

Herzer, Dierk; Nunnenkamp, Peter

**Working Paper**

Private donations, government grants, commercial activities, and fundraising: Cointegration and causality for NGOs in international development cooperation

Kiel Working Paper, No. 1769

**Provided in Cooperation with:**

Kiel Institute for the World Economy – Leibniz Center for Research on Global Economic Challenges

*Suggested Citation:* Herzer, Dierk; Nunnenkamp, Peter (2012) : Private donations, government grants, commercial activities, and fundraising: Cointegration and causality for NGOs in international development cooperation, Kiel Working Paper, No. 1769, Kiel Institute for the World Economy (IfW), Kiel

This Version is available at:

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## **Working Papers**

**Kiel Institute  
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**Private Donations, Government  
Grants, Commercial Activities, and  
Fundraising: Cointegration and  
Causality for NGOs in International  
Development Cooperation**

**by Dierk Herzer  
Peter Nunnenkamp**

**No. 1769 | April 2012**

**Web: [www.ifw-kiel.de](http://www.ifw-kiel.de)**

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## **Private Donations, Government Grants, Commercial Activities, and Fundraising: Cointegration and Causality for NGOs in International Development Cooperation**

Dierk Herzer and Peter Nunnenkamp

### Abstract:

NGOs could help scale up foreign aid efforts by mobilizing private donations. However, fundraising activities do not necessarily result in higher donations, and substitution effects between different sources of revenue may diminish the overall pool of NGOs' resources. This paper examines the determinants of private donations to US-based NGOs engaged in international development cooperation. We employ panel cointegration and causality techniques to analyze the interactions between private donations, government grants, commercial revenues and fundraising expenditures. According to our results, a marginal dollar spent on fundraising yields almost five dollars in new donations in the long run. Government grants crowd in private donations in the long run, whereas commercial revenues crowd out donations in the long run. Moreover, our panel vector error correction model reveals complex short-run dynamics.

**Keywords:** non-governmental organizations; development cooperation; private donations; panel cointegration .

**JEL classification:** L31; F35; C23

### **Dierck Herzer**

Helmut-Schmidt-University Hamburg,  
Holstenhofweg 85  
D-22043 Hamburg, Germany  
phone: +49-40-6541-2775  
Fax: +49-40-6541-2118  
E-mail: [herzer@hsu-hh.de](mailto:herzer@hsu-hh.de)

### **Peter Nunnenkamp**

Kiel Institute for the World Economy  
Hindenburgufer 66  
D-24105 Kiel, Germany  
phone: +49-431-8814-209  
Fax: +49-431-8814-500  
E-mail: [peter.nunnenkamp@ifw-kiel.de](mailto:peter.nunnenkamp@ifw-kiel.de)

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## 1. Introduction

Due to the budget constraints of official aid agencies it largely depends on non-governmental organizations (NGOs) whether international efforts to scale up foreign aid will succeed. NGOs engaged in international development cooperation could supplement official aid by engaging in fundraising and mobilizing private donations. However, the degree to which NGOs can actually raise additional aid resources remains open to debate. First, private donors tend to dislike NGOs that spend a large share of their budget on fundraising (Rose-Ackerman, 1982) so that fundraising expenditures do not necessarily result in higher donations. Second, substitution effects between different sources of revenues may diminish the overall pool of NGOs' resources. In particular, private donations may be crowded out once the government refinances NGO activities or NGOs attempt to generate commercial revenues through service fees, gift shops and other sales.

The determinants of private donations have been analyzed in the previous literature on national charities, notably domestic activities of US-based NGOs. It has been shown that the effects of fundraising and government grants on private donations vary substantially across sectors in which local NGOs are active (see, e.g., Okten and Weisbrod, 2000). This heterogeneity also implies that results found for charities at home do not necessarily carry over to NGOs engaged in international development cooperation. Private donors tend to be more familiar with local charities, while principal-agent problems and information asymmetries loom larger in giving to internationally active NGOs. However, the literature on international NGOs is scarce.<sup>1</sup> Furthermore, a large part of the previous literature on the determinants of private donations suffers from endogeneity problems (related to both fundraising expenditures and other revenues such as government grants) and lack of suitable instruments.<sup>2</sup> Consequently, issues of causation are far from resolved.

This paper attempts to fill these gaps by analyzing the relationship between private donations, government grants, commercial revenues, and fundraising expenditures for US-based NGOs engaged in international development cooperation using panel cointegration and causality techniques. Specifically, we make the following contributions:

1. Panel cointegration estimators are employed to examine the long-run effects of government grants, commercial revenues, and fundraising expenditures on private donations for 51

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<sup>1</sup> The few studies on donations to internationally active NGOs include Ribar and Wilhelm (2002), McCleary and Barro (2008), and Nunnenkamp and Öhler (2012b). See Section 2 for details on the relevant literature.

<sup>2</sup> For example, Okten and Weisbrod (2000) note that two-stage models would ideally use instruments other than lagged values of the endogenous variables. Payne (1998: 340) notes that it is "quite difficult" to find measures that are correlated with government grants but are not correlated with private donations. Ribar and Wilhelm (2002: 438 and 446) argue that previous studies relied on "questionable instruments" and fail themselves to "locate any theoretically justified instruments that were reliable predictors of government spending." Nunnenkamp and Öhler (2012b) admit that their cross-section study on the determinants of private donations cannot establish clear causal links.

international NGOs over the period from 1983 to 2005. An important feature of these estimators is that they are robust under cointegration to a variety of estimation problems that often plague empirical work, including omitted variables, endogeneity, and measurement errors (Baltagi and Kao, 2000; Pedroni, 2007).

2. A panel vector error correction model (VECM) is estimated to investigate both the long-run causality and short-run interactions among the variables.

To anticipate our main results, we find that a marginal dollar spent on fundraising yields, on average and in the long run, almost five dollars in new donations. Government grants crowd in private donations in the long run, whereas commercial revenues crowd out donations in the long run. Moreover, our VECM reveals complex short-run dynamics.

## 2. Background and hypotheses

The extent to which NGOs can help scale up international aid efforts mainly depends on the development of private donations. Private donations represent the most important revenue item of US-based NGOs engaged in international development cooperation. Our sample of 51 NGOs raised more than US\$ 40 billion of private donations (in constant prices of 1983/84) throughout the period from 1983 to 2005, accounting for half of overall revenues. Government grants contributed 44 percent to overall revenues, while commercial revenues were less important with six percent.

