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Substitutes or complements?

The relationship between the donation of money and time: Disaggregated analysis.

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This paper analyzes aggregated and disaggregated level of relationship between donations of money and time. By using Feldman's (2010) methodology with 2011 PSID data, the aggregated result shows that two altruistic behaviors are substitutes. However, in the disaggregated level, in secular industry and religious industry, this paper finds a different relationship: While donations of time and money are substitutes for secular organizations, they are neither substitutes nor complements for religious organizations. This paper also finds that there is positive effect of price of monetary donation on volunteering which occurs outside the change of relative price. Since this effect is larger than the negative effect of relative price across aggregated level and disaggregated level, previous literature interpreted their coefficient of tax price on volunteering as complementary relationship.

Keywords: **charitable giving, volunteering, substitutes, complements, disaggregated analysis**
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1. Introduction

Charitable giving consists of huge part of the US GDP; 2 percent of GDP, and approximately $373.25 billion in 2015. This is more than 6 times as big as 60 years earlier. This large amount of money came mainly from individuals, taking up 73 percent of the donation. Even considering participation rate, the number remained large: 67 percent of the entire households in the US donated in 2014.[1] Volunteering is another part of people's altruistic behaviors and as popular as charitable giving. According to the Bureau of Labor statistics, 45 percent of US citizens volunteered in 2014 and their average hours are 233 hours per year: Recalculating this into total time volunteered in the US, it is 8.1 billion hours.[2] These large amounts of money and time, and high participation rate have attracted many scholars to research about the supply of philanthropic behaviors and how individuals decide on which way of charitable contribution to choose.

The US government started to intervene in the supply of altruistic behaviors long time ago: they have given tax benefits such as deduction to money-donators since 1917. Because of popularity among US people and long history of intervention, many economists have researched about monetary donation, and predicted the effect of the government policies; calculating tax-price elasticity of monetary donation. However, some researchers found out that tax policies is not only related to donation of money, but also related to donation of time: Brown and Lankford (1992) argued that previous literature under-stated the policy effect because they ignored interdependence between two altruistic behaviors. Feldman (2010) even showed existence of direct effect of price of monetary donation on volunteering in addition to the indirect relationship.

In addition, some researchers have expected that even all other extrinsic things being equal, individual donates their money and time differently across types of a charity: since charities differ in the bundle of opportunities they make available to volunteers, the supply of volunteer is different across industries even if volunteers have an identical preference. Heterogeneous preference among people is another

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[1] Philanthropy-round-table Statistics on U.S. Generosity. http://www.philanthropyroundtable.org/almanac/statistics/

[2] Bureau of Labor Statistics U.S. Department of Labor. 2015. Volunteering in the Unities States – 2014.

reason to expect the supply differs. (Segal and Weisbrod. 2002) Regarding donation of money, in order to meet different level of altruism and any other feelings such as religiosity, people donate more money for some charities and less for the others. Therefore, these imply that various demographic, financial and other factors are associated with monetary donation and volunteering differently, including direct and indirect effects of price of monetary donation.

Putting together, to understand the relationship between two popular altruistic behaviors and predict effects of government policies better, we need to estimate and distinguish between direct and indirect effect of the price of monetary donation in the disaggregated level. There is presumption in the previous literature that religious giving is somehow different than other forms of giving (Andreoni et al. 1996) and American spend much time for religiosity, which is the a critical determinant of well-being. (Iannaccone, 1998. Gruber, 2004.) Moreover, individuals allocate their time and goods for religious organizations to maximize afterlife utility. (Azzi and Ehrenberg, 1975) These are the reasons why this paper analyzes two altruistic behaviors, separating into religious charities and non-religious charities. Many papers have found that economic factors such as income and price are less correlated to religious activities than non-religious activities. This paper also finds similar pattern in tax-price, income.

DiNardo and Lemieux (1992, 2001) made a nice structural model to find this relationship and Feldman (2010) used this for the aggregated-level analysis of charitable activities. I modify utility function by substituting summation of utility of altruistic behaviors in each organization for utility of the behaviors in aggregated level.

The rest of this paper is following: Chapter 2 reviews previous literature about the relationship between two altruistic behaviors. Chapter 3 introduces a simple theory about monetary donation and volunteering, and Chapter 4 explains empirical methodology this paper uses. Chapter 5 talks about data, and in Chapter 6, I present and interpret the result. Chapter 7 visualizes the result by simulating the policy change. Chapter 8 concludes.

2. Literature review

As a basic tool to study donation of money and time, many economists have used tax-price as price of monetary donations. Especially, in the United States,

monetary donation is tax-deductible, so if donators itemize, they can get some federal tax discounts. Thus, economists define price of monetary donation as $p_c = 1 - \tau$ where τ is marginal federal and state tax rate. In other words, a donator pays $1 - \tau$ dollar for one-dollar monetary donation good. On the other hand, there has been a dispute about the price of volunteering, such as wage and working hours. (Bauer et al. 2012)

With tax price, while there have been a lot of papers studying about monetary donation, there have been few studies about volunteer activities. Regarding volunteering, some tried to find the relationship with donation of money by adding the price of donation as independent variables. Dye (1980) used linear probability model in which a binary indicator for volunteering is regressed on individual characteristics and tax price. According to him, estimated cross-price elasticity is -0.136, interpreting two altruistic behaviors are complements. Menchik and Weisbrod (1986) used multivariate tobit model to find out which model is right; the consumption model versus the investment model. Their result was in line with the investment model. And, with the significantly negative coefficient of tax price in time equation, they also concluded that donations of time and money are complements. Freeman (1997) found out that among time-and-money-donators as wage or incomes increases, people tends to substitutes monetary donation for volunteering, which indicates they are substitutes as wage is considered as price of volunteering. According to his paper, although the pattern of volunteering participation seems different from substitutionary relationship, this is because those donating money are more frequently asked to volunteer. Segal and Weisbrod (2002) used tobit model where hours of volunteering individual spent are a dependent variable. However, they did not researched in aggregated level, but disaggregated level across industries: Their idea was that like individual gets different level of utility when they do different volunteer activities, they feel different level of utility across industries. Their result confirmed that not only various factors are differently associated with volunteering, depending on types of organizations, but also the relationship between donations of time and money are different; complements in education industry, substitutes in religious industry, and neither complements nor substitutes in health industry.

The first paper studying donation of money and time jointly was Brown and Lankford (1992). Their motivation is that because of interdependence between those, the effect of government tax policy may be under- or over-stated by considering monetary donation alone. By using bivariate tobit regression on donation money and time they found complementary relationship, which suggests the effect of policy on philanthropy is understated. Another paper looking at those

is Duncan (1999): He developed a public good theory extending volunteering and donating[3], predicting that two behaviors are perfectly substitutable in equilibrium and individual cares about total supply of public good. His empirical result casted a doubt that individual receives 'warm-glow' utility derived from gifts of time and money separately.[4] Thus, he argued that although cross-price elasticity for volunteering is negative, this does not mean that donation of money and time are complements. To sum up his paper, he did not find direct evidence of substitutes, but he found empirical evidence consistent with the substitutionary relationship. Andreoni et al. (1996) was first to use utility maximizing model with bivariate tobit model. Although they found the small negative cross-price elasticity, supporting gross complementary relationship[5], they did not allow the direct effect of tax-price of on volunteering: they only considered the effect derived by the change of relative price.

Unlike Andreoni et al. (1996), Feldman (2010) distinguished between three effects of price of monetary donation; the own price effect on monetary donation, the substitution effect by the change of relative price, and finally the non-substitution effect on volunteering by the direct impact of tax-price. She showed that they are actually substitutes and the final effect exists, explaining possible sources of the effect. She also mentioned that the reason why the past studies concluded complementary relationship between those is that the coefficient of tax price in their time equation reflects two confounded effects; the substitution effect and non-substitution effect that work outside of change of the relative price. If non-substitution effect is larger than the substation effect, this makes two behaviors seem complements. Although her analysis is not quantities of donations of time and money but participation or not, it is meaningful that her methodology can clearly show their relationship.

Bauer et al. (2012) used the disaggregated data in European countries. Because

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[3] Bergstrom et al. (1986) developed a public good theory about monetary contribution, and Andreoni (1990) extended this theory, adding impure altruism, in other words, warm-glow.

[4] With this finding, he argued that tax-price, which is used for the price of donation, is price of total value of charitable giving, not the price of monetary donation.

[5] However, using Hicksian demand, they estimated positive cross-price elasticity, which suggests monetary donation and volunteering is substitutes.

the data does not have tax, they used working hours as the price of volunteering. In the aggregated level, they found the lowest probability of donating money for those who are not employed (who does not spend any hour for working) and the highest probability of donating money for those working more than 45 hours, concluding that time and money donations are substitutes. In the disaggregated level, they found this substitutionary relationship in social and leisure activity organizations. However, the problem is that this result can be derived from differences in unobservable variables between non-employed individuals and those working exceedingly long hours. Moreover, even if this could be concluded as the substitutionary relationship, this pattern does not appear clearly.

