.

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[21] Our implication is also related to Eckel and Grossman (2008), who presented a field experiment on financial incentives for giving, in that both implications support the image motive of donors.

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Table 1. Marginal Income Tax Rates (%)

<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>35</td><td>35</td></tr>
<tr><td>(E) 15000 - 30000</td><td rowspan="3">38</td><td rowspan="2">38</td><td>38</td></tr>
<tr><td>(F) 30000 - 50000</td><td rowspan="2">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.

Table 2. Descriptive Statistics

	N	Mean	Std.Dev.
Income and giving price			
Annual labor income (unit: 10,000KRW)	37901	1924.13	2631.33
Annual total income (unit: 10,000KRW)	37901	3088.10	2808.14
Appricale price	37901	0.85	0.05
Charitable giving			
Annual chariatable giving (unit: 10,000KRW)	37901	32.48	122.76
Dummary of donation > 0	37901	0.23	0.42
Dummy of declaration of giving	37901	0.11	0.31
Demographics			
Age	37901	51.33	15.95
Wage earner dummy	37893	0.48	0.50
Number of household members	37901	3.20	1.26
Dummy of having dependents	37901	0.68	0.47
Female dummy	37901	0.35	0.48
Academic history: University	37900	0.46	0.50
Academic history: High school	37900	0.32	0.47

Notes: Our data is unbalanced panel data consisting of 8,441 unique individuals and 8 years period (2010–2017)

Table 3. Estimation Results of First-Price Elasticities

	Log donation			Dummy of donor		
	FE		FE-2SLS	FE		FE-2SLS
	(1)	(2)	(3)	(4)	(5)	(6)
Applicable price (β_a)	-1.082***			-0.184***		
	(0.332)			(0.058)		
Effective price (β_e^{FE})		-0.641**			-2.729***	
		(0.255)			(0.073)	
Effective price (β_e^{IV})			-1.560***			-0.617***
			(0.486)			(0.182)
Log income	1.629	1.862	1.277	1.464***	0.675***	1.420***
	(1.347)	(1.334)	(1.348)	(0.209)	(0.190)	(0.202)
Implied price elasticity						
Estimate				-0.791***	-11.717***	-2.647***
				(0.250)	(0.314)	(0.782)
1st stage information (Excluded instrument: Applicable price)						
F-statistics of instrument			1401.509			1812.348
Wu-Hausman test, p-value			0.004			< 0.001
Num.Obs.	7776	7776	7776	30 252	30 252	30 252

Notes: * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$. Standard errors clustered at the household level are in parentheses. An outcome variable is the logged value of the effective price. For estimation, Models (1)–(3) use donors only (intensive-margin sample), and Models (4)–(6) use not only donors but also non-donors (extensive-margin sample). In addition to logged income, covariates consist of squared age (divided by 100), number of household members, a dummy that indicates having dependents, a dummy that indicates wage earner, a set of industry dummies, a set of residential area dummies, and individual and time fixed effects. The excluded instrument is a logged applicable price. The excluded instrument is a logged applicable price in Models (3) and (6).

Table 4. Policy Effect of 2014 Tax Reform

		Declaration (%)		Effective price			Intensive margin		Extensive margin	
2013 Income bracket	N	2013	2014	2013	2014	Change (%)	2013 average	Change (%)	2013 average	Change (%)
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
(A) –1200	1084	0.738	1.015	1.000	0.998	-0.107	8.074	0.167	0.122	0.283
(B) 1200–4600	2222	11.116	5.986	0.983	0.991	0.952	18.324	-1.485	0.204	-2.520
(C) 4600–8800	823	38.275	28.311	0.908	0.958	6.666	65.649	-10.399	0.450	-17.645
(D) & (E) 8800–30000	174	36.782	31.034	0.871	0.953	12.969	146.213	-20.231	0.494	-34.328
Weighted average						2.264		-3.532		-5.993

Notes: We use those whose declaration status is observed for 2013 and 2014. Column (1) shows the sample size by income bracket for 2013. Columns (2) and (3) are the declaration rates for each year. Columns (4) and (5) are the average effective price for each year. Column (6) reports the percentage change in the effective price. Column (8) shows the percentage change in donor contributions, which is the product of the value in Column (6) and the estimated intensive-margin effective price elasticity (-1.56). Column (10) shows the percentage change in the donor rate, which is the product of the value in Column (6) and the estimated extensive-margin effective price elasticities (-2.647). Columns (7) and (9) show the average donor contribution and the donor ratio in 2013, respectively. Columns (2)–(10) divide the sample by income bracket, claiming status in 2013, and claiming status in 2014, calculate the corresponding indicator in each subset, and then calculate the average of each indicator weighted by the subset sample size in each income bracket. The bottom row shows the average weighted by the bracket sample size.