Private donations to all NGOs in our sample quadrupled during the period of observation. At the same time, fundraising expenditures of these NGOs increased steadily (see Section 3.2 for details). Yet it remains open to debate whether fundraising is effective in terms of having positive causal effects on private donations. The previous literature on charities at the local or national level argues that fundraising expenditures have two opposing effects on private donations (see, e.g., Khanna and Sandler, 2000; Okten and Weisbrod, 2000).

On the one hand, donors are often perceived to dislike fundraising; they are thus likely to direct their donations to NGOs with lower shares of revenues used for fundraising (Rose-Ackerman 1982).<sup>3</sup> Similar to NGOs' costs for administration and management, fundraising expenditures may be regarded as "unproductive" or wasteful in the sense of not being directly related to the charitable output that donors would like to support.<sup>4</sup> Aldashev and Verdier (2010) list fundraising activities such as mailing of brochures, door-to-door campaigning, advertising in the media and organizing dinners as potential sources of inefficiency. These activities raise the "price of giving," i.e., the cost

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<sup>3</sup> According to survey results reported by Hager et al. (2001), respondents rank the use of revenues, notably program-related spending, to be most important for deciding on donations.

<sup>4</sup> However, Rose-Ackerman (1982: 197) also considers the case that "donors are somewhat more sophisticated and recognize that high levels of fundraising may be translated into higher donations from *others*."

to the donor of “buying” one additional unit of charitable output from the NGO (Khanna and Sandler, 2000). A higher price of giving, in turn, can be expected to reduce private donations.

On the other hand, fundraising is comparable to corporate advertising and should stimulate private giving by informing the public and soliciting donations. Andreoni and Payne (2003) assume that potential donors face high transaction costs in figuring out charities with preferred activities and sufficient quality of delivery. In addition, potential donors may “have good intentions to give to the charity but procrastinate in doing so” (Andreoni and Payne, 2003: 794). NGOs can reduce these transaction and procrastination costs through fundraising activities as listed above. Hence, donations are expected to increase when people are asked to donate.

Aldashev and Verdier (2010) distinguish between two positive effects of fundraising on private donations. First, fundraising helps increase the overall pool of donations to be shared by all NGOs as it “awakens” potential new donors who had not supported any NGO before. Note that free-riding of individual NGOs, especially smaller NGOs, is a possibility here. At least in the short run, some NGOs may avoid fundraising expenditures and, nonetheless, receive higher donations as new donors are awakened by the fundraising of other NGOs. Second, fundraising expenditures help “persuade donors that the NGO’s project is ‘closer’ to their preferred dimension of development” (Aldashev and Verdier, 2010: 52). Fundraising by one particular NGO is thus expected to increase donations to this NGO by diverting private giving away from other NGOs with less fundraising effort.

Previous empirical evidence suggests that the positive effects of fundraising on private donations dominate the negative effects due to a higher price of giving (see, e.g., Khanna and Sandler, 2000; Ribar and Wilhelm, 2002). Andreoni and Payne (2011) find a particularly strong effect of one dollar spent on fundraising yielding more than five dollars of donations. However, Okten and Weisbrod (2000) report strikingly different results for NGO engaged in specific (domestic) sectors such as hospitals and research institutions. This implies that previous results do not necessarily carry over to NGOs engaged in international development cooperation. In the area of international development cooperation, the role of fundraising in reducing information deficits and aligning donor preferences with the project portfolio and specialization profiles of NGOs could be particularly important. Compared to local charities, donors are probably less familiar with the portfolio and profiles of internationally active NGOs. This invites our first hypothesis:

*H1: Even though donors may regard fundraising as wasteful, private giving to international NGOs is likely to respond positively to fundraising expenditures.*

Turning to the relations between major revenue items, government grants to NGOs tend to reduce private giving in a standard neoclassical model (Rose-Ackerman, 1986). This applies as long as private donors derive benefits only from the public good produced by the NGO. The supply of the public good could be sustained with less private giving when the government steps in and co-finances the NGO with a fixed grant. Private donors regard their own giving as a perfect substitute for government grants in this model.<sup>5</sup> As stressed by Rose-Ackerman (1986), however, the assumptions of the simple model of crowding-out are unlikely to hold in actual practice. It is widely accepted in the relevant literature that private donors do not only benefit from the supply of the public good, but also derive “warm glow” utility from giving per se. In other words, private donations are motivated not only by pure altruism. Donors may even be purely egoistic as “an individual’s own gift has properties of a private good that are independent of its properties as a public good” (Andreoni, 1990: 465). Private donations could thus be unaffected if the government co-finances the NGO with a fixed grant.

For several reasons, private donations may even increase in line with co-financing by the government. Official co-financing may stimulate private donations when the government provides matching grants, instead of fixed grants (Rose-Ackerman, 1986). Similar to tax deductions for private giving, matching grants lower the price of giving, i.e., the effective private monetary contribution required per unit of charitable output (see also Khanna and Sandler, 2000). Private donations are likely to be stimulated by higher matching grants, unless the government undermines the price effect on private donations by collecting higher taxes to re-finance the matching grants. Meier’s (2007) results from a randomized field experiment support the hypothesis that matching mechanisms increase private contributions to a public good.<sup>6</sup> Once matching grants were stopped, however, the contribution rate declined in the experiment.

Matching grants to NGOs are used by various government agencies. Andreoni (2006: 18) mentions the example of the National Endowment for the Arts in the United States which requires a match of its seed money of at least one to one. According to Smillie (1995), the terms and conditions of matching formulae vary considerably from less than 50 percent to more than 90 percent of project costs contributed by the government.<sup>7</sup> USAID (2002: 140-1) requires registered NGOs to “receive part of annual revenue from the private sector” and “to increase volunteerism and private contributions to their overseas programs,” in order to benefit from USAID’s co-financing.

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<sup>5</sup> See also Andreoni and Payne (2011) and the literature given there.

<sup>6</sup> For experimental studies on the role of seed money and matching grants for private donations, see also Karlan et al. (2011) and several other contributions to the same special issue on charitable giving and fundraising of the *Journal of Public Economics*, as well as the literature given in these contributions.