3. Theoretical background

Here, I use Feldman's (2010) model which was originally from DiNardo and Lemieux (1992, 2001) based on private consumption model with a little modification. Individual prefers more consumption good, x, leisure, l, donation of money and time for each organization, c_i, v_i. This is represented by

$$U(x\ l, c_i, v_i) = u_1(x) + u_2(l) + \sum_{i=r,n} \emptyset_i(c_i, v_i)$$

where U is increasing in each of its argument, quasi-concave, and twice continuously differentiable. What is different from Feldman (2010) is that this paper segments utility of altruistic behaviors on the basis of organization types. On the functional form, it is $\sum_{i=r,n} \emptyset_i(c_i, v_i)$ rather than $\emptyset(c, v)$. $\emptyset_i(c_i, v_i)$ is additionally assumed to be quadratic in $c_i\ and\ v_i$ as a local approximation to an arbitrary utility function, which is

$$\emptyset_i(c_i, v_i) = r_{0_i} + r_{c_i}c_i + r_{v_i}v_i + r_{cv_i}c_i \cdot v_i + \left(\frac{r_{cc_i}}{2}\right)c_i^2 + \left(\frac{r_{vv_i}}{2}\right)v_i^2$$

where r_{cv_i} indicates whether donation of time and money are Frisch complements ($r_{cv_i} > 0$), Frisch substitutes ($r_{cv_i} < 0$), or separable ($r_{cv_i} = 0$).[6] Note that the

[6] See Appendix about Frisch complements and substitutes in this model. For more detail about Frisch demand, refer to Browning et al. (1985).

above utility function internally assumes that decision on monetary donation and volunteering for religious organizations is separable from those for non-religious organizations.

Assume r_{cc_i} and r_{vv_i} are negative, which means the marginal utility decreases as individual donates more. The maximization problem is

$$U(x\ l, c_i, v_i) \text{ s.t.}$$

$$x + \sum_{i=r,n} p_c c_i < \text{y}$$

$$l + \sum_{i=r,n} p_v v_i < T$$

$$c_i \geq 0$$

$$v_i \geq 0$$

where y, T indicate individual's total income and non-labor hours and p_c, p_v are price of donation of money and time.

The first order conditions of the above are

$$x\colon\ u_1' - \lambda_c = 0$$

$$l\colon\ u_2' - \lambda_v = 0$$

$$c_i\colon r_{c_i} + r_{cv_i} v_i + r_{cc_i} c_i - \lambda_c p_c + \xi_{c_i} = 0$$

$$v_i\colon r_{v_i} + r_{cv_i} c_i + r_{vv_i} v_i - \lambda_v p_v + \xi_{v_i} = 0$$

whereλ_i and ξ_{i_j} for $j = r, n$ and $i = c, v$ are Lagrange multiplier. Complementary slackness adds

$$\xi_{c_i} c_i = 0 \text{ and } \xi_{v_i} v_i = 0.$$

Using the above notations, we can make the conditions for donations of time and money: Individual donates their money for religious or non-religious organizations if the marginal utility minus marginal cost is positive at zero donations. Similarly, they volunteer if the difference is positive at zero volunteering. This can be written as

- Outcome 1 (Neither)

$$r_{c_i} - \lambda_c p_c < 0 \;\; and \; r_{v_i} - \lambda_v p_v < 0$$

- Outcome 2 (Only donating money)

$$r_{c_i} - \lambda_c p_c > 0 \; and \; r_{v_i} - \lambda_v p_v - \left(\frac{r_{cv_i}}{r_{cc_i}}\right)(r_{c_i} - \lambda_c p_c) < 0$$

- Outcome 3 (Only volunteering)

$$r_{c_i} - \lambda_c p_c - \left(\frac{r_{cv_i}}{r_{vv_i}}\right)\left(r_{v_i} - \lambda_v p_v\right) < 0 \; and \;\; r_{v_i} - \lambda_v p_v > 0$$

- Outcome 4 (Both donating money and volunteering)

$$r_{c_i} - \lambda_c p_c - \left(\frac{r_{cv_i}}{r_{vv_i}}\right)\left(r_{v_i} - \lambda_v p_v\right) > 0 \; and \;\; r_{v_i} - \lambda_v p_v - \left(\frac{r_{cv_i}}{r_{cc_i}}\right)\left(r_{c_i} - \lambda_c p_c\right) > 0$$

Specifically, Outcome 1 can be gotten this way: according to the first order condition of c_i, when individual does not give money to charities, $r_{c_i} + r_{cv_i} \cdot 0 + r_{cc_i} \cdot 0 - \lambda_c p_c + \xi_{c_i}$. And if this is optimal, $r_{c_i} + r_{cv_i} \cdot 0 + r_{cc_i} \cdot 0 - \lambda_c p_c + \xi_{c_i} = 0$. Note that by complementary slackness, $\xi_{ci} > 0$. Thus, $r_{c_i} - \lambda_c p_c < 0$. You can get $r_{v_i} - \lambda_v p_v < 0$ with the similar way. To get outcome 2, the condition of $r_{v_i} - \lambda_v p_v$ is opposite to Outcome 1 since the first of condition is $r_{c_i} + r_{cv_i} \cdot 0 + r_{cc_i} c_i - \lambda_c p_c$ =0 where r_{cc_i} is assumed to be negative. However, the condition of volunteering is complicated. By the first order condition of c_i, $c_i = \frac{\lambda_c p_c - r_{c_i}}{r_{cc_i}}$ when $v_i = 0$. Putting this c_i in the first order condition of v_i, $r_{v_i} + r_{cv_i} \cdot (\frac{\lambda_c p_c - r_{c_i}}{r_{cc_i}}) + r_{vv_i} \cdot 0 - \lambda_v p_v + \xi_{v_i} = 0$. After rearranging, $r_{c_i} - \lambda_c p_c - \left(\frac{r_{cv_i}}{r_{vv_i}}\right)\left(r_{v_i} - \lambda_v p_v\right) < 0$. Outcome 3 and 4 can be gotten similarly.

Simply, the above condition can be written as

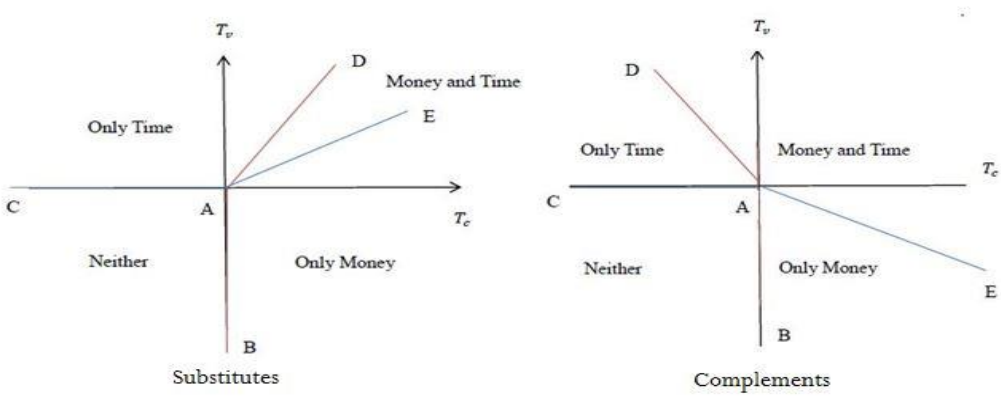
$$I_{c_i} = 1 \;\leftrightarrow T_{c_i} - I_{v_i}\left(\frac{r_{cv_i}}{r_{vv_i}}\right) T_{v_i} > 0$$

$$I_{v_i} = 1 \leftrightarrow T_{v_i} - I_{c_i}\left(\frac{r_{cv_i}}{r_{cc_i}}\right)T_{c_i} > 0$$

where $T_{c_i} \equiv \gamma_{c_i} - \lambda_c p_c$ and $T_{v_i} \equiv \gamma_{v_i} - \lambda_v p_v$. Intuitively when one decides to donate money, this decision influences on the process of decision on volunteering. Figure 1 describes how thresholds changes when donation of money and time are substitutes and complements respectively. If one's T_{c_i} *and* T_{v_i} are located over CAE and on the right of BAD, he is willing to donate money and time. As seen the Figure 1, if donation of money and time are substitutes threshold of money and time increase as the other threshold increases and if complements, vice versa: In the case of substitutes, those who volunteer require more satisfaction in order to start donating money than those who do not volunteer.

Figure 1: Threshold of time and money

when they are substitutes and complements.



Assuming tax-price does not impact on T_{v_i}, if two behaviors are substitutes, then increase of tax price will increase $T_{v_i} - I_{c_i}\left(\frac{r_{cv_i}}{r_{vv_i}}\right)T_{c_i}$ by reducing T_{c_i}. (Since r_{cc_i} is assumed to be negative, $\frac{r_{cv_i}}{r_{vv_i}}$ is positive if they are substitutes.) Here, r_{cv_i} captures extrinsic motivations by the change of relative price.

However, assuming tax-price does not impact on T_{v_i} is too restrictive. For example, as Feldman (2010) points out that governmental subsidization of monetary contribution may increase the utility for time donations, since this

subsidization can play a role like campaign for charitable giving. Moreover, the subsidization is more likely to motivate more people to donate money, and this increased participation can reduce the cost of volunteer activities. How? When donating money for an organization, they can get information on this organization and are more likely to be asked to participate in donating time. Freeman (1997) called these effects "tastes" for charitable giving. He claimed that these tastes must outweigh the substitution effect. This paper will check out finding is in line with his argument.