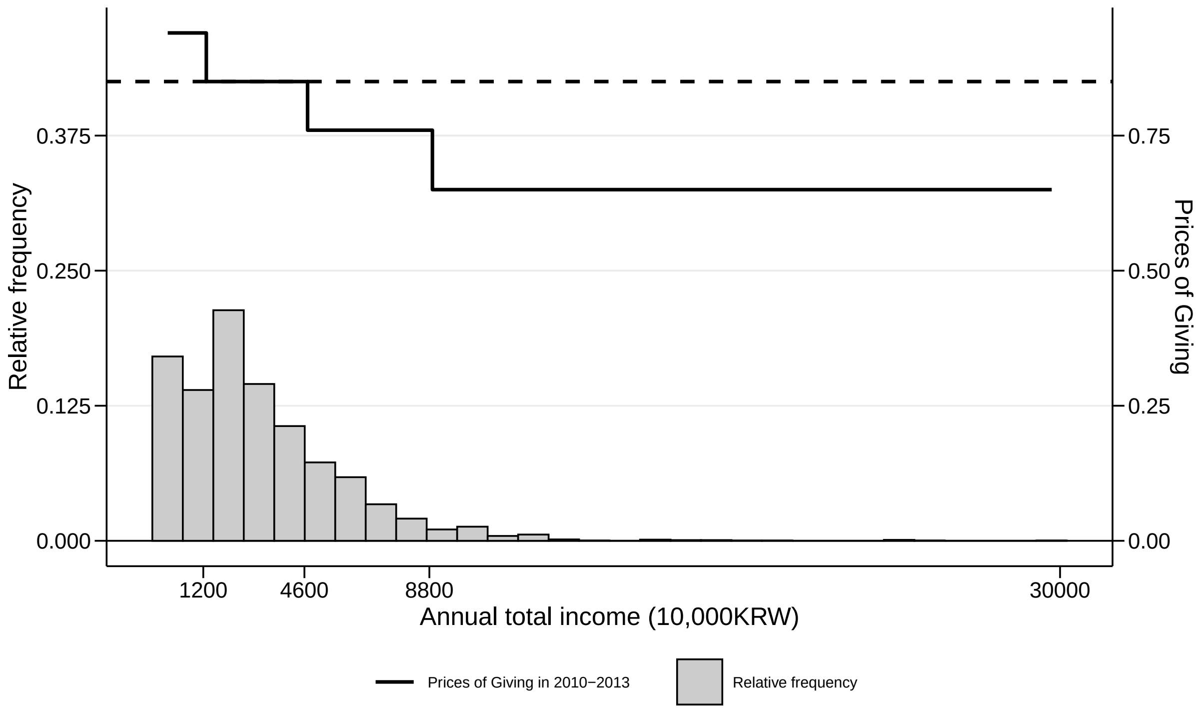

Figure 1. Income Distribution in 2013 and Prices of Giving by Income Bracket

Notes: This figure plots income distribution in 2013 (grey bars) and the prices of giving (solid step line and dashed line) by income bracket. The left and right axes measure the relative frequency of respondents and the price of giving, respectively. The solid step line represents the giving price in 2010–2013. The dashed horizontal line represents the price of giving in 2014–2017.