<sup>7</sup> See also Dreher et al. (2010) on the generous provision of matching grants to Swedish NGOs through the official aid agency SIDA.

Even fixed grants may be associated with higher private donations. The government may engage in “leadership giving” (Andreoni, 2006). Leadership giving provides a signal to other donors that the charity is of high quality and its cause deserves to be supported (see also Okten and Weisbrod, 2000).<sup>8</sup> The government, by providing seed money, can avoid an outcome with no giving at all that may otherwise result from private donors’ lack of information.<sup>9</sup> Official grants typically imply that the government “carries out monitoring and information dissemination activities that inform everyone about the actual level of all the  $q_j$ ”, i.e., the quality of the NGOs and the worthiness of their cause (Rose-Ackerman, 1986: 321). This may induce giving by risk-averse donors who gave nothing under conditions of higher uncertainty.<sup>10</sup>

Complementarities between government grants and private financing may also result from the “marketization” of official support. Government grants offered through competitive tenders and renewable contracts are increasingly meant to fund specific projects, while administrative overheads have to be covered from private sources and the NGO’s own resources (Cooley and Ron, 2002; Smith, 2006). Finally, complementarities may result from government grants being earmarked for use in strategically important middle-income countries. Explicitly referring to USAID’s relations with NGOs, Kerlin (2006: 384) observes that the “encroachment of foreign policy goals on humanitarian and development assistance has often sat uneasily with INGOS and has raised some difficult situations for INGOS with USAID.” Compared to USAID, NGOs typically prefer a stronger focus on the poorest recipient countries. NGOs drawing on USAID funding would therefore have to look for private donations in order to be present where foreign aid may be needed most from a purely developmental point of view.

Empirical findings on local and national NGOs suggest that government grants weaken the incentive to engage in fundraising, whereas the evidence for direct crowding-out of private donations is weak (Andreoni and Payne, 2003; 2011). Earlier studies point to significant crowding-in effects of government grants on private donations.<sup>11</sup> Considerable differences across sectors “remain a puzzle” (Okten and Weisbrod, 2000: 267). The scarce evidence on NGOs in international development cooperation tends to support complementarities between government grants and private donations (Ribar and Wilhelm, 2002; McCleary and Barro, 2008; Nunnenkamp and Öhler,

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<sup>8</sup> Heutel (2009) finds that crowding-in effects of government grants on private donations are particularly pronounced for younger NGOs. This is consistent with signaling models according to which government grants reveal the quality of NGOs and help overcome information asymmetries.

<sup>9</sup> Large private foundations could play the same role. Yet the government’s “stamp of approval” may be particularly effective in inducing private donations if private leadership giving is hard to find, e.g., when the required seed money is more than any private donor can possibly afford to pay.

<sup>10</sup> See also Khanna and Sandler (2000) as well as Andrés-Alonso et al. (2006).

<sup>11</sup> Examples include Okten and Weisbrod (2000), Khanna and Sandler (2000), and Heutel (2009).



2012b). Even though most of these studies fail to properly address endogeneity concerns, the previous discussion leads to our second hypothesis:

*H2: Official co-financing of NGOs in international development cooperation is unlikely to reduce private donations, and may even result in significantly higher giving.*

Compared to official co-financing, the interrelations between commercial revenues of NGOs – including user fees and ancillary activities such as gift shops – and private donations have received considerably less attention in the literature. Segal and Weisbrod (1998) represent a major exception. These authors consider commercial activities to be ‘non-preferred’ by NGOs. Consequently, they hypothesize that NGOs raise commercial revenues only to a degree required to smooth variations in private donations. In other words, commercial revenues are expected to change inversely with the preferred source of financing. The empirical estimations of Segal and Weisbrod (1998) reveal considerable variation between sectors as concerns the expected crowding-out of commercial revenues by donations.<sup>12</sup> Feedback effects and reverse causality also appear to be sector-specific.

Reciprocal effects of commercial revenues on private donations could be positive if donors favored NGOs’ self-help and rewarded the mobilization of additional sources of revenues (Segal and Weisbrod, 1998; Okten and Weisbrod, 2000). Furthermore, Smith (2006: 240) argues that commercial activities “may help publicize the organization and bring new members or donors into the organization.” Even if commercial activities do not generate substantial amounts of revenues, NGOs may still find them worthwhile for reasons of visibility and reputation. McManus and Bennet (2011) make the same point, but these authors also consider the possibility of commercial revenues resulting in lower donations. For example, potential donors buying goods from an NGO’s gift shop may “see merchandise and donations as substitutes” (McManus and Bennet, 2011: 414).

The effects of commercial revenues on private donations would also be negative if donors disapproved strictly of commercial activities by charities (Segal and Weisbrod, 1998). This may be the case especially if donors are aware of “mental accounting” by NGOs (Ly, 2006).<sup>13</sup> This means that NGOs do not treat commercial revenues and donations in the same way. They use donations primarily to finance charitable output, but “changes in commercial income sources seem to affect mostly expenditures that relate less to the NGO’s charitable mission” (Ly, 2006). Specifically,

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<sup>12</sup> The sample of US-based NGOs is dominated by local charities engaged in sectors such as health, education, and shelter. Less than one percent of the sample belongs to the sector “International, foreign affairs, and national security.”

<sup>13</sup> In contrast to Segal and Weisbrod (1998), Ly (2006) no longer assumes that commercial revenues are non-preferred by NGOs.

commercial revenues may be diverted to finance perquisite consumption, i.e., expenditures increasing the utility of NGO staff (ranging from travel expenses and headquarter facilities to office equipment and pay).<sup>14</sup> Private donors may thus be reluctant to give to NGOs with relatively high commercial revenues as they are suspicious of perquisite consumption. Previous empirical evidence is particularly scarce with regard to our third hypothesis:

*H3: Commercial revenues may crowd out private giving if donors suspecting “wealthy” NGOs to be less deserving outnumber donors rewarding self-help of NGOs.*

### 3. Empirical model and data

The objective is to examine the short- and long-run effects of government grants, commercial revenues, and fundraising expenditures on private donations and to study the dynamic interactions between these variables using panel cointegration and causality techniques. In this section, we discuss the empirical long-run model (Section 3.1). Then, we describe the data (Section 3.2).