4. Econometric specification

For econometric specification, consider the assumption (A1) γ_{c_i} and γ_{v_i} are stochastically distributed across people. Then, it can be written as

$$\text{(A1)} \qquad \gamma_{c_i} = X\beta_{c_i} + \varepsilon_{c_i}$$

$$\gamma_{v_i} = X\beta_{v_i} + \varepsilon_{v_i}$$

where X is a vector of individual characteristics and

$$\varepsilon_{c_i},\ \varepsilon_{v_i} \sim N(0, \boldsymbol{E}) \ \ and \ \ \boldsymbol{E} = \begin{pmatrix} {\sigma_{c_i}}^2 & \rho_i \sigma_{c_i} \sigma_{v_i} \\ \rho_i \sigma_{c_i} \sigma_{v_i} & {\sigma_{v_i}}^2 \end{pmatrix}.$$

This indicates that unobservable variables of giving of time and money may be correlated. And, consider another assumption that marginal utility of income is function of income.

$$\text{(A2)} \qquad \lambda_c p_c \approx \alpha_{0c} + \alpha_{y_c} y + \alpha_{cc} p_c$$

$$\lambda_v p_v \approx \alpha_{0v} + \alpha_{y_v} y + \alpha_{vv} p_c$$

Since money that individual spends for donation is about 2% among total consumption and time for volunteering is relatively small, this assumption that the marginal utility of income and time is only influenced by income is reasonable. (Feldman, 2010) Then, $T_{ci} \equiv \gamma_{ci} - \lambda_c p_c$ and $T_{vi} \equiv \gamma_{vi} - \lambda_v p_v$ can be written as

$$\text{(A3)} \qquad T_{ci} \equiv Z\eta_{ci} + \varepsilon_{ci}$$

$$T_{vi} \equiv Z\eta_{vi} + \varepsilon_{vi}.$$

where Z includes tax price, income and individual characteristics. If the assumptions of γ_{c_i}, γ_{v_i}, $\lambda_c p_c$, and $\lambda_v p_v$ were right, this model could have been identified by achieving exclusion restrictions[7] and on the basis of functional form. However, since p_c can somehow influence on T_{vi} and so can p_v on T_{ci}, so this model relies solely on functional form assumption only to identify the parameters of interest of the model. It is another reason to rely on the assumption that there exists the argument over which variable is appropriate for p_v.

Using the above notation, the constraints of four outcomes are

- Outcome 1 (neither donation)

$$\varepsilon_{c_i} < -T_{c_i} \; and \; \varepsilon_{v_i} < -T_{v_i}$$

- Outcome 2 (money only)

$$\varepsilon_{c_i} > -T_{c_i} \; and \; \varepsilon_{v_i} - \left(\frac{r_{cv_i}}{r_{cc_i}}\right) \cdot \varepsilon_{c_i} < -T_{v_i} + \left(\frac{r_{cv_i}}{r_{cc_i}}\right) T_{c_i}$$

- Outcome 3 (time only)

$$\varepsilon_{c_i} - \left(\frac{r_{cv_i}}{r_{vv_i}}\right) \cdot \varepsilon_{v_i} < -T_{c_i} + \left(\frac{r_{cv_i}}{r_{vv_i}}\right) T_{v_i} \; and \; \varepsilon_{v_i} > -T_{v_i}$$

- Outcome 4 (donations of money and time)

$$\varepsilon_{c_i} - \left(\frac{r_{cv_i}}{r_{vv_i}}\right) \cdot \varepsilon_{v_i} > -T_{c_i} + \left(\frac{r_{cv_i}}{r_{vv_i}}\right) T_{v_i} \; and \; \varepsilon_{v_i} - \left(\frac{r_{cv_i}}{r_{cc_i}}\right) \cdot \varepsilon_{c_i} > -T_{v_i} + \left(\frac{r_{cv_i}}{r_{cc_i}}\right) T_{c_i}.$$

To estimate coefficients, it needs to construct log-likelihood function and use Maximum Likelihood Estimation. Since this model uses marginal utility and marginal cost, which are latent variables, this model can be estimated up to a scale. The log likelihood function after scaling is

[7] Since I_{v_i} and I_{c_i} are endogenous variables by simultaneity, using p_c as instrument for I_{c_i} and p_v as that for I_{v_i}

$$L_{i=r,n} = \sum_{j=1}^{N} I_{j\in Outcome\ 1} log\Phi\left(-t_{v_{ji}},\ -t_{c_{ji}};\ \rho_i\right)$$

$$+ I_{j\in Outcome\ 2} log\Phi\left(\frac{-t_{v_{ji}} + \varphi_{v_i} t_{c_{ji}}}{s_{v_i}},\ t_{c_{ji}}; \frac{\left(-\rho_i\ + \varphi_{v_i}\right)}{s_{v_i}}\right)$$

$$+ I_{j\in Outcome\ 3} log\Phi\left(t_{v_{ji}}, \frac{-t_{c_{ji}} + \varphi_{c_i} t_{v_{ji}}}{s_{c_i}}; \frac{-\rho_i + \varphi_{c_i}}{s_{c_i}}\right)$$

$$+ I_{j\in Outcome\ 4} log\Phi\left(\frac{t_{v_{ji}} - \varphi_{v_i} t_{c_{ji}}}{s_{v_i}}, \frac{t_{c_{ji}} - \varphi_{c_i} t_{v_{ji}}}{s_{c_i}}, \frac{\left[\rho_i\left(1 + \varphi_{v_i}\varphi_{c_i}\right) - \left(\varphi_{v_i} + \varphi_{c_i}\right)\right]}{s_{v_i} s_{c_i}}\right)$$

where Φ indicates cumulative distribution function of bivariate normal distribution, and

$$t_{c_{ji}} = \frac{T_{c_{ji}}}{\sigma_{c_i}},\ t_{v_{ji}} = \frac{T_{v_{ji}}}{\sigma_{v_i}},$$

$$s_{c_i}{}^2 = 1 + \varphi_{c_i}{}^2 - 2\rho_i\varphi_{c_i},\ s_{v_i}{}^2 = 1 + \varphi_{v_i}{}^2 - 2\rho_i\varphi_{v_i},$$

$$\varphi_{c_i} = \frac{\gamma_{cv_i}\sigma_{v_i}}{\gamma_{vv_i}\sigma_{c_i}}, \varphi_{v_i} = \frac{\gamma_{cv_i}\sigma_{c_i}}{\gamma_{cc_i}\sigma_{v_i}}.$$

In this function $\frac{\boldsymbol{\eta}_{c_i}}{\sigma_{c_i}}, \frac{\boldsymbol{\eta}_{v_i}}{\sigma_{v_i}}, \varphi_{c_i}, \varphi_{v_i}, \rho_i$ can be estimated. If monetary donation and volunteering are substitutes, φ_{c_i} and φ_{v_i} are positive because γ_{vv_i} and γ_{cc_i} are assumed to be negative (Concavity Assumption).

5. Data

This paper uses PSID (The US Panel Study of Income Dynamics), which was conducted every two years from 1968 with a nationally representative sample of over 18,000 individuals living in 5,000 families. The *Center on Philanthropy Panel Study* conducted the survey with PSID to get data of charitable giving and volunteer activities from 2001 to 2011. However, due to insufficient fund, they did not survey about volunteer activities in 2005, 2007, 2009. Thus, I use data in 2011. The number of families participating in the survey is 8,907, and after excluding missing data for variables this paper uses, the number becomes 4,421.

There are some advantages for using PSID rather than *Giving and Volunteering* used by Feldman (2010). First, The Data of *Giving and Volunteering* has insufficient data to analyze in organization types specifically in 1996. They asked participants' volunteering in each type, but it has a large amount of missing data, and the number of participants answering all question is very small. On the other hand, the number of participants answering all volunteering questions is 5,457. And excluding missing data for other independent variables, the number, 4,421, is still enough to analyze empirically. Second, PSID has more appropriate data to calculate tax-price for donation of money and after-tax income than *Giving and Volunteering*. TAXSIM program is widely used to calculate tax-price and income.[8] (Feenberg and Elizabeth Coutts, 1993) *Giving and Volunteering* does not have data like pensions, gross social security income, and investment income, which are inputs of TAXSIM program, but PSID has. Thus, PSID can calculate more precisely these variables. Moreover, many researchers developed a method to use TAXSIM program with PSID data. (Butrica and Burkhauser, 1997 ; Kimberlin et al., 2015) so, this is another benefit by using PSID.

However, calculating and using tax price directly with the actual amount of individual's monetary donation for an independent variable can cause endogeneity since a donator contribute more, tax price gets higher. Feldman (2010) and Yoruk (2011) solved this problem by calculating tax-price assuming zero monetary contribution. Similarly I calculate after tax income.[9]

The other variables, financial and socio-demographic factors, are frequently used when analyzing individuals' charitable behaviors. Table 1 is summary of statistics of dependent data, whether they donated or not and whether volunteering or not for any organizations, for religious organizations, and for non-religious organizations, and Table 2 is about independent variables. Since this paper only

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[8] Appendix A2 and Table A1 gives the calculation of TAXSIM program for a sample entry.

[9] There is the other issue on calculating tax-price assuming zero monetary contribution, borderline itemizer. Borderline itemizer is a household that would no longer itemize in the case of zero monetary charitable contributions. In other words, it is a household whose monetary donation is a critical factor to itemize or not. According to Feldman (2010), less than 3 percent of itemizers are borderline itemizers, so it is reasonable to consider tax-price as fairly exogenous to charitable giving.

uses data from head of household[10], the proportion of male is higher than other studies. The reason why using only head's data is that they are mainly responsible for financial matters. For example, some wives do not donate money just because their heads donate. Including this kind of data makes it difficult to find factors influencing altruistic behaviors and the relationship between those. Thus, this paper excludes data from wives and other members of households.

Table 1. Money and Time Contributions for Charity in 2010.