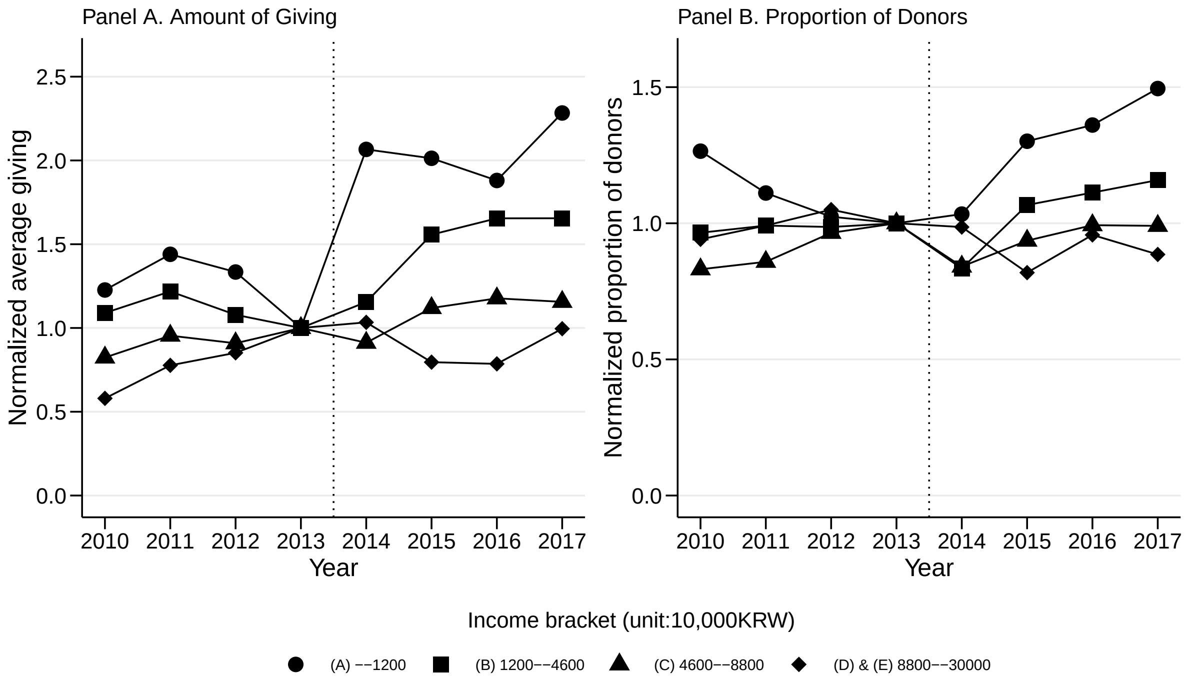

Figure 2. Average Giving Amount (Panel A) and Proportion of Givers (Panel B) by 2013 Income Bracket.

Notes: The trend of the average amount of giving and proportion of givers in each income bracket of 2013 are respectively shown in Panel A and B. The values are normalized to one in 2013. For panel A, we limit the sample to the donors to make the graph.

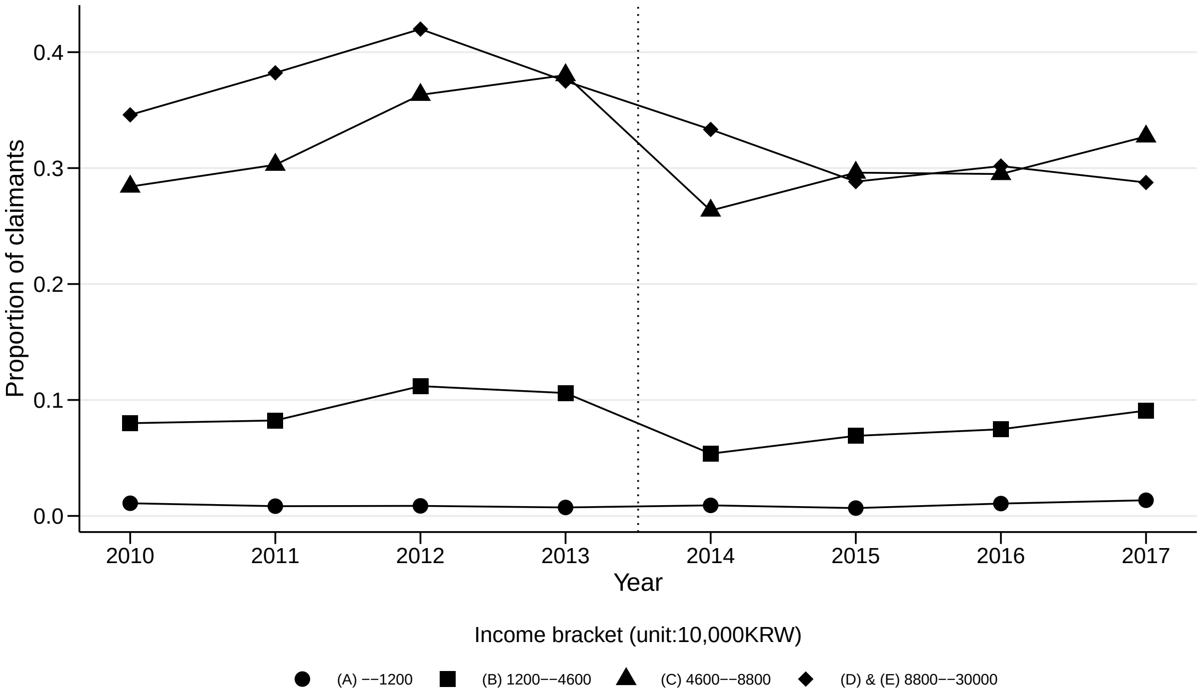

Figure 3. Declaration Rates by 2013 Income Bracket

Notes: This Figure shows the change in the proportion of claimants as a share of all taxpayers including non-donors in each income bracket in 2013.