#### 3.1. Basic empirical model and econometric issues

We assume that the functional form of the long-run relationship between private donations, government grants, commercial revenues, and fundraising expenditures is given by

$$Donations_{it} = a_i + \delta_i t + \beta_1 GovGrants_{it} + \beta_2 Com_{it} + \beta_3 Fundrais_{it} + \varepsilon_{it} \quad (1)$$

where the subscript  $i$  refers to one of the  $N$  international NGOs,  $i = 1, 2, \dots, N$ , and the subscript  $t$  refers to one of the  $T$  time points,  $t = 1, 2, \dots, T$ .  $Donations_{it}$ ,  $GovGrants_{it}$ ,  $Com_{it}$ , and  $Fundrais_{it}$  represent, respectively, private donations, government grants, commercial revenues, and fundraising expenditures. Following, among others, Payne (1998) and Andreoni and Payne (2011), the variables are expressed in (dollar) levels, rather than logs. Consequently, the  $\beta$  coefficients capture the long-run changes in private giving due to changes in the explanatory variables in monetary (dollar) terms. As is standard in the literature, we include organization fixed effects,  $a_i$ , to control for any organization- and location-specific omitted factors that are relatively stable over time (such as norms, ideology, religious orientation of the organization, location-specific policies that are constant over our sample period, infrastructure, and proximity to potential donors). In addition, any

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<sup>14</sup> Nunnenkamp and Öhler (2012a) report inconclusive evidence on the effects of commercial revenues on perquisite consumption of US-based NGOs.

organization-specific omitted factors that evolve smoothly over time (such as the age of the NGO) are captured by organization-specific time trends,  $\delta_{it}$ .

Given that all four variables exhibit trends (as shown in Figures A1-A4 in the Appendix), it is reasonable to assume that  $Donations_{it}$ ,  $GovGrants_{it}$ ,  $Com_{it}$ , and  $Fundrais_{it}$  are nonstationary integrated processes. If this assumption is correct, the linear combination of these four variables must be stationary, or, in the terminology of Engle and Granger (1987),  $Donations_{it}$ ,  $GovGrants_{it}$ ,  $Com_{it}$ , and  $Fundrais_{it}$  must be cointegrated. If the variables are not cointegrated, there is no long-run relationship between private donations, government grants, commercial revenues, and fundraising expenditures. In this case, Equation (1) would be a spurious regression in the sense of Granger and Newbold (1974).<sup>15</sup> The requirement for the above regression not to be spurious is thus that the four (integrated) variables cointegrate.

A regression containing all the variables of a cointegrating vector has a stationary error term,  $\varepsilon_{it}$ , implying that no relevant integrated variables are omitted. Any omitted nonstationary variable that is part of the cointegrating relationship would become part of the error term, thereby producing nonstationary residuals and thus leading to a failure to detect cointegration. If there is cointegration between a set of variables, this stationary relationship also exists in extended variable space (see, e.g., Johansen, 2000). An important implication of finding cointegration is thus that no control variables are required to produce unbiased estimates of the parameters of Equation 1.

Of course, there are several factors (such as the social and economic status of the area in which the organization is located, and the population of the area) that may affect donations. Adding further variables to the model may therefore result in further cointegrating relationships (that could be identified and estimated). However, the estimates of the original cointegrating equation would not be significantly affected by the presence or absence of additional variables (see, e.g., Juselius, 2006). This justifies a reduced form model, such as Equation (1), if the variables are cointegrated.

Another assumption inherent in Equation (1) is that private donations are endogenous in the sense that, in the long run, changes in government grants, commercial revenues, and fundraising expenditures cause changes in private donations. However, although the existence of cointegration implies long-run Granger causality in at least one direction, private donations may also be a determinant of commercial activities, public funding, and fundraising activities (see Section 2). The empirical implication is that it is important to not only examine the time-series properties of the

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<sup>15</sup> The spurious regression problem can also arise in panels when dealing with nonstationary variables. Entorf (1997) and Kao (1999) demonstrate that the tendency for spuriously indicating a relationship may even be stronger in panel data regressions than in pure time series regressions.

variables and test whether the variables are cointegrated, but also to deal with this endogeneity problem and investigate the direction of causality.

A final econometric issue is the potential cross-sectional dependence in the data through common time effects. For example, the data may be partly driven by common business cycles and other common factors. Examples of such common factors that affect donations to NGOs at the same time might include natural disasters, wars and famines. Given that standard panel unit root and cointegration tests may be biased in the presence of cross-sectional dependence, we also use recent advances in panel data econometrics to account for this issue.

### 3.2. Data

The data are from McCleary and Barro (2008).<sup>16</sup> All variables are deflated using the consumer price index (with a base of 1983-84 = 1.0). *Donations* include both cash and in-kind contributions from private donors. *Com* is defined as “other forms of private revenues” in the database. *GovGrants* comprises all revenues received from the US federal government (notably grants and contracts from USAID and other federal agencies), other official agencies in the United States, foreign governments, and international agencies. Note also that the database reports fundraising expenditures (*Fundrais*) separately from NGOs’ expenditures on administration.

The identification and estimation of cointegrating relationships requires the use of continuous data over a sufficiently long period of time. Panel cointegration procedures exploit both the time-series and cross-sectional dimensions of the data and can therefore be implemented with shorter data spans than their time-series counterparts. Consequently, a period of 23 years should be more than sufficient for our purposes. Several panel cointegration studies are based on shorter time periods (see, e.g., Guellec and Van Pottelsberghe, 2004; Apergis et al., 2008; Apergis and Payne, 2011).

We include all NGOs for which complete data are available over the period 1983-2005, with the exception of four organizations with zero values for government grants and fundraising expenditures in 22 of the 23 years. The reason for excluding these organizations (with only one year of positive government grants and fundraising expenditures) is that one-time grants and fundraising activities are unable to capture long-run effects, and this could bias our results. However, including these organizations does not qualitatively change our conclusions, as shown in the robustness checks later. Thus, our panel consists of 1173 observations on 51 organizations. Each organization

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<sup>16</sup> The data are available at the web site of Rachel McCleary, <http://scholar.harvard.edu/rachelmccleary/>.

received private and public donations, and engaged in fundraising and commercial activities in at least four years between 1983 and 2005.