Aggregate		Time		
		No	Yes	Total
Money	No	1,000	364	1,364
	Yes	1,590	1,467	3,057
	Total	2,590	1,831	4,421

Religious		Time		
		No	Yes	Total
Money	No	2,299	109	2,408
	Yes	1,290	723	2,013
	Total	3,580	832	4,421

Secular		Time		
		No	Yes	Total
Money	No	1,395	475	1,870
	Yes	1,445	1,106	2,551
	Total	2,840	1,581	4,421

[10] For example, Brown et al only used data from heads. (2012)

Table 2. Summary of Statistics of Independent Variables in 2010.

Variable	Description	Mean	Std. Dev.
Taxprice	Equal to $1-\tau$ where τ is the marginal rate applicable on the first dollar of monetary donations	0.882	0.149
Income($0000)	After-tax household income. Equal to income minus federal and state taxes where taxes are calculated assuming zero monetary contribution	4.690	5.560
Age(10)	Age of respondent.	4.535	1.547
Children	Number of children under 18 in household.	0.894	1.181
Child in college	Equal to one if the respondent is a college graduate, zero otherwise.	0.890	1.125
Married	Equal to one if married, zero otherwise.	0.708	0.455
Religious	Equal to zero if the respondent never attends a religious service, one if attending once a year, two if attending once every month, three if the attending once every two weeks, four if attending once every week, five if attending once everyday	1.765	1.599
College grad.	Equal to one if the respondent is a college graduate, zero otherwise.	0.551	0.497
Max. educ.	Equal to one if at least one member of the household is a college graduate, zero otherwise.	0.696	0.460
Homeowner	Equal to one if the respondent is a homeowner, zero otherwise.	0.662	0.473
Parent educ.	0 if the both respondent's parents had no education, 1 if the at least one of respondent's parents completed 0-5 grades, 2 if 6-8 grades, 3 if 9-11 grades, 4 if 12 grades, 5 if 12 grades plus nonacademic training, 6 if non-degree in some college, 7 if B.A in college, 8 if graduate degree in college	4.600	2.282
Employed	Equal to one if the respondent is employed full time, zero otherwise.	0.674	0.469
Minority	Equal to one if the respondent identities as a member of a minority (non-white) group, zero otherwise.	0.305	0.461
Hispanic	Equal to one if the respondent identities as Hispanic, zero otherwise.	0.085	0.279
Male	Equal to one if the respondent is male, zero otherwise.	0.858	0.349

6. Result

1) Result of probit and bivariate probit model

Column 1 and 2 in table 3 is the results of the aggregated level in the following probit, bivariate probit model:

$$I_{c_i} = 1 \leftrightarrow Z\eta_{c_i} + \varepsilon_{c_i} > 0$$

$$I_{v_i} = 1 \leftrightarrow Z\eta_{v_i} + \varepsilon_{v_i} > 0$$

where γ_{cv_i} is constrained to equal zero in both models and ρ_i is constrained to zero in probit model.

Our main interest, tax price is negatively correlated to the money donation in column 1 and 2. At the mean of each independent variable, 10% increase of tax price reduces the probability of money donation by 5 percent (p-value of 0.00) in probit regression. Considering the time donation, in both probit models, tax price is negatively correlated to the probability, which tempts researchers to interpret that the relationship of time and money donation is complementary. As tax price goes up by 10%, the probability of donating time decreases by 0.02 at the mean in probit model. (p-value of 0.00) With respect to income, as income goes up, the probability of donating money increases, but the marginal effect of an additional income decreases. This pattern appears similarly in time equation. At the mean, increase of income $10,000 is associated with increase in probability of donating money by 0.02 and of donating time by 0.01. The positive coefficient of income in money equation supports that monetary donation is a normal good. Regarding volunteering, since the shadow value of time should increase as income increases, donation of time should fall. At the same time, there may be opposite forces. For example, if volunteering is a normal good, demand for it should increases as income rises. Or, income may represent social status, which can be another force that makes the coefficient of income positive. (Feldman, 2010) Here, like Feldman's result, the positive coefficient of income shows that the latter force is stronger than the former force.

Table 4 and 5 is the result of time and money donation for religious and non-religious organizations in probit, bivariate probit, and full structural model. Segal and Weisbrod (2002) argued that considering volunteer labor a homogeneous

activity may make a wrong conclusion. Moreover, Bauer et al. (2012) found a similar result that all parameters across the four types of organizations for donating time and money (social organization, leisure activity, work-related and political organizations, religious organizations) are rejected. Our result shows that in probit and bivariate probit model, the hypothesis all parameters including constant are equal between religious and non-religious giving is rejected.[11]

For religious organizations, tax price is negatively correlated with probability of giving money and time in both probit models significantly. At the mean, increase in tax-price by 10% leads to decreasing the probability of monetary giving by 4 percent and the probability of volunteering by 1.5 percent. For non-religious organizations, tax price is negatively correlated to money and time equation. If the price increases by 10%, the probability of money decreases by 5% and that of time goes down by 1.5% respectively in column 1.

With respect to income, for religious organizations, the coefficient in money and time equation is positive but is not significant anymore. In money equation, homeowner is more likely to donate, so this means that the stability of income matters and monetary donation is still a normal good. Nonetheless, in time equation, neither income and nor owning home is significantly positive. Borrowing the explanation from Feldman (2010), the positive force of income effect such as social status is not larger than the shadow price effect. For non-religious organizations, the coefficient of income in money and time equation is similar to the aggregated result.

Correlation gives information on unobservable variables related to the altruistic behaviors to us. Column 2 in table 3, 4 and 5 shows significantly positive correlation in the aggregated level and regardless of the type of organizations. Thus, positive correlation implies that the unobservable variables such as altruism determine both behaviors.

The most important thing we find in both probit models is that regardless of the type of organization, donation of time and money seems complement.

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[11] Rejection is based on Chi-square test statistics with 21 degrees of freedom of 2099.46, and 1286.68 for money and time equations, respectively in probit model. In bivariate probit model, 1967.7 and 1287,26 for money and time equations respectively.

Table 3. Result of the aggregate level

VARIABLES	(1) Probit	(2) Bivariate Probit	(3) Full Structural
Money			
Taxprice	-1.664***	-1.683***	-1.670***
	(0.203)	(0.202)	(0.202)
Income($0000)	0.0691***	0.0659***	0.0676***
	(0.0148)	(0.0152)	(0.0144)
Income_sq	-0.000543***	-0.000513***	-0.000540***
	(0.000113)	(0.000118)	(0.000111)
Constant	-1.487***	-1.490***	-0.0303
	(0.207)	(0.209)	(0.482)
Log-likelihood	-1,982.6479		
Time			
Taxprice	-0.429***	-0.442***	-1.022***
	(0.138)	(0.138)	(0.337)
Income($0000)	0.0148*	0.0152*	0.0414***
	(0.00886)	(0.00906)	(0.0154)
Income_sq	-0.000196**	-0.000201**	-0.000381***
	(9.20e-05)	(9.39e-05)	(0.000124)
Constant	1.013***	0.931***	1.003***
	(0.346)	(0.348)	(0.318)
Correlation		0.312***	0.755***
		(0.031)	(0.125)
φ_c			0.561***
			(0.128)
φ_v			0.459**
			(0.211)
Log-likelihood	-2,061.8041	-4,004.0798	-3,996.3148
Observations	4,421	4,421	4,421

Table 4: Result of religious giving

VARIABLES	(1) Probit	(2) Bivariate Probit	(3) Full Structural
Money			
Taxprice	-0.996***	-0.995***	-1.018***
	(0.199)	(0.193)	(0.192)
Income($0000)	0.00541	0.00593	0.00579
	(0.00951)	(0.00986)	(0.00967)
Income_sq	0.000115	0.000120	0.000118
	(0.000147)	(0.000163)	(0.000156)
Constant	-2.888***	-2.877***	-2.782***
	(0.249)	(0.254)	(0.256)
Log-likelihood	-2,048.0507		
Time			
Taxprice	-0.823***	-0.761***	-0.795***
	(0.152)	(0.154)	(0.282)
Income($0000)	-0.00671	-0.00920	-0.00752
	(0.0111)	(0.0120)	(0.0132)
Income_sq	-3.48e-06	2.89e-05	5.18e-05
	(0.000140)	(0.000143)	(0.000147)
Constant	-3.001***	-3.013***	-3.005***
	(0.268)	(0.274)	(0.269)
Correlation		0.531***	0.736***
		(0.027)	(0.212)
φ_c			0.597***
			(0.222)
φ_v			0.164
			(0.490)
Log-likelihood	-1,494.5068	-3,436.3013	-3,432.831
Observations	4,421	4,421	4,421

Table 5: Result of non-religious giving

VARIABLES	(1) Probit	(2) Bivariate Probit	(3) Full Structural
Money			
Taxprice	-1.326***	-1.334***	-1.319***
	(0.145)	(0.147)	(0.137)
Income($0000)	0.0687***	0.0672***	0.0676***
	(0.0116)	(0.0119)	(0.0113)
Income_sq	-0.000515***	-0.000502***	-0.000512***
	(9.14e-05)	(9.19e-05)	(8.84e-05)
Constant	-1.210***	-1.209***	-0.644*
	(0.230)	(0.230)	(0.333)
Log-likelihood	-2,417.3356		
Time			
Taxprice	-0.404***	-0.418***	-0.758***
	(0.122)	(0.121)	(0.208)
Income($0000)	0.0160*	0.0163**	0.0365**
	(0.00833)	(0.00831)	(0.0156)
Income_sq	-0.000179**	-0.000182**	-0.000314***
	(8.05e-05)	(8.04e-05)	(0.000118)
Constant	-0.193	-0.207	-0.150
	(0.222)	(0.222)	(0.241)
Correlation		0.285***	0.686***
		(0.025)	(0.145)
φ_c			0.537***
			(0.140)
φ_v			0.377*
			(0.209)
Log-likelihood	-2,246.1124	-4,616.432	-4,610.5612
Obervations	4,421	4,421	4,421