Appendix A   Additional Tables and Figures

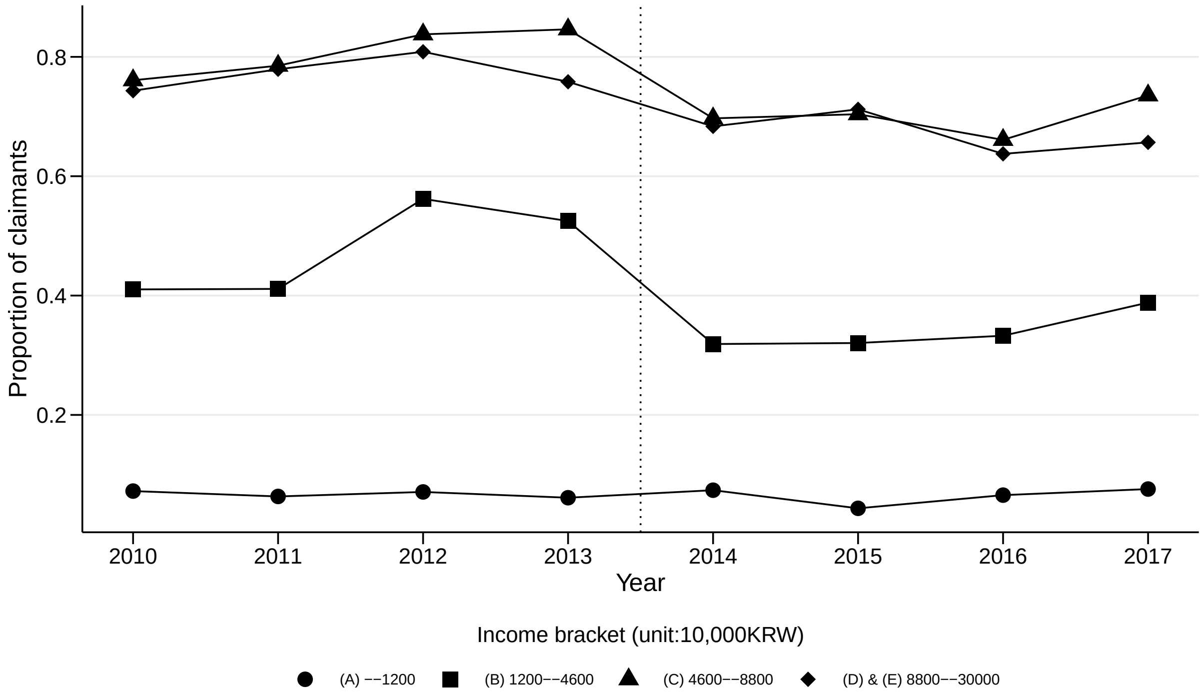

Figure A1. Declaration Rates of Donors by 2013 Income Bracket

Notes: This figure shows the change in the proportion of claimants as a share of donors in each income bracket in 2013.

Table A1. First-Stage Models

	Effective price	
	Donors (Intensive margin)	Donors and Non-donors (Extensive margin)
	(1)	(2)
Excluded instruments		
Applicable price	0.694***	0.299***
	(0.038)	(0.019)
Covariates		
Log income	−0.225	−0.071
	(0.147)	(0.047)
Num.Obs.	7776	30 252
RMSE	0.05	0.04

Notes: * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$. Standard errors clustered at household level are in parentheses. The outcome variable is the logged value of the effective price. For estimation, Model (1) uses donors only (intensive-margin sample), and Model (2) uses not only donors but also non-donors (extensive-margin sample). In addition to logged income shown in table, covariates consist of squared age (divided by 100), number of household members, a dummy that indicates having dependents, a dummy that indicates a wage earner, a set of industry dummies, a set of residential area dummies, and individual and time fixed effects. The excluded instrument is the logged applicable price.