Figure 1

Cross-sectional averages of the variables, 1983-2005

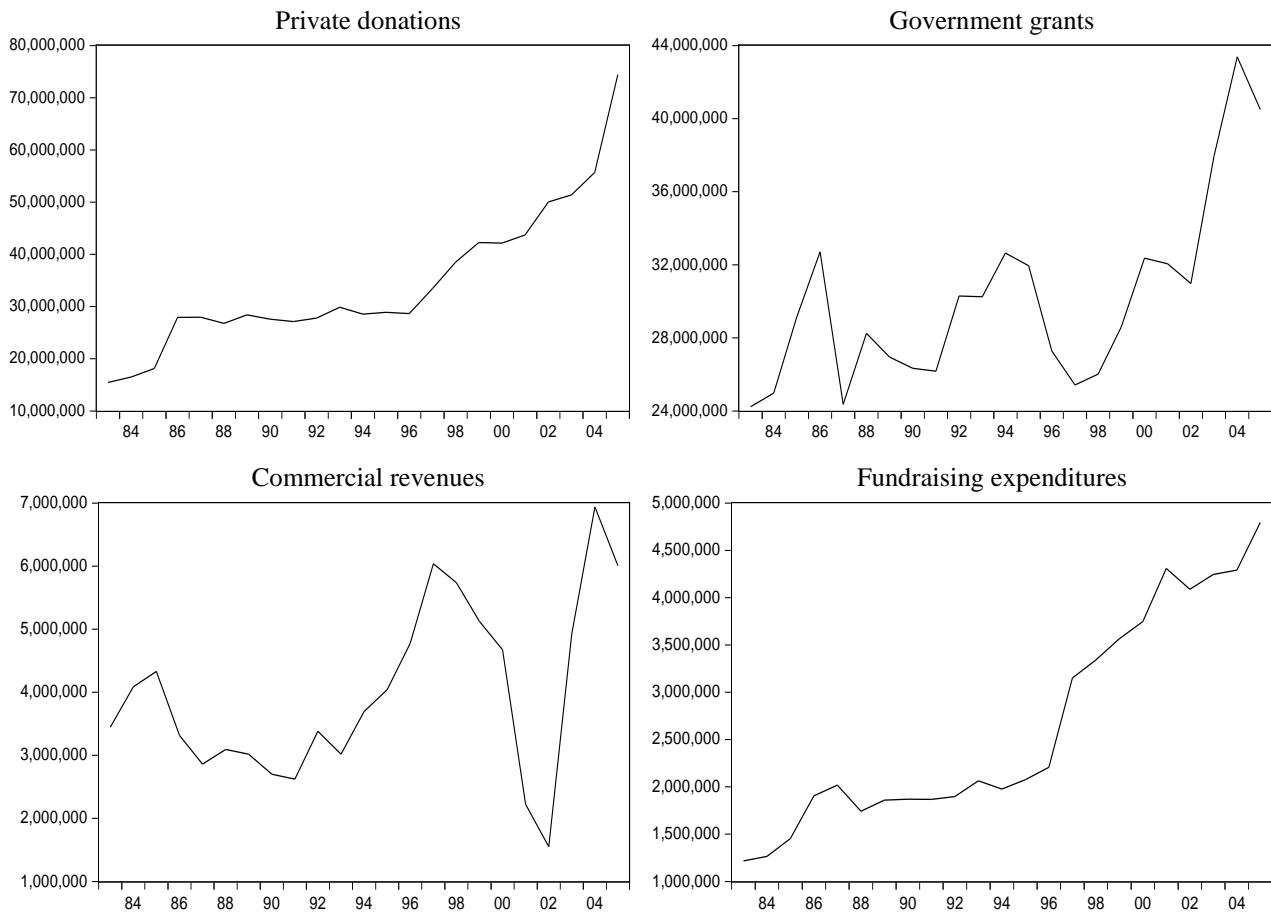


Figure 1 shows the cross-sectional averages of the variables for this period. Private donations more than quadrupled on average from 1983 to 2005, while government grants almost doubled in this period. Commercial revenues first rose on average from 1983 to 1985 and then fell. Between 1991 and 1997 commercial revenues rose again, dropped abruptly between 1997 and 2002, and then rose rapidly from 2002 to 2004. Fundraising expenditures grew rather steadily over the entire 23-year period.

Figures A1-A4 in Appendix A1 plot the variables for each organization. They show that  $Donations_{it}$ ,  $GovGrants_{it}$ ,  $Com_{it}$ , and  $Fundrais_{it}$  exhibit positive and/or negative trends as well as deviations from these trends. Overall, the time-series evolution is consistent with the possibility that the variables are nonstationary and cointegrated. This is confirmed by several panel unit root and cointegration tests reported in Appendices A2 and A3.

## 4. Empirical analysis

In this section, we examine the following questions:

1. What are the long-run effects of government grants, commercial revenues, and fundraising expenditures on private donations (Section 4.1)?
2. Which variables are, in the long run, caused by the other variables and how do the variables affect each other in the short run (Section 4.2)?

### 4.1. Long-run relationship

There are several estimators for cointegrated panel data. Phillips and Moon (1999), for example, have proposed a panel equivalent to the conventional time series fully modified OLS (FMOLS) estimator, while Mark and Sul (1999) have proposed using a panel version of the time series dynamic OLS (DOLS) estimator. Since Kao and Chiang (2000) have shown that the panel DOLS estimator is less biased than the panel FMOLS procedure, we employ a panel DOLS estimator which has been used, among others, by MacDonald and Ricci (2007) and Nowak-Lehmann et al. (2012). The estimator has the following form:

$$\begin{aligned} Donations_{it} = & a_i + \delta_i t + \beta_1 GovGrants_{it} + \beta_2 Com_{it} + \beta_3 Fundrais_{it} \\ & + \sum_{j=-k}^k \Phi_{1j} \Delta GovGrants_{it-j} + \sum_{j=-k}^k \Phi_{2j} \Delta Com_{it-j} + \sum_{j=-k}^k \Phi_{3j} \Delta Fundrais_{it-j} + \varepsilon_{it} \end{aligned} \quad (2)$$

where  $\Phi_{1j}$ ,  $\Phi_{2j}$ , and  $\Phi_{3j}$  are coefficients of current, lead, and lag differences which account for possible serial correlation and endogeneity of the regressors. Thus, an important feature of the DOLS procedure is that it generates unbiased estimates for variables that cointegrate even with endogenous regressors. Consequently, in contrast to cross-section and conventional panel approaches, the DOLS approach does not require exogeneity assumptions nor does it require the use of instruments.