2) Result of full structural model

Probit and bivariate probit model assume that charitable giving and voluntary activities are separable ($\gamma_{cv_i} = 0$) in consumption. Nonetheless, many studies argue that they are complements (Brown and Lankford, 1992) or substitutes (Segal and Weisbrod, 2002) in some types of charities. If their interpretations were right in Frisch sense, the effect of tax price on volunteering outside of the effect of relative price should not have existed. Thus, whether using probit and bivariate probit model is appropriate or not depends on this existence. However as later we will check, the direct effect of tax price on volunteering exists. As DiNardo and Lemieux (1992, 2001) and Feldman (2010) did, I use full structural model to find out the relationship, assuming the marginal utility of time affects that of money and vice versa. Like probit and bivariate probit model, the hypothesis all parameters including constant are equal between religious and non-religious giving is rejected.[12]

φ_v and φ_c in column 3 in table 3 support that they are substitutes. To argue they are substitutes, what we have to focus on is not only φ_v and φ_c, but also the difference of the coefficient of tax price for time donation in column 2 and 3. This is because even though r_{cv_i} is not large enough to express substitutionary or complementary effect, small γ_{vv_i} and γ_{cc_i}, which cannot be estimated in this model, can make φ_v and φ_c significantly positive. Moreover, the coefficient in column 2 reflects two confounding effects, the effect of relative price plus the effect that work outside the change of the relative price. Thus, in addition to φ_v and φ_c, if they are substitutes and the model is well constructed, the coefficient of tax price in time equation in bivariate probit model is larger than the coefficient in full structural model. When moving from bivariate probit model to the full structural model, the coefficient increases over twice in table 3.[13] As expected, in full structural model, the coefficient in the time equation indicates that non-substitution effect is negatively correlated to time donation and the difference of

[12] Rejection is based on Chi-square test statistics with 22 degrees of freedom of 1424.87, and 1139.11 for money and time equations, respectively.

[13] The hypothesis the coefficient of log price in column 2 and 3 are same is rejected by 10 percent.

coefficients indicates the positive substitution effect if the government increases the tax price. In column 3, the coefficient of tax price in time equation can be considered as "societal approval of charitable giving" or Freeman's claim, "tastes for charitable giving" made by decrease of the price of donating money. Here, as Freeman (1997) argued, these tastes outweigh the substitution effect.

Like probit and bivariate probit model, I analyze two behaviors, dividing by two sectors, religious and non-religious sectors with full structural model, which appears in table 4 and 5. In religious sector, interestingly, after distinguishing the substitution effect and non-substitution effect, the coefficient of tax price in time equation does not change between column 2 and 3. Although φ_c is significantly positive and the hypothesis that φ_c and φ_v are equal to zero is rejected, the change of the coefficient of tax price in Time equation is not big.[14] This indicates that the substitution effect of the change of relative price does not exist. Remembering the form of φ_c and φ_v, φ_c can be large even if γ_{cv} is small because of small γ_{vv_i} and γ_{cc_i}. Thus, the relationship between both giving behaviors is not substitutionary for religious organizations. This result is consistent with Bauer et al. (2010), which found no relationship, but not line with Segal and Weisbrod (2002) who found substitutionary relationship in religious giving. Since our result shows that outside-effect on volunteering exists and Segal and Weisbrod (2002) used simple tobit model in time equation, in Frisch sense their negative coefficient of tax-price in time equation should not be interpreted as the substitutionary relationship.

On the other hand, for non-religious organizations, after distinguishing substitution and non-substitution effect, the absolute value of the coefficient of the price in Time equation gets almost twice bigger. [15]Moreover, φ_c and φ_v are significantly positive. This pattern is similar to the aggregate result, showing that two donation behaviors are substitutes. Segal and Weisbrod (2002) found complementary relationship in education sector, but Bauer et al. (2010) found substitutionary in social and leisure organizations. Again, since our result shows that outside-effect on volunteering exists, and Segal and Weisbrod (2002) used simple tobit model in time equation, their positive coefficient of tax-price in time

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[14] The hypothesis that the coefficient of log price in column 2 and 3 are same is cannot be rejected by any statistical meaningful level.

[15] The hypothesis that the coefficient of log price in column 2 and 3 are same is rejected by 10 percent.

equation reflects two confounding effect: the relative price effect plus the direct effect of monetary donation price.

Here after considering substitution effect, correlation is still significantly positive in aggregated and disaggregated level. Thus, again, there are unobservable variables, internal altruism or something else determining both donations of time and money.

7. Policy simulation: Discount the price of donation of money by 10%

As seen the model, discounted tax price in this model does not have same effects on all households. Thus, to visualize the effect of tax price on donation of money and time, this paper simulates change of tax policy; discounting tax-price by 10 percent. Figure 2 indicates the change of proportion of the four outcomes if the government discounts the price of donation of money by 10 percent. This policy change may be introduction of a universal tax deduction for donations of money like Feldman (2010), the increase of dollar deduction for charitable giving, and so on.

Panel A indicates the change by the substitution effects from change of the relative price, which is φ_c, φ_v or the difference between the coefficient of tax-price of time equation in column 2 and 3 in the table. As the absolute value of φ_c and φ_v and the change of coefficient are largest in the aggregate result, change of the blue bar is the biggest. Conversely, as expected, change of religious organization is very small, which indicates no substitution effect in religious sector. Comparing with Feldman (2010), here, the substitution effect is enough to push those who only volunteer to donate money in aggregate level and for non-religious organizations.

Panel B shows the effect of non-substitution effects. These effects include the effect on money by the change of own price, and other effects rather than substitution effect by change of relative price, for example, “societal approval”. In other words, using notations in the model, these effects show direct tax-price effect on both T_{c_i} and T_{v_i}. What is interesting here, as shown in the result, discounted price of donating money directly increases T_{v_i}. The proportion of people who neither donate money and time decreases and that of those who donate both increases, which supports “societal approval”. This change can be because of the

campaign effect, augmenting marginal utility of volunteering, or more information on charities due to more people donating money, diminishing the cost of volunteering. Compared to the substitution effect here, the change in religious sector is relatively large. Thus, for non-substitution effect, there is no significant difference between religious and non-religious sector.

Panel C shows the sum of two previous effects. First, in the aggregate, the change of tax policy by 10% reduces the proportion of Neither and Time only by 2.9 percent and 1.5 percent, respectively. In contrast, the proportion of Money only and both increases by 1.1 percent and 3.3 percent. For religious organizations, that of Neither decreases 4.3 percent but here, that of Time only increases by 0.02 percent which is very small. Like the aggregate, that of Money only and of Both go up by 2.8 percent and 1.5 percent. As the next figure shows, this change is almost from the non-substitution effect. Finally, the direction and magnitude of change of proportion for non-religious sector is similar with the aggregate result. (Decrease in Neither and Time only by 4.2 percent and 1 percent, and increase in Money only and Both by 2.4 percent and 2.7 percent)