Appendix B Proof

We show that the parameter $\mathrm{Cov}(\ln p_{it}, \hat{r}_{it})/\mathrm{Var}(\hat{r}_{it})$ is in the range 0 to 1 if residuals $\hat{r}_{it}$ are mean independent of a dummy indicating declaration of giving, R_{it}. We obtain the residuals $\hat{r}_{it}$ from the following model:

$$\ln(1 - q_{it}) = \mu_i + \theta_t + \lambda X_{it} + r_{it}, \tag{B1}$$

By $E(\hat{r}_{it}) = 0$, $\mathrm{Var}(\hat{r}_{it}) = E(\hat{r}_{it}^2)$. Additionally, $E(\hat{r}_{it}) = 0$ implies $\mathrm{Cov}(\ln p_{it}, \hat{r}_{it}) = E(\ln p_{it}\hat{r}_{it})$. By the law of iterated expectations,

$$\begin{aligned} & \frac{\mathrm{Cov}(\ln p_{it}, \hat{r}_{it})}{\mathrm{Var}(\hat{r}_{it})}, \\ =& \frac{E(\ln p_{it}\hat{r}_{it})}{E(\hat{r}_{it}^2)}, \\ =& \frac{E(\ln(1 - q_{it})\hat{r}_{it}|R_{it} = 1)\Pr(R_{it} = 1)}{E(\hat{r}_{it}^2|R_{it} = 1)\Pr(R_{it} = 1) + E(\hat{r}_{it}^2|R_{it} = 0)\Pr(R_{it} = 0)}. \end{aligned} \tag{B2}$$

Note that $p_{it} = 1 - R_{it}q_{it}$.

By the auxiliary regression model (B1), the variable $\ln(1 - q_{it})$ is a sum of a predicted value $E[\ln(1 - q_{it})|\mu_i, \theta_t, X_{it}]$ and a residual $\hat{r}_{it}$. Thus, we can reformulate the numerator of Equation (B2) as follows:

$$\begin{aligned} & E\{\ln(1 - q_{it})\hat{r}_{it}|R_{it} = 1\}\Pr(R_{it} = 1), \\ =& E\{(E[\ln(1 - q_{it})|\mu_i, \theta_t, X_{it}] + \hat{r}_{it})\hat{r}_{it}|R_{it} = 1\}\Pr(R_{it} = 1), \\ =& E\{E[\ln(1 - q_{it})|\mu_i, \theta_t, X_{it}]\hat{r}_{it}|R_{it} = 1\}\Pr(R_{it} = 1) + E(\hat{r}_{it}^2|R_{it} = 1)\Pr(R_{it} = 1), \\ =& E[\ln(1 - q_{it})|\mu_i, \theta_t, X_{it}]E(\hat{r}_{it}|R_{it} = 1)\Pr(R_{it} = 1) + E(\hat{r}_{it}^2|R_{it} = 1)\Pr(R_{it} = 1). \end{aligned} \tag{B3}$$

Thus, if the residual $\hat{r}_{it}$ and the dummy variable R_{it} are mean independent, that is $E(\hat{r}_{it}|R_{it} = 1) = E(\hat{r}_{it}) = 0$, then Equation (B3) reduces to $E(\hat{r}_{it}^2|R_{it} = 1)\Pr(R_{it} = 1)$, and the parameter $\mathrm{Cov}(\ln p_{it}, \hat{r}_{it})/\mathrm{Var}(\hat{r}_{it})$ becomes

$$\frac{\mathrm{Cov}(R_{it}\ln(1 - q_{it}), \hat{r}_{it})}{\mathrm{Var}(\hat{r}_{it})} = \frac{E(\hat{r}_{it}^2|R_{it} = 1)\Pr(R_{it} = 1)}{E(\hat{r}_{it}^2|R_{it} = 1)\Pr(R_{it} = 1) + E(\hat{r}_{it}^2|R_{it} = 0)\Pr(R_{it} = 0)}, \tag{B4}$$

which is in the range 0 to 1.

Appendix C Additional Exercises

For the robustness of our main results, we perform three exercises.

1. Estimate effective last-price elasticities
2. Estimate effective price elasticities excluding the announcement effect
3. Estimate effective price elasticities removing price variation in the income deduction period

To show that our main results differ from the price elasticities of declared contributions estimated using tax record data, we perform the following two exercises.

4. Estimate the intensive-margin price elasticities for claimants
5. Estimate the price elasticities of the declaration

In this appendix, we discuss each exercise in detail.

C.1 Exercise 1

Motivation. In the income deduction period, the tax incentive depends on the giving amount, $T'(y–g)$. Thus, the actual effective and applicable prices are the relative prices in the case of the actual donation amount (last prices). However, in our main analysis, we use the relative price in the case of zero donation (first price), $T'(y)$, which differs from the last price. Note that the first prices are equal to the last price in the income credit period. Thus, we estimate the effective and applicable last-price elasticities.

