Substitutes or complements: a budget-based analysis of the relationship between donating and volunteering

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Introduction

Motivation and question

- Non-profit and philanthropic organizations rely on charitable gifts of various types, e.g. **donating and volunteering**
- Individuals' gifts of money and time are often studied independently of each other or in limited contexts
- Knowledge of **underlying preferences** for charitable giving benefits general understanding of altruistic preferences

Are donating and volunteering substitutes or complements?
How to sensibly test this?

Literature

Textbook definition (Nicholson and Snyder, 2016):

- Two goods are substitutes if an increase in the price of one good increases the quantity demanded of the other good
- Two goods are complements if an increase in the price of one good decreases the quantity demanded of the other good

- Effect of tax treatment donations (its "price") on volunteering (e.g., Andreoni et al., 1996; Brown and Lankford, 1992; Feldman, 2010)
  - Always based on American giving data
  - Overall inconclusive results

- (Partial) lab studies using real-effort volunteering tasks suggest substitute relationship (Brown et al., 2019; Lilley and Slonim, 2014; Ploner and Regner, 2013)

- Field experiment by Yeomans and Al-Ubaydli (2018) shows that a charity's (starting) volunteers reduce their volunteering hours after receiving a donation request

Contribution

- Derive a **model of donating and volunteering** with an explicit role for the money and time budgets available for these gifts
- Show that the relationship between donating and volunteering can (under certain conditions) be identified by their **cross-budget effect**
- Present an **empirical application** using an econometric model that mimics these conditions
- Estimate own- and cross-budget effects using a **panel dataset of Dutch individuals** and relate estimates to the theoretical model

Theoretical model

A model of donating and volunteering

$$U(c, l, d, v) = u_\alpha(c) + u_\beta(l) + \phi(d, v)$$

c = composite private consumption
l = leisure
d = donating
v = volunteering

$$\begin{aligned} \underset{c,\,l,\,d,\,v}{\text{maximize}} \quad & U(c, l, d, v) \\ \text{subject to} \quad & c + p_d d \leq M, \\ & l + p_v v \leq T, \\ & d \geq 0, \\ & v \geq 0. \end{aligned}$$

$$u_\alpha(c) = \alpha_c c + (\alpha_{cc}/2)c^2 \quad \text{and} \quad u_\beta(l) = \beta_l l + (\beta_{ll}/2)l^2$$

$$\phi(d, v) = \gamma_d d + \gamma_v v + \gamma_{dv} dv + (\gamma_{dd}/2)\, d^2 + (\gamma_{vv}/2)\, v^2$$

Giving outcomes

1. No giving
2. Donating only
3. Volunteering only
4. Donating & volunteering

▸ Derivations

$$d_2 = \frac{A_1}{B_1}$$

$$A_1 = [\alpha_c + \alpha_{cc} M] p_d - \gamma_d$$
$$B_1 = [\gamma_{dd} + \alpha_{cc} p_d^2] < 0$$

$$d_4 = \frac{\gamma_{dv} A_2 - A_1 B_2}{\underbrace{\gamma_{dv}^2}_{>0} - \underbrace{B_1 B_2}_{>0}}$$

$$A_2 = [\beta_I + \beta_{II} T] p_v - \gamma_v$$
$$B_2 = [\gamma_{vv} + \beta_{II} p_v^2] < 0$$

Model predictions

1. No giving
2. Donating only
3. Volunteering only
4. Donating & volunteering

$$\frac{\mathrm{d}d_2}{\mathrm{d}M} = \frac{\alpha_{cc} p_d}{\gamma_{dd} + \alpha_{cc} p_d^2}$$

$$\frac{\mathrm{d}d_2}{\mathrm{d}T} = 0$$

$$\frac{\mathrm{d}d_4}{\mathrm{d}M} = \frac{-\alpha_{cc} p_d B_2}{\gamma_{dv}^2 - B_1 B_2}$$

$$\frac{\mathrm{d}d_4}{\mathrm{d}T} = \frac{\gamma_{dv} \beta_{ll}}{\gamma_{dv}^2 - B_1 B_2}$$