Figure 2: The change of proportion of outcomes after discounting price by 10%

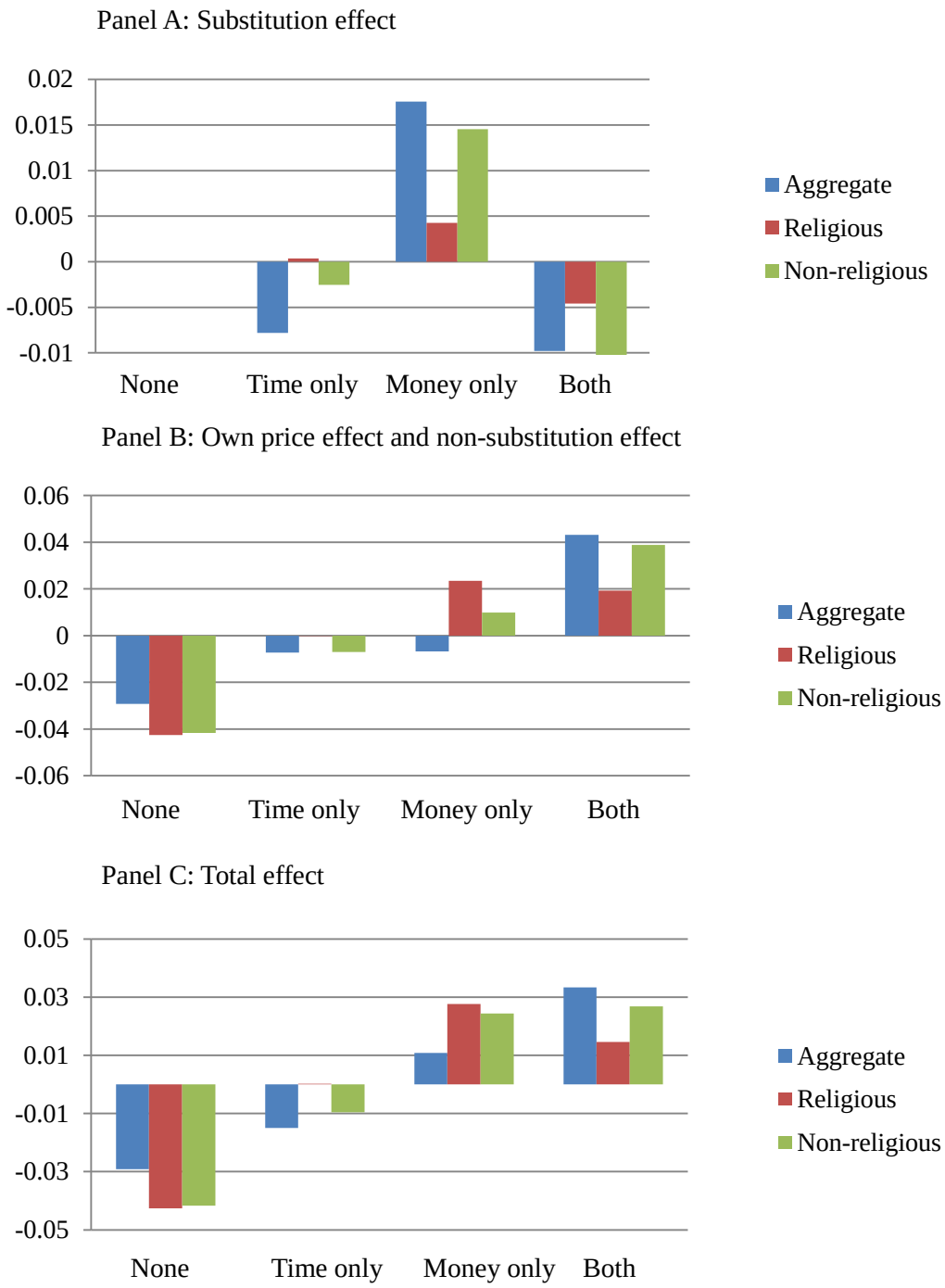
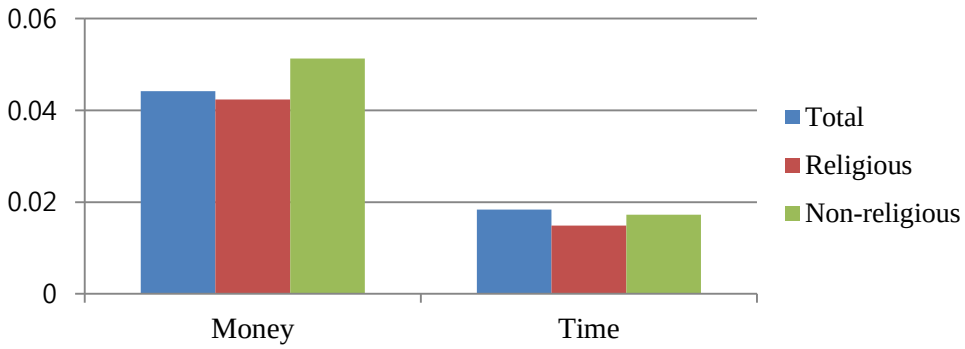


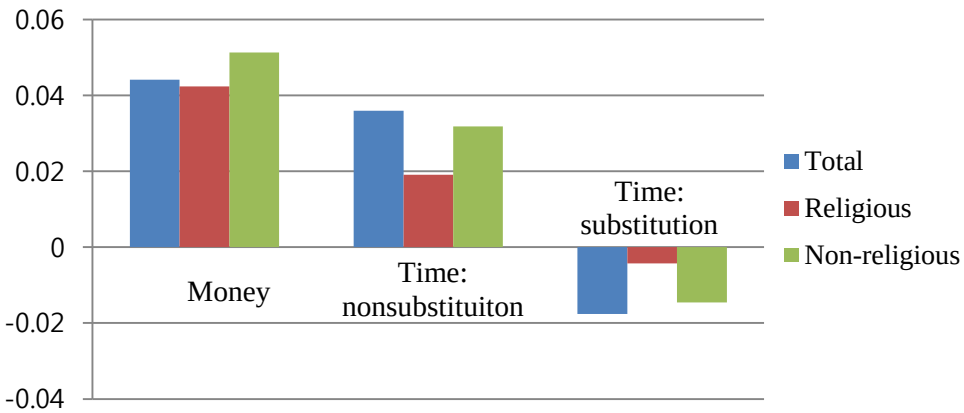
Figure 3 analyzes the effects in change of Time and Money. Panel A indicates that by total effects, the proportion of donating money and time goes up by approximately 4.2 percent and 1.5 percent in religious sector, and 5.1 percent and 1.7 percent in non-religious sectors. However, this result does not mean donation of money and time are complements. Breaking up the total effect of time into substitution and non-substitution effects, the change of religious sector is mainly from non-substitution effects. This, again, supports that there's no relationship between money and time in religious sector. Thus, while people are influenced by intrinsic and extrinsic motivations when deciding whether donating money or time for secular organizations, when deciding charitable activities for religious organizations, people are motivated only with intrinsic factors.

Figure 3: The Change of Proportion of Outcomes after Discounting Price by 10%: Gross Donation of Money and Time

Panel A: Total effect



Panel B: Total effect disaggregated



8. Conclusion

Many papers have focused only on monetary charitable giving without analyzing volunteer activities although volunteering is popular, comprises a huge part of the total value of charitable gifts, and is expected to have somewhat relationship with donation. Because of ignoring volunteering, their study under or over-stated tax policy on altruistic behaviors. Brown and Lankford (1992) found this problem, and many economists tried to find the relationship between two

activities, but their results have been different. Feldman (2010) borrowed a nice approach from DiNardo and Lemieux (1992, 2001) to find it, and concluded that they are substitutes. However, she also pointed out that there is no reason to think that their relationship have to remain same across different purposes. This was a point that Segal and Weisbrod (2002) argued as well.

With this motivation, this paper analyzes the relationships for religious organizations and for non-religious, secular organizations, using PSID data. By using PSID data, this paper can use more recent data and calculate tax price, income after taxation more precisely than Feldman (2010). Also, PSID data has individuals' answers about which organizations they volunteered and donated for 2010. The result is that in aggregate analysis of two behaviors, they are substitutes, which confirms same result with Feldman (2010). However, in disaggregate analysis, while finding substitutionary relationship in secular sector, which is similar with the level of the aggregate, this paper finds neither substitutionary nor complementary relationship between two behaviors in religious sector. With this finding, we can say that people do not substitute their hours for money by extrinsic factors in religious sectors. Time is not Money between religious charitable activities. To make this finding visible, this paper shows the result of simulation: If the government discount tax price by 10 percent, what happens in four outcomes in the aggregated and disaggregated level? As expected, the substitutionary effect is very small for religious giving, while there is the significant effect in non-religious giving.

Obviously, this paper has some limit points, and one of them is that this paper finds out the relationship between money and time donation within but not between organizations. For example, those who donate money for religious organization might be more likely to donate for non-religious organizations. Brown et al. (2009) handled similar issue: Regardless of organizations, those had donated money donated more for victims of Tsunami in 2004, and those had donated for the victims donated less in 2005. This implies that there is complementary or substitutionary relationship between organizations. This issue is left for future research.

Another limit point is that this research is based on bivariate probit model and modified version. As individual decides to donate and volunteer for each organization, error terms across organizations are more likely to be correlated, which means that multivariate probit and modified multivariate model are more accurate for disaggregated analysis. However, multivariate probit model has many obstacles to be used. (Greene, 2002) So, by this time, bivariate probit model is the

best option for this analysis.

There is another issue rather than tax policy: Government direct subsidies to charities and gifts of others, which might crowd out individual's gifts. According to the Duncan (1999) and Bergstrom et al. (1986), these are likely to crowd out individual's gift if they are motivated by total supply of public good. This issue was researched by Duncan (1999) in aggregated level, but like the effect of tax policies on monetary donation, there might be different effects of these across types of charities. These are left for further research.

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Appendix

A) Frisch complements and substitutes in this model

Note that when donation of time and money are substitutes, there exist people who donate both money and time only if $r_{cc_i}r_{vv_i} - {r_{cv_i}}^2 > 0$. Since in the data, a large number of respondents are a time-and-money donator (Outcome 4). Thus, $r_{cc_i}r_{vv_i} - {r_{cv_i}}^2 > 0$.

Note that by addictive form of utility function, the Frisch demand of c_i and v_i are $f(\emptyset_i, p_c, p_c, \lambda_c, \lambda_v)$ and $g(\emptyset_i, p_c, p_c, \lambda_c, \lambda_v)$, respectively. When individual donates positive amount of money and time,

$$\binom{c_i}{v_i} = \begin{pmatrix} \dfrac{r_{cv_i}(r_{v_i} - \lambda_v p_v) - r_{vv_i}(r_{c_i} - \lambda_c p_c)}{r_{cc_i}r_{vv_i} - {r_{cv_i}}^2} \\ \dfrac{r_{cv_i}(r_{c_i} - \lambda_c p_c) - r_{cc_i}(r_{v_i} - \lambda_v p_v)}{r_{cc_i}r_{vv_i} - {r_{cv_i}}^2} \end{pmatrix}$$

By the condition of Outcome 4, $r_{cv_i}(r_{v_i} - \lambda_v p_v) - r_{vv_i}(r_{c_i} - \lambda_c p_c) > 0$ and $r_{cv_i}(r_{c_i} - \lambda_c p_c) - r_{cc_i}(r_{v_i} - \lambda_v p_v) > 0$. Thus, $\frac{\partial v_i}{\partial p_c} = \frac{-r_{cv_i}\lambda_c}{r_{cc_i}r_{vv_i} - {r_{cv_i}}^2}$. Since if $\frac{\partial v_i}{\partial p_c} > 0$, c_i and v_i are Frisch substitutes and if $\frac{\partial v_i}{\partial p_c} < 0$, they are Frisch complements, $r_{cv_i} > 0$, and $r_{cv_i} < 0$ indicate Frisch substitutes and complements respectively.