The DOLS procedure is applied to both the raw data and to data adjusted for common time effects. Specifically, and following, for example, Canning and Pedroni (2008), each variable is first regressed on time dummies. Then, the residuals from this regression are used in place of the original variables.

The estimation results are presented in columns (1) and (2) of Table 1. As can be seen, the adjusted and unadjusted data produce similar results. We find that government grants crowd in private donations, consistent with theoretical and empirical results of Heutel (2009). According to the DOLS results with transformed data, the level of crowding-in is 0.125, suggesting that for the average international NGO, if government grants increase by one dollar, private donations will increase by about 13 cents. Commercial revenues, in contrast, crowd out private donations.

According to the DOLS coefficients on  $Com_{it}$ , each extra dollar of commercial revenues causes a significant reduction in private donations by about 0.40 dollars. For the effect of fundraising on private donations, we find DOLS coefficients ranging from 4.771 to 4.917. Thus, a marginal dollar spent on fundraising yields, on average, about five dollars in new donations. This result is in line with the results of Andreoni and Payne (2001), who report fundraising coefficients between 3.381 and 5.747.

Table 1

Estimates of the long-run effects of government grants, commercial revenues, and fundraising expenditures on private donations

Explanatory variables	(1) DOLS with unadjusted data	(2) DOLS with data adjusted for common time effects	(3) DOLS with data adjusted for common time effects	(4) FMOLS with data adjusted for common time effects
$GovGrants_{it}$	0.131** (3.58)	0.125** (3.46)	0.231** (8.28)	0.230** (9.28)
$Com_{it}$	-0.400** (-3.10)	-0.390** (-3.04)	-0.261** (-2.99)	-0.514** (-5.53)
$Fundrais_{it}$	4.917** (19.81)	4.771** (19.31)	6.401** (21.39)	4.669** (18.31)
Number of included Organizations	51	51	55	51

The dependent variable is  $Donations_{it}$ . \*\* indicate significance at the 1% level.  $t$ -statistics in parentheses. The DOLS regressions were estimated with one lead and one lag.

Next, we perform several robustness checks. First, the DOLS regression (with adjusted data)<sup>17</sup> is re-estimated excluding one organization at a time from the sample to verify that the estimated effects are not due to individual outliers. The sequentially estimated coefficients and their  $t$ -statistics are presented in Figure 2. As they are relatively stable and always significant at least at the 5% level, we conclude that our results are not due to potential outliers.

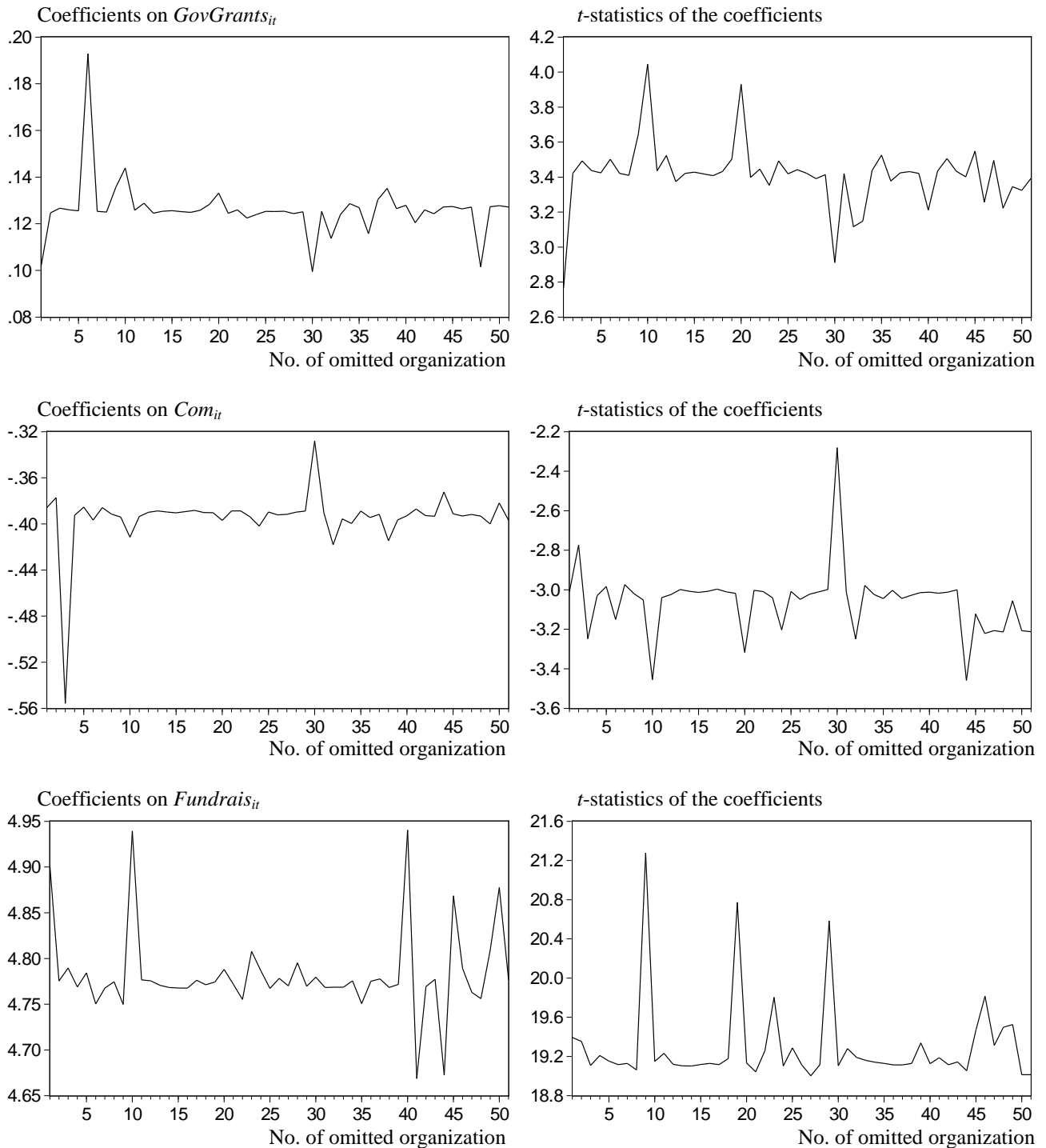
We also examine whether our results are affected by sample selection. A potential problem with our sample could be that we excluded four organizations. To ensure that the inclusion of these four organizations does not change the sign and significance of the coefficients, we re-estimate the DOLS regression for the whole sample of 55 organizations. The resulting coefficients are given in column (3) of Table 1. The coefficients on  $GovGrants_{it}$  and  $Fundrais_{it}$  are somewhat higher, while the coefficient on  $Com_{it}$  is somewhat lower (in absolute value) than the corresponding values in