Application

Data

- Giving in the Netherlands Panel Survey (Center for Philanthropic Studies at VU Amsterdam) (Bekkers et al., 2021)
  - Unbalanced panel representative of Dutch population ($>$ 18 years age)
  - Biennial since 2002

- Estimation sample of 503 individuals, 2439 observations
  - Inclusion rule $T \geq 4$, average $T = 4.85$
  - Years 2006-2019

- Data on time and money budgets and charitable gifts
  - Average work week of 18 hours, net household income of €2270
  - $\frac{1}{3}$ of all observations: participation in both *donating & volunteering*
  - Average among individuals in that category: €400/year of donations & 20.2 volunteer hrs/month

Variables

- *Donating* = household total value (in €) of money and goods donations in a certain calendar year
- *Volunteering* = individual hours spent on volunteering per month in a certain year
- *Income* = household net monthly income (in €) $\rightarrow$ proxy for money budget M
- *Working hours* = individual paid hours of work per week $\rightarrow$ inversely related to time budget T
- Battery of time-variant control variables
  (#kids in hh, moving provinces, home ownership status, working hours partner)

Empirical strategy

- Estimate (volunteering) own-budget effects using Fixed Effects Poisson model
- **Main model: Correlated Random Effects two-part model**
  - Goal: estimate cross-budget effect for individuals in regime *donating & volunteering*
  - First-part logit to estimate donating *participation*
  - Second-part Poisson to estimate donating *amount* using only the positive observations
  - Pooled estimation
- Income and working hours assumed strictly exogenous conditional on fixed and correlated random effects

Empirical strategy: Second-part conditional mean model

$$\mathrm{E}(\mathit{donating}_{it} \mid \mathrm{x}_i, \mathrm{S}_i, \delta_t) = \exp(\psi + \bar{\mathrm{x}}_i\boldsymbol{\xi} + \overline{\mathrm{w}}_i\boldsymbol{\eta} + \mathrm{x}_{it}\boldsymbol{\beta} + \mathbf{w}_{i,t,t-1}\boldsymbol{\theta} + \mathrm{S}_i\boldsymbol{\tau} + \delta_t)$$

- x_{it} = vector including income_{it} & $\mathit{workinghours}_{it}$ & time-variant individual controls
- $\mathrm{w}_{i,t,t-1}$ = vector including dummy for last-period participation in volunteering and its interaction with $\mathit{workinghours}_{it}$
- $\bar{\mathrm{x}}_i, \overline{\mathrm{w}}_i$ = averages of x_{it} & $\mathrm{w}_{i,t,t-1}$, $t = 1, \ldots, T$
- δ_t = vector of time dummies
- S_i = a vector of selection dummies

Results: Volunteering own-budget effect

Poisson model estimates of volunteer time

	(1)	(2)	(3)
Income	0.005	0.014**	0.015**
	(0.006)	(0.007)	(0.007)
Working hours	-0.029***	-0.025***	-0.025***
	(0.004)	(0.006)	(0.006)
X^2	45.20***	29.08***	44.75***
Individual FE		✓	✓
Indiv. controls			✓
N	2439	1440	1440

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Notes: SE clustered at the individual level in parentheses. Each model includes time dummies. Income equals net monthly household income *in €100*. The FE model uses only the observations of individuals with at least some variation in volunteering.

Results: Donating cross-budget effect

Two-part model estimates of donations

POISSON SECOND-PART		
Income	0.007	0.006
	(0.005)	(0.005)
Working hours	-0.006*	-0.006*
	(0.004)	(0.004)
V_{t-1}* Working hours	0.009*	0.009*
	(0.005)	(0.005)
V_{t-1}	-0.102	-0.103
	(0.125)	(0.126)
X^2	111.27***	189.09***
N	2048	2048
CRE individual means	✓	✓
Individual controls		✓

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Notes: SE clustered at the individual level in parentheses. Each model includes time dummies and selection dummies for obs./indiv. Income equals net monthly household income *in €100*. The second part-model only uses observations of positive donations.