Method. Since the last price depends on the amount of giving, we estimate an FE-2SLS model with the applicable first prices as the instrumental variable. Let $p_{it}(g_{it})$ be the effective last price. Let $1–q_{it}(g_{it})$ be the applicable last price. We estimate the following FE-2SLS:

$$\begin{aligned} Y_{it} &= \mu_i + \theta_t + \beta \ln p_{it}(g_{it}) + \delta X_{it} + \epsilon_{it}, \\ \ln p_{it}(g_{it}) &= \mu_i + \theta_t + \gamma \ln(1 - q_{it}(0)) + \lambda X_{it} + u_{it}, \end{aligned} \tag{C1}$$

where $p_{it}(0)$ and $1 - q_{it}(0)$ are the effective first price and the applicable first price, respectively. Our parameter of interest is β, which represents the effective last-price elasticities. Note that the parameter β is equal to β_e^{IV}, which is our main result of effective price elasticities when we use $\ln p_{it}(0)$. For estimation of the applicable last-price elasticities, we replace $p_{it}(g_{it})$ with $1-q_{it}(g_{it})$. Then, the parameter β shows the applicable last-price elasticities. Note that this model can solve the endogeneity problem due to the selection of declaration, which is our original research motivation.

Table C1. Last-Price Elasticities on the Intensive Margin

	Log donation			
	FE		FE-2SLS	
	(1)	(2)	(3)	(4)
Applicable last-price	−0.812**		−1.122***	
	(0.347)		(0.345)	
Effective last-price		−0.595**		−1.625***
		(0.259)		(0.508)
Log income	1.777	1.884	1.589	1.217
	(1.348)	(1.336)	(1.349)	(1.353)
1st stage information (Excluded instrument: Applicable price)				
Estimate				
F-statistics of instrument			84 392.469	1295.556
Wu-Hausman test, p-value			< 0.001	0.002
Num.Obs.	7776	7776	7776	7776

Notes: * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$. Standard errors clustered at the household level are in parenthesis. The outcome variable is the logged value of the amount of charitable giving. For estimation, we use donors only (intensive-margin sample). For the outcome equation, we control for squared age (divided by 100), number of household members, a dummy that indicates having dependents, a dummy that indicates a wage earner, a set of industry dummies, a set of residential area dummies, and individual and time fixed effects. For FE-2SLS, we use the logged applicable first price as an instrument.

Table C2. Last-Price Elasticities on the Extensive Margin

	Donor dummy			
	FE		FE-2SLS	
	(1)	(2)	(3)	(4)
Applicable last-price	−0.147**		−0.187***	
	(0.059)		(0.059)	
Effective last-price		−2.759***		−0.636***
		(0.074)		(0.187)
Log income	1.499***	0.657***	1.462***	1.412***
	(0.210)	(0.190)	(0.209)	(0.202)
Implied price elasticity				
Estimate	−0.632**	−11.845***	−0.801***	−2.729***
	(0.252)	(0.317)	(0.253)	(0.805)
1st stage information (Excluded instrument: Applicable price)				
F-statistics of instrument			1 481 835.010	1725.090
Wu-Hausman test, p-value			< 0.001	< 0.001
Num.Obs.	30 252	30 252	30 252	30 252

Notes: * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$. Standard errors clustered at the household level are in parentheses. The outcome variable is a dummy indicating a donor. For estimation, we use not only donors but also non-donors (extensive-margin sample). For the outcome equation, we control for squared age (divided by 100), number of household members, a dummy that indicates having dependents, a dummy that indicates a wage earner, a set of industry dummies, a set of residential area dummies, and individual and time fixed effects. For FE-2SLS, we use the logged applicable first price as an instrument. We calculate implied price elasticities by dividing the estimated coefficient on price by the sample proportion of donors.

Results. See Table C1 for the intensive-margin price elasticities and Table C2 for the extensive-margin price elasticities. The results are quantitatively similar to our main results.

C.2 Exercise 2

Motivation. Since the Korean government announced the 2014 tax reform in 2013, intertemporal substitution may have occurred. For example, individuals who anticipated that the 2014 tax reform would result in higher donation prices may have reduced their donations in 2014 and beyond and increased their giving in 2013. Since this would introduce a positive bias in the elasticities, we estimate the price elasticities while excluding this announcement effect.

Method. Assuming that intertemporal substitution occurs in 2013 and 2014, we exclude observations in that period and estimate the FE-2SLS model (7) that we propose in Section 4.2.