<sup>17</sup> In the following, we use the adjusted data to account for the likely cross-sectional dependence through common time effects.

columns (1) and (2). The coefficients are still statistically significant at the 1% level. Thus, it can be concluded that the inclusion of these four organizations does not qualitatively change our results.

Figure 2

DOLS estimation with single organization excluded from the sample





Finally, we check whether our results are robust to alternative estimation techniques. To this end, we report panel FMOLS results in column (4).<sup>18</sup> Again, the estimated coefficient on commercial revenues is significantly negative, while the coefficients on government grants and fundraising expenditures are significantly positive.

#### 4.2. Long-run causality and short-run dynamics

The above interpretation of the estimation results is based on the assumption that long-run causality runs from  $GovGrants_{it}$ ,  $Com_{it}$ , and  $Fundrais_{it}$  to  $Donations_{it}$ . In order to test this assumption, and to examine the short-run dynamics between the variables, we use a two-step procedure. In the first step, we employ the DOLS estimate (from Table 1, column (2)) of the long-run relationship to construct the disequilibrium term

$$ect_{it} = Donations_{it} - [\hat{a}_i + \hat{\delta}_i t + 0.125 GovGrants_{it} - 0.390 Com_{it} + 4.771 Fundrais_{it}]. \quad (3)$$

In the second step, we estimate the VECM

$$\begin{aligned} \Delta Donations_{it} &= c_{1i} + a_1 ect_{it-1} + \sum_{j=1}^3 \varphi_{11j} \Delta Donations_{it-j} + \sum_{j=1}^3 \varphi_{12j} \Delta GovGrants_{it-j} \\ &\quad + \sum_{j=1}^k \varphi_{13j} \Delta Com_{it-j} + \sum_{j=1}^k \varphi_{14j} \Delta Fundrais_{it-j} + e_{it}^{Donations} \\ \Delta GovGrants_{it} &= c_{2i} + a_2 ect_{it-1} + \sum_{j=1}^3 \varphi_{21j} \Delta Donations_{it-j} + \sum_{j=1}^3 \varphi_{22j} \Delta GovGrants_{it-j} \\ &\quad + \sum_{j=1}^k \varphi_{23j} \Delta Com_{it-j} + \sum_{j=1}^k \varphi_{24j} \Delta Fundrais_{it-j} + e_{it}^{GovGrants} \\ \Delta Com_{it} &= c_{3i} + a_3 ect_{it-1} + \sum_{j=1}^3 \varphi_{31j} \Delta Donations_{it-j} + \sum_{j=1}^3 \varphi_{32j} \Delta GovGrants_{it-j} \\ &\quad + \sum_{j=1}^k \varphi_{33j} \Delta Com_{it-j} + \sum_{j=1}^k \varphi_{34j} \Delta Fundrais_{it-j} + e_{it}^{Com} \\ \Delta Fundrais_{it} &= c_{4i} + a_4 ect_{it-1} + \sum_{j=1}^3 \varphi_{41j} \Delta Donations_{it-j} + \sum_{j=1}^3 \varphi_{42j} \Delta GovGrants_{it-j} \\ &\quad + \sum_{j=1}^k \varphi_{43j} \Delta Com_{it-j} + \sum_{j=1}^k \varphi_{44j} \Delta Fundrais_{it-j} + e_{it}^{Fundrais}, \end{aligned} \quad (4)$$

where the lagged differenced variables capture the short-run dynamics. The error-correction term,  $ect_{it-1}$ , represents the error in, or deviation from, the equilibrium, while the adjustment coefficients  $a_1$ ,  $a_2$ ,  $a_3$ , and  $a_4$  capture how  $Donations_{it}$ ,  $GovGrants_{it}$ ,  $Com_{it}$ , and  $Fundrais_{it}$  respond to deviations from the equilibrium relationship. From the Granger representation theorem, we know that at least

<sup>18</sup> Like the time series FMOLS estimator, the panel FMOLS estimator incorporates a semi-parametric correction to the OLS estimator to eliminate the endogeneity and serial correlation (see, e.g., Phillips and Moon, 1999).

one of the adjustment coefficients must be nonzero if a long-run relationship between the variables is to hold. A significant error-correction term also indicates long-run Granger causality, and thus long-run endogeneity (see, e.g., Hall and Milne, 1994), whereas a non-significant adjustment coefficient implies long-run Granger non-causality from the independent to the dependent variable(s), as well as weak exogeneity. Following common practice (see, e.g., Urbain, 1995; Lütkepohl and Wolters, 1998; Herzer, 2008), we test for weak exogeneity of the variables, and thus for long-run Granger non-causality between  $Donations_{it}$ ,  $GovGrants_{it}$ ,  $Com_{it}$ , and  $Fundrais_{it}$ , by first successively eliminating the insignificant short-run dynamics with the lowest  $t$ -values. Then, we test the significance of the adjustment coefficients by means of a  $t$ -test.