Giving to church

- Opportunity to study relationship between two modes of disagreggate giving
- Small remaining sample of religious givers
- No own-budget effect time on volunteering for church
- Also no cross-budget effect time on donating to church (as predicted by model in case of no own-budget effects)

Sensitivity analyses

- Results robust to changes in inclusion rules ($T > 2$ or $T > 4$ instead of $T > 3$)
- And to including in the analysis the years 2002 and 2004 which used slightly different questions
- Excluding 2019: stronger time effects, but sensitive to inclusion of control variables
- Monetary giving: two-part model estimates become weaker rather than stronger

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Conclusions

Findings

- Significant negative effect of change in working hours on volunteering hours: **positive own-budget effect for volunteering**
- Within-individual variation in working hours also weakly influences donation level: **non-zero cross-budget effect of time on donating**
- The **direction** of this effect **differs** per "giving regime"
- For *don & vol* individuals, the cross-budget effect is **negative but insignificant** and significantly differs from that of *donating only* individuals
- (Weakly) suggests that donating and volunteering are substitutes

Bottom line

- Budget variation instead of price variation to determine the relationship between donating and volunteering
- Especially useful to apply to **contexts with limited price variation of donations** (importance of charitable deductions)
- Application(s) with different panel data needed for **more conclusive evidence in the future**
- Multi-mode, multi-budget model as starting point for research in other domains of prosocial behavior

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Thank you!

Questions and contact:
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Appendix

Constrained optimization problem

$$\begin{aligned}\mathcal{L} =& u_\alpha(c) + u_\beta(l) + \gamma_d d + \gamma_v v + \gamma_{dv} dv + (\gamma_{dd}/2)\, d^2 + (\gamma_{vv}/2)\, v^2 \\ &+ \lambda_m(M - c - p_d d) + \lambda_t(T - l - p_v v) + \mu_d d + \mu_v v\end{aligned}$$

$$\begin{aligned}
c: &\quad u'_\alpha(c) - \lambda_m = 0 && (1)\\
l: &\quad u'_\beta(l) - \lambda_t = 0 && (2)\\
d: &\quad \gamma_d + \gamma_{dd} d + \gamma_{dv} v - \lambda_m p_d + \mu_d = 0 && (3)\\
v: &\quad \gamma_v + \gamma_{vv} v + \gamma_{dv} d - \lambda_t p_v + \mu_v = 0 && (4)\\
\lambda_m: &\quad M - c - p_d d = 0 && (5)\\
\lambda_t: &\quad T - l - p_v v = 0 && (6)\\
&\quad \mu_d d = 0 && (7)\\
&\quad \mu_v v = 0 && (8)
\end{aligned}$$

Derivations of d and v

1. No giving
2. Donating only
3. Volunteering only
4. Donating & volunteering

Return

$$A_1 = [\alpha_c + \alpha_{cc} M] p_d - \gamma_d$$
$$B_1 = [\gamma_{dd} + \alpha_{cc} p_d^2] < 0$$
$$A_2 = [\beta_I + \beta_{II} T] p_v - \gamma_v$$
$$B_2 = [\gamma_{vv} + \beta_{II} p_v^2] < 0$$

Regime 2

Combining (1), (3) & (5) and plugging in $v_2 = 0$:

$$d_2 = \frac{A_1}{B_1}$$

Regime 4

Combining (1), (3) & (5):

$$v = \frac{A_1 - B_1 d}{\gamma_{dv}} \qquad (9)$$

Combining (2), (4) & (6):

$$d = \frac{A_2 - B_2 v}{\gamma_{dv}} \qquad (10)$$

Substituting (9) in (10):

$$d_4 = \frac{\gamma_{dv} A_2 - A_1 B_2}{\underbrace{\gamma_{dv}^2}_{>0} - \underbrace{B_1 B_2}_{>0}}$$