Table C3. First-Price Elasticities Excluding Announcement Effects

	Log donation			Donor dummy		
	FE		FE-2SLS	FE		FE-2SLS
	(1)	(2)	(3)	(4)	(5)	(6)
Applicable price (β_a)	−1.312***			−0.220***		
	(0.474)			(0.077)		
Effective price (β_e^{FE})		−0.618*			−2.809***	
		(0.344)			(0.088)	
Effective price (β_e^{IV})			−1.843***			−0.765***
			(0.679)			(0.247)
Log income	1.642	1.936	1.150	1.591***	0.820***	1.523***
	(1.880)	(1.884)	(1.920)	(0.255)	(0.236)	(0.247)
Implied price elasticity						
Estimate				−0.928***	−11.824***	−3.219***
				(0.325)	(0.371)	(1.039)
1st stage information (Excluded instrument: Applicable price)						
F-statistics of instrument			941.601			1141.395
Wu-Hausman test, p-value			0.002			< 0.001
Num.Obs.	5936	5936	5936	22 684	22 684	22 684

Notes: * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$. Standard errors clustered at the household level are in parentheses. The outcome variable is the logged value of the amount of charitable giving in Models (1)–(3) and a donor dummy in Models (4)–(6). For estimation, Models (1)–(3) use donors only (intensive-margin sample), and Models (4)–(6) use not only donors but also non-donors (extensive-margin sample). To exclude the announcement effect, we exclude observations from 2013 and 2014. For the outcome equation, we control for squared age (divided by 100), number of household members, a dummy that indicates having dependents, a dummy that indicates a wage earner, a set of industry dummies, a set of residential area dummies, and individual and time fixed effects. For FE-2SLS, we use the logged applicable price as an instrument. To obtain the extensive-margin price elasticities in Models (4)–(6), we calculate implied price elasticities by dividing the estimated coefficient on price by the sample proportion of donors.

Results. See Table C3. As expected, the estimated elasticities are somewhat elastic when we exclude the announcement effect.

C.3 Exercise 3

Motivation. The indirect income effect may confound the price effect since the change in the price of giving is driven by the change in the income level in the income deduction period. This is because the observed income is the synthesis of transitory and permanent incomes, and their effects on the price of giving may differ. This motivates us to perfectly isolate the change in the price of giving from the change in income level.

Method. We use two subsets and estimate the FE-2SLS model (7) that we propose in Section 4.2. The first subset excludes those whose price of giving changed during the income deduction period from our main study sample. The second subset uses 2012 data (before the 2014 tax reform) and 2015 data (after the 2014 tax reform).

Table C4. First-Price Elasticities Removing Price Variation in Income Deduction Period

	Log donation			Donor dummy		
	FE		FE-2SLS	FE		FE-2SLS
	(1)	(2)	(3)	(4)	(5)	(6)
Applicable price (β_a)	−1.172***			−0.276***		
	(0.436)			(0.090)		
Effective price (β_e^{FE})		−0.670**			−2.878***	
		(0.320)			(0.094)	
Effective price (β_e^{IV})			−1.563***			−0.673***
			(0.589)			(0.203)
Log income	2.496	2.258	2.007	2.046***	1.090***	1.859***
	(1.666)	(1.674)	(1.692)	(0.300)	(0.304)	(0.286)
Implied price elasticity						
Estimate				−1.176***	−12.270***	−2.869***
				(0.385)	(0.400)	(0.866)
1st stage information (Excluded instrument: Applicable price)						
F-statistics of instrument			1068.639			1770.695
Wu-Hausman test, p-value			0.021			< 0.001
Num.Obs.	5825	5825	5825	21 962	21 962	21 962

Notes: * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$. Standard errors clustered at the household level are in parentheses. The outcome variable is the logged value of the amount of charitable giving in Models (1)–(3) and a donor dummy in Models (4)–(6). For estimation, Models (1)–(3) use donors only (intensive-margin sample), and Models (4)–(6) use not only donors but also non-donors (extensive-margin sample). We exclude those whose prices changed during the income deduction period. For the outcome equation, we control for squared age (divided by 100), number of household members, a dummy that indicates having dependents, a dummy that indicates a wage earner, a set of industry dummies, a set of residential area dummies, and individual and time fixed effects. For FE-2SLS, we use the logged applicable price as an instrument. To obtain the extensive-margin price elasticities in Models (4)–(6), we calculate implied price elasticities by dividing the estimated coefficient on price by the sample proportion of donors.