B) An example of TAXSIM program

Here is a sample entry for a single tax-payer with one child in Michigan. (Labor income: $50,000, Property tax: $3,000, Other income: $4,000 Childcare expanse: $4,000 Short-term capital gain: -$1,000, Mortgage interest paid, charitable giving, etc.: $0) Then TAXSIM program will give

year	state	mstat	depx	pwages	rentpaid	proptax	otheri~m	mortgage	childc~e	depchild	stcg
2010	23	1	1	50000	0	3000	4000	0	3000	1	-1000

taxsimid	fiitax	siitax	fica	frate	srate	ficar
1	2397.5	1042.2	7650	15	6.45	15.3

To interpret the above, his tax liability for 2010 is $2,397.5 for federal tax, $1042.2 for state tax, and $7,650 for Federal Insurance Contribution Act (FICA) tax. His marginal tax rate for additional $1 income is 0.15, 0.0645, 0.153 respectively. What if inputs increase by $1,000? Table A1 shows the change of taxes in each case.

Table A1. Change of taxes by increasing inputs by $1,000.

+$1,000	Federal tax	State tax	Federal tax rate	State tax rate
Income	+$150	+$64.5	0	0
Rent paid	0	-$119.9	0	0
Property tax	-$29.54	-$450	-$0.08	-$2.1
Other item	$-96.33	+$0.02	-$0.97	0
Mortgage	$-96.33	+$0.02	-$0.97	0
Childcare	0	+$0.02	0	0
STCG	-$150	-$43.48	0	0

Table A2. The regions in the United States.

Variable	States
Region 1	Connecticut, Maine, Massachusetts, New Hampshire, New Jersey, New York, Pennsylvania, Rhode Island, Vermont
Region 2	Illinois, Indiana, Iowa, Kansas, Michigan, Minnesota, Missouri, Nebraska, North Dakota, Ohio, South Dakota, Wisconsin
Region 3	Alabama, Arkansas, Delaware, Florida, Georgia, Kentucky, Louisiana, Maryland, Mississippi, North Carolina, Oklahoma, South Carolina, Tennessee, Texas, Virginia, Washington DC, West Virginia
Region 4	Arizona, California, Colorado, Idaho, Montana, Nevada, New Mexico, Oregon, Utah, Washington, Wyoming, Alaska, Hawaii

Table A3: Full result of the aggregated level

VARIABLES	(1) Probit	(2) Bivariate Probit	(3) Full Structural
Money			
Taxprice	-1.664***	-1.683***	-1.670***
	(0.203)	(0.202)	(0.202)
Income($0000)	0.0691***	0.0659***	0.0676***
	(0.0148)	(0.0152)	(0.0144)
Income_sq	-0.000543***	-0.000513***	-0.000540***
	(0.000113)	(0.000118)	(0.000111)
Age(10)	0.324***	0.322***	0.393***
	(0.0903)	(0.0910)	(0.0904)
Age_sq	-0.0157	-0.0153	-0.0218**
	(0.0105)	(0.0106)	(0.0103)
Children	-0.0913**	-0.0956**	-0.0662
	(0.0442)	(0.0442)	(0.0405)
Child in college	0.0336	0.0446	0.0266
	(0.0435)	(0.0439)	(0.0395)
Married	0.271***	0.266***	0.0920
	(0.0578)	(0.0584)	(0.0630)
Religious	0.207***	0.207***	0.243***
	(0.0170)	(0.0171)	(0.0183)
College grad.	0.300***	0.296***	0.358***
	(0.0755)	(0.0767)	(0.0827)
Max. educ	0.236***	0.240***	0.246***
	(0.0742)	(0.0753)	(0.0778)

Homeowner	0.254***	0.255***	0.240***
	(0.0524)	(0.0514)	(0.0528)
Parent educ.	0.0500***	0.0504***	0.0647***
	(0.0150)	(0.0152)	(0.0133)
Employed	-0.132*	-0.128	-0.157**
	(0.0787)	(0.0790)	(0.0760)
Minority	-0.233***	-0.237***	-0.249***
	(0.0461)	(0.0466)	(0.0459)
Hispanic	-0.101	-0.0928	-0.100*
	(0.0659)	(0.0657)	(0.0590)
Male	-0.456***	-0.456***	-1.982***
	(0.0766)	(0.0763)	(0.419)
Dum_region2	-0.187**	-0.185**	-0.174*
	(0.0902)	(0.0931)	(0.0904)
Dum_region3	-0.160**	-0.152**	-0.165**
	(0.0696)	(0.0728)	(0.0718)
Dum_region4	-0.0273	-0.0236	-0.00184
	(0.0773)	(0.0796)	(0.0792)
Constant	-1.487***	-1.490***	-0.0303
	(0.207)	(0.209)	(0.482)
Log-likelihood	-1982.6479		
Time			
Taxprice	-0.429***	-0.442***	-1.022***
	(0.138)	(0.138)	(0.337)
Income($0000)	0.0148*	0.0152*	0.0414***
	(0.00886)	(0.00906)	(0.0154)
Income_sq	-0.000196**	-0.000201**	-0.000381***
	(9.20e-05)	(9.39e-05)	(0.000124)
Age(10)	0.434***	0.437***	0.437***
	(0.0703)	(0.0709)	(0.0648)
Age_sq	-0.0375***	-0.0374***	-0.0321***
	(0.00681)	(0.00686)	(0.00680)
Children	0.0891**	0.0862*	0.0433
	(0.0443)	(0.0448)	(0.0498)
Child in college	-0.00598	-0.00333	0.00953
	(0.0465)	(0.0471)	(0.0431)
Married	-0.732***	-0.741***	-0.568***
	(0.0820)	(0.0815)	(0.130)
Religious	0.227***	0.227***	0.266***
	(0.0142)	(0.0143)	(0.0163)
College grad.	0.334***	0.332***	0.379***
	(0.0689)	(0.0701)	(0.0756)
Max. educ	0.159**	0.157*	0.219***
	(0.0798)	(0.0809)	(0.0748)
Homeowner	0.0212	0.0192	0.117**

	(0.0550)	(0.0550)	(0.0519)
Parent educ.	0.0825***	0.0823***	0.0881***
	(0.0133)	(0.0131)	(0.0129)
Employed	-0.125***	-0.120***	-0.170***
	(0.0381)	(0.0393)	(0.0542)
Minority	-0.157***	-0.156***	-0.206***
	(0.0445)	(0.0438)	(0.0502)
Hispanic	-0.0407	-0.0445	-0.0603
	(0.0612)	(0.0610)	(0.0537)
Male	-3.232***	-3.154***	-3.211***
	(0.307)	(0.307)	(0.283)
Dum_region2	0.0285	0.0223	-0.0596
	(0.0878)	(0.0892)	(0.0905)
Dum_region3	-0.0386	-0.0368	-0.126*
	(0.0668)	(0.0669)	(0.0686)
Dum_region4	0.137**	0.129**	0.0844
	(0.0597)	(0.0604)	(0.0666)
Constant	1.013***	0.931***	1.003***
	(0.346)	(0.348)	(0.318)
Correlation		0.312***	0.755***
		(0.031)	(0.125)
φ_c			0.561***
			(0.128)
φ_v			0.459**
			(0.211)
Log-likelihood	-2061.8041	-4004.0798	-3996.3148
Observations	4,421	4,421	4,421

Table A4: Full result of religious giving

VARIABLES	(1) Probit	(2) Bivariate Probit	(3) Full Structural
Money			
Taxprice	-0.996***	-0.995***	-1.018***
	(0.199)	(0.193)	(0.192)
Income($0000)	0.00541	0.00593	0.00579
	(0.00951)	(0.00986)	(0.00967)
Income_sq	0.000115	0.000120	0.000118
	(0.000147)	(0.000163)	(0.000156)
Age(10)	0.356***	0.350***	0.369***
	(0.0954)	(0.0951)	(0.0920)
Age_sq	-0.0176*	-0.0173*	-0.0194**