Table C5. First-Price Elasticities Using 2012 and 2015 Data

	Log donation			Donor dummy		
	FE		FE-2SLS	FE		FE-2SLS
	(1)	(2)	(3)	(4)	(5)	(6)
Applicable price (β_a)	−1.275			−0.326*		
	(1.276)			(0.190)		
Effective price (β_e^{FE})		−1.129			−2.757***	
		(1.601)			(0.225)	
Effective price (β_e^{IV})			−1.725			−1.084*
			(1.754)			(0.574)
Log income	−3.555	−3.777	−3.951	2.062**	1.550**	2.034***
	(10.491)	(10.312)	(10.299)	(0.838)	(0.725)	(0.761)
Implied price elasticity						
Estimate				−1.388*	−11.734***	−4.612*
				(0.808)	(0.958)	(2.443)
1st stage information (Excluded instrument: Applicable price)						
F-statistics of instrument			288.802			282.264
Wu-Hausman test, p-value						
Num.Obs.	2004	2004	2004	7671	7671	7671

Notes: * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$. Standard errors clustered at the household level are in parentheses. The outcome variable is the logged value of the amount of charitable giving in Models (1)–(3) and a donor dummy in Models (4)–(6). For estimation, Models (1)–(3) use donors only (intensive-margin sample), and Models (4)–(6) use not only donors but also non-donors (extensive-margin sample). We use only data from 2012 and 2015. For the outcome equation, we control for squared age (divided by 100), number of household members, a dummy that indicates having dependents, a dummy that indicates a wage earner, a set of industry dummies, a set of residential area dummies, and individual and time fixed effects. For FE-2SLS, we use the logged applicable price as an instrument. To obtain the extensive-margin price elasticities in Models (4)–(6), we calculate implied price elasticities by dividing the estimated coefficient on price by the sample proportion of donors.

Results. Table C4 shows estimation results using the first subset. The results are similar to our main results. Table C5 shows estimation results using the second subset. The estimated intensive-margin price elasticities are quantitatively similar to our main results. The estimated extensive-margin price elasticities are twice as elastic as our main results. However, the statistical significance of these estimates is weak due to the small sample.

C.4 Exercise 4

Motivation. Effective price elasticities are price elasticities of total giving. This may be different from the price elasticities of declared giving estimated using tax record data. To check this point, we attempt to estimate the price elasticities of declared giving, using the Korean household panel survey data, NASTAB (see Section 3 in the data description).

Method. We use only claimants (exclude non-claimants from the main study sample). Since claimants are donors, we cannot estimate the extensive-margin price elasticities. Moreover, the effective prices are equal to the applicable prices in these data. Thus, we are free from the endogeneity problem due to the selection into claiming. Then, we employ the FE model (2), which estimates the applicable price elasticities (see Section 4.2).

Table C7. First-Price Elasticity of Declaration

	1 = Declaration
	FE
	(1)
Applicable price	−0.220***
	(0.050)
Log income	1.380***
	(0.177)
Implied price elasticity	
Estimate	−1.982***
	(0.452)
Num.Obs.	30 252

Notes: * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$. Standard errors clustered at the household level are in parentheses. The outcome variable is a declaration dummy. We control for squared age (divided by 100), the number of household members, a dummy that indicates having dependents, a dummy that indicates a wage earner, a set of industry dummies, a set of residential area dummies, and individual and time fixed effects. To obtain the price elasticity, we calculate implied price elasticities by dividing the estimated coefficient on price by the sample proportion of claimants.

Table C6. Intensive-Margin First-Price Elasticities for Claimants

	Log donation
	FE
	(1)
Applicable price (β_a)	−1.147**
	(0.506)
Log income	−1.221
	(2.213)
Num.Obs.	4171

Notes: * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$. Standard errors clustered at the household level are in parentheses. The outcome variable is the logged value of the amount of charitable giving. For estimation, we use claimants only. We control for squared age (divided by 100), the number of household members, a dummy that indicates having dependents, a dummy that indicates a wage earner, a set of industry dummies, a set of residential area dummies, and individual and time fixed effects.

Results. See Table C6. We assume that all claimants report all contributions on their tax returns (no partial reporting). Under this assumption, the estimated elasticities can be interpreted as the price elasticity of reported contributions.

C.5 Exercise 5

Motivation. The extensive-margin price elasticities estimated using tax record data capture the price effect on the decision to file a tax return for the donation. This may be different from the price effect on the decision to donate, which is captured by our extensive-margin price elasticities. To show this, we estimate the price elasticities of claiming.

Method. We use the original study sample and estimate the standard FE model (2), replacing the outcome variable with a claiming dummy, R_{it}.

Results. See Table C7. We find that the estimated price elasticity of claiming is approximately -2, which is less elastic than our main results.