	(0.00991)	(0.00986)	(0.00956)
Children	-0.0478	-0.0466	-0.0492
	(0.0497)	(0.0484)	(0.0466)
Child in college	0.0705	0.0737	0.0757*
	(0.0463)	(0.0455)	(0.0423)
Married	0.317***	0.306***	0.269***
	(0.0673)	(0.0689)	(0.0731)
Religious	0.514***	0.513***	0.532***
	(0.0208)	(0.0211)	(0.0251)
College grad.	0.0600	0.0545	0.0617
	(0.0771)	(0.0779)	(0.0776)
Max. educ	0.288***	0.290***	0.281***
	(0.0785)	(0.0784)	(0.0830)
Homeowner	0.241***	0.248***	0.235***
	(0.0598)	(0.0595)	(0.0546)
Parent educ.	0.0193	0.0194	0.0218*
	(0.0128)	(0.0127)	(0.0122)
Employed	-0.0480	-0.0471	-0.0618
	(0.0685)	(0.0681)	(0.0672)
Minority	-0.109	-0.115	-0.0981
	(0.0755)	(0.0767)	(0.0681)
Hispanic	-0.0376	-0.0363	-0.0431
	(0.0813)	(0.0807)	(0.0776)
Male	-0.265***	-0.263***	-0.380***
	(0.0802)	(0.0802)	(0.0814)
Dum_region2	0.0608	0.0660	0.0787
	(0.0869)	(0.0889)	(0.0876)
Dum_region3	0.0352	0.0421	0.0551
	(0.0625)	(0.0622)	(0.0636)
Dum_region4	-0.0235	-0.00945	0.00511
	(0.0812)	(0.0802)	(0.0814)
Constant	-2.888***	-2.877***	-2.782***
	(0.249)	(0.254)	(0.256)
Log-likelihood	-2048.0507		
Time			
Taxprice	-0.823***	-0.761***	-0.795***
	(0.152)	(0.154)	(0.282)
Income($0000)	-0.00671	-0.00920	-0.00752
	(0.0111)	(0.0120)	(0.0132)
Income_sq	-3.48e-06	2.89e-05	5.18e-05
	(0.000140)	(0.000143)	(0.000147)
Age(10)	0.416***	0.400***	0.385***
	(0.0921)	(0.0942)	(0.0859)
Age_sq	-0.0344***	-0.0324***	-0.0293***

	(0.00978)	(0.00990)	(0.00966)
Children	-0.0370	-0.0227	-0.0179
	(0.0604)	(0.0597)	(0.0624)
Child in college	0.0761	0.0660	0.0628
	(0.0617)	(0.0634)	(0.0696)
Married	-0.299***	-0.318***	-0.246
	(0.104)	(0.104)	(0.193)
Religious	0.477***	0.494***	0.521***
	(0.0232)	(0.0249)	(0.0724)
College grad.	0.117	0.116	0.108
	(0.0977)	(0.0986)	(0.0942)
Max. educ	0.112	0.0999	0.119
	(0.108)	(0.107)	(0.122)
Homeowner	0.0412	0.0586	0.0944
	(0.0661)	(0.0647)	(0.0856)
Parent educ.	0.0467***	0.0447***	0.0418***
	(0.0146)	(0.0136)	(0.0125)
Employed	-0.110*	-0.101*	-0.104*
	(0.0590)	(0.0574)	(0.0553)
Minority	0.0337	0.0669	0.0644
	(0.0552)	(0.0543)	(0.0875)
Hispanic	-0.0797	-0.0656	-0.0640
	(0.110)	(0.104)	(0.0905)
Male	-0.682***	-0.652***	-0.622***
	(0.0968)	(0.0952)	(0.115)
Dum_region2	0.232*	0.216*	0.203*
	(0.125)	(0.125)	(0.118)
Dum_region3	0.222*	0.212*	0.185
	(0.118)	(0.121)	(0.116)
Dum_region4	0.215	0.190	0.155
	(0.161)	(0.162)	(0.136)
Constant	-3.001***	-3.013***	-3.005***
	(0.268)	(0.274)	(0.269)
Correlation		0.531***	0.736***
		(0.027)	(0.212)
φ_c			0.597***
			(0.222)
φ_v			0.164
			(0.490)
Log-likelihood	-1494.5068	-3436.3013	-3432.831
Observations	4,421	4,421	4,421

Table A5: Full result of non-religious giving

VARIABLES	(1) Probit	(2) Bivariate Probit	(3) Full Structural
Money			
Taxprice	-1.326***	-1.334***	-1.319***
	(0.145)	(0.147)	(0.137)
Income($0000)	0.0687***	0.0672***	0.0676***
	(0.0116)	(0.0119)	(0.0113)
Income_sq	-0.000515***	-0.000502***	-0.000512***
	(9.14e-05)	(9.19e-05)	(8.84e-05)
Age(10)	0.306***	0.305***	0.328***
	(0.0914)	(0.0907)	(0.0849)
Age_sq	-0.0147	-0.0146	-0.0176**
	(0.00939)	(0.00931)	(0.00861)
Children	-0.0829**	-0.0849**	-0.0616
	(0.0405)	(0.0407)	(0.0394)
Child in college	0.0385	0.0428	0.0407
	(0.0406)	(0.0413)	(0.0382)
Married	0.144***	0.144***	0.0234
	(0.0529)	(0.0526)	(0.0653)
Religious	2.88e-05	0.000921	0.0169
	(0.0129)	(0.0130)	(0.0122)
College grad.	0.257***	0.261***	0.318***
	(0.0571)	(0.0576)	(0.0638)
Max. educ	0.236***	0.233***	0.232***
	(0.0636)	(0.0640)	(0.0657)
Homeowner	0.154***	0.156***	0.134***
	(0.0418)	(0.0413)	(0.0393)
Parent educ.	0.0518***	0.0520***	0.0612***
	(0.0121)	(0.0121)	(0.0111)
Employed	-0.142**	-0.143**	-0.172***
	(0.0637)	(0.0631)	(0.0630)
Minority	-0.226***	-0.228***	-0.241***
	(0.0583)	(0.0584)	(0.0573)
Hispanic	-0.125*	-0.123*	-0.119**
	(0.0675)	(0.0670)	(0.0579)
Male	-0.525***	-0.523***	-1.008***
	(0.0659)	(0.0656)	(0.163)
Dum_region2	-0.210**	-0.210**	-0.200**
	(0.0890)	(0.0886)	(0.0896)
Dum_region3	-0.183**	-0.180**	-0.190**
	(0.0765)	(0.0767)	(0.0767)
Dum_region4	-0.132	-0.136	-0.126
	(0.0914)	(0.0908)	(0.0883)
Constant	-1.210***	-1.209***	-0.644*
	(0.230)	(0.230)	(0.333)

Log-likelihood	-2417.3356		
Time			
Taxprice	-0.404***	-0.418***	-0.758***
	(0.122)	(0.121)	(0.208)
Income($0000)	0.0160*	0.0163**	0.0365**
	(0.00833)	(0.00831)	(0.0156)
Income_sq	-0.000179**	-0.000182**	-0.000314***
	(8.05e-05)	(8.04e-05)	(0.000118)
Age(10)	0.253***	0.255***	0.284***
	(0.0738)	(0.0747)	(0.0668)
Age_sq	-0.0234***	-0.0236***	-0.0226***
	(0.00732)	(0.00740)	(0.00658)
Children	0.0924***	0.0960***	0.0608
	(0.0344)	(0.0347)	(0.0417)
Child in college	0.0238	0.0202	0.0349
	(0.0377)	(0.0375)	(0.0369)
Married	-0.609***	-0.617***	-0.536***
	(0.0692)	(0.0688)	(0.0880)
Religious	0.103***	0.104***	0.0883***
	(0.0141)	(0.0140)	(0.0170)
College grad.	0.360***	0.357***	0.380***
	(0.0571)	(0.0577)	(0.0589)
Max. educ	0.102	0.105	0.149**
	(0.0701)	(0.0703)	(0.0703)
Homeowner	-0.0368	-0.0346	0.00813
	(0.0542)	(0.0540)	(0.0556)
Parent educ.	0.0650***	0.0657***	0.0724***
	(0.0132)	(0.0129)	(0.0124)
Employed	-0.149***	-0.150***	-0.198***
	(0.0393)	(0.0398)	(0.0520)
Minority	-0.165***	-0.168***	-0.208***
	(0.0537)	(0.0537)	(0.0520)
Hispanic	-0.0686	-0.0668	-0.0728
	(0.0556)	(0.0528)	(0.0456)
Male	-1.365***	-1.358***	-1.404***
	(0.0878)	(0.0877)	(0.0928)
Dum_region2	-0.00838	-0.0110	-0.0726
	(0.0753)	(0.0756)	(0.0815)
Dum_region3	-0.0572	-0.0603	-0.129*
	(0.0680)	(0.0686)	(0.0748)
Dum_region4	0.0346	0.0327	-0.0124
	(0.0504)	(0.0497)	(0.0628)
Constant	-0.193	-0.207	-0.150
	(0.222)	(0.222)	(0.241)

Correlation		0.285***	0.686***
		(0.025)	(0.145)
φ_c			0.537***
			(0.140)
φ_v			0.377*
			(0.209)
Log-likelihood	-2246.1124	-4616.432	-4610.5612
Observations	4,421	4,421	4,421

요약(국문초록)

본 연구에서는 기부와 봉사활동에 대해서 종합적인(aggregate) 측면에서와 자선 단체의 종류별 측면(Disaggregate)에서의 두 행동 관계를 분석하였다. 2011년 PSID 데이터를 이용하여, Feldman(2010)의 방법론을 통해 분석한 결과, 기부와 봉사활동은 서로 대체재인 것으로 나타났다. 하지만, 이 두 행동을 자선 단체의 종류별로 나눠서 분석을 하였을 때, 두 행동은 서로 다른 관계를 보였다. 즉, 비종교적인 자선 단체에서는 사람들은 봉사활동을 대체하기 위해 기부를 하였지만, 종교적인 자선단체에서는 두 행동이 서로 대체재, 보완재 관계가 나타나지 않았다. 또한 본 연구에서는 기부의 가격효과가 상대가격 효과가 아닌 직접적으로 봉사활동에 영향을 주는 것을 발견하였다. 이 효과가 상대가격효과보다 컸기 때문에 이전 논문들에서는 이 두 행동을 대체재가 아닌 보완재로 해석을 하였다.

……

주요어 : 기부, 봉사활동, 대체재, 보완재, Disaggregated analysis.

학 번 : 2014-20210