Table 2

Vector error-correction model, long-run causality and short-run dynamics

Explanatory variables	(1)	(2)	(3)	(4)
	Dependent variable $\Delta Donations_{it}$	Dependent variable $\Delta GovGrants_{it}$	Dependent variable $\Delta Com_{it}$	Dependent variable $\Delta Fundrais_{it}$
$ect_{it-1}$	-0.609** (-14.73)	0.007 (0.18)	-0.013 (0.90)	0.002 (0.42)
$\Delta Donations_{it-1}$	—	—	—	—
$\Delta Donations_{it-2}$	0.176** (4.67)	—	—	0.009* (2.32)
$\Delta Donations_{it-3}$	0.139** (3.49)	—	0.033* (2.49)	—
$\Delta GovGrants_{it-1}$	0.133** (4.78)	-0.162** (-5.33)	0.026* (2.61)	—
$\Delta GovGrants_{it-2}$	0.143** (5.01)	-0.240** (-7.84)	—	—
$\Delta GovGrants_{it-3}$	—	0.164** (4.82)	—	—
$\Delta Com_{it-1}$	0.171* (2.35)	—	-0.278** (-10.05)	—
$\Delta Com_{it-2}$	—	—	-0.092** (-2.95)	—
$\Delta Com_{it-3}$	0.188* (2.15)	—	-0.371** (-11.28)	—
$\Delta Fundrais_{it-1}$	—	—	—	-0.146** (-4.31)
$\Delta Fundrais_{it-2}$	—	—	—	—
$\Delta Fundrais_{it-3}$	-0.866** (-2.76)	0.900** (3.21)	—	-0.093** (-2.83)

Notes: \*\* (\*) indicate significance at the 1% (5%) level.  $t$ -statistics in parentheses. Insignificant short-run dynamics were eliminated successively according to the lowest  $t$ -values and hence are not reported here. The estimates are based on the adjusted data to account for the likely cross-sectional dependence through common time effects.

Table 2 reports the results. According to the  $t$ -statistics of the error-correction terms, government grants, commercial revenues, and fundraising expenditures are weakly exogenous, whereas the null hypothesis of weak exogeneity is decisively rejected for private donations. Consequently,  $Donations_{it}$  is the only variable that is endogenous in the cointegrating relationship and hence Granger-caused by  $GovGrants_{it}$ ,  $Com_{it}$ , and  $Fundrais_{it}$  in the long run. In other words, long-run causality is unidirectional from government grants, commercial revenues, and fundraising expenditures to private donations. From this it follows that the estimates in the previous section in

fact reflect a negative long-run causal effect of commercial revenues on private donations, while government grants and fundraising expenditures have positive long-run causal effects on private donations.

As far as the short-run effects are concerned, the results in column (1) show that the coefficients on  $\Delta GovGrants_{it-1}$ ,  $\Delta GovGrants_{it-2}$ ,  $\Delta Com_{it-1}$  and  $\Delta Com_{it-3}$  are significantly positive, while the coefficient on  $\Delta Fundrais_{it-3}$  is significantly negative. Accordingly, government grants and commercial revenues have positive short-run effects on private donations. Fundraising activities, in contrast, cause a short-run reduction in private donations. Thus, the short-run effects of commercial revenues and fundraising expenditures differ from the long-run effects. Short-run complementarities with commercial revenues may result from customers responding favorably to donation pledges received while visiting NGOs' gift shops (see, e.g., McManus and Bennet, 2011). More generally, donors appear to honor NGOs' financial self-help in the short run, while they see less need for donations to commercially viable or "wealthy" NGOs in the longer run. As concerns fundraising, a higher price of giving may be responsible for negative short-run effects on donations (Section 2). In addition, free-riding of smaller NGOs on the fundraising effort of larger peers may play a role, as stressed by Aldashev and Verdier (2010).

Another interesting result is that the coefficient on  $\Delta Fundrais_{it-3}$  is statistically significant and positive in the government grants equation presented in column (2), suggesting that fundraising activities exert a positive causal effect on government funding in the short run. The response patterns after emergencies provide a possible explanation. NGOs typically react promptly, not least by intensifying fundraising efforts to grasp the opportunity of collecting donations from emotionally affected donors. At the same time, governments deliver emergency aid through NGOs, but official re-financing of NGOs is often delayed (Forman and Stoddard, 2002). Furthermore, governments may honor fundraising as an indication that NGOs aim at diversifying their revenue base, rather than relying permanently and mainly on official funding.<sup>19</sup>

Moreover, there is evidence of short-run causality from private donations and government grants to commercial revenues given that  $\Delta Donations_{it-3}$  and  $\Delta GovGrants_{it-1}$  are significant and positive in the commercial revenues equation in column (3). This pattern may be related to attempts by NGOs to maintain their preferred financing structure, including commercial revenues and the associated perquisite consumption (Ly, 2006). However, it may also be due to external pressure that commercial revenues increase in line with other revenue items. Smith (2006: 239) argues that seed

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<sup>19</sup> According to Smillie (1995), some governments provide matching grants and seed money based partially on an NGO's fundraising effort.

money from official sources or private foundations is often associated with the request to diversify the revenue base, which “has also encouraged nonprofits to generate higher fee income through ‘social enterprise’ activities.”<sup>20</sup>

Finally, there is also evidence that an increase in private donations causes an increase in fundraising activities, as indicated by the significant and positive coefficient on  $\Delta Donations_{it-2}$  in column (4). NGOs may intensify fundraising efforts once the effectiveness in raising additional donations has become evident. More surprisingly perhaps, we do not find that government grants weaken fundraising efforts. The statistically insignificant short-run effects seem to suggest that the disincentive effects stressed by Andreoni and Payne (2003; 2011) take time to materialize.<sup>21</sup>

## 5. Conclusions

NGOs could help scale up foreign aid efforts by mobilizing private donations. On theoretical grounds, however, fundraising activities do not necessarily result in higher donations, and substitution effects between different sources of revenue may diminish the overall pool of NGOs’ resources. In this paper, we provided an empirical analysis of the determinants of private donations to US-based NGOs engaged in international development cooperation. We employed panel cointegration and causality techniques to assess the interactions between private donations, government grants, commercial revenues and fundraising expenditures.

According to our results, fundraising tends to reduce private donations in the short run, possibly due to a higher price of giving and free-riding of some NGOs on the fundraising effort of peers. In the long run, however, a marginal dollar spent on fundraising yields almost five dollars in new donations. Government grants crowd in private donations, both in the long and the short run. By contrast, private donors appear to honor NGOs’ financial self-help only in the short run, whereas commercial revenues crowd out donations in the long run.

These findings have important implications for NGO managers, official agencies delivering foreign aid through NGOs, and the international development community as a whole. First of all, overall aid efforts can indeed be scaled up by NGOs engaging in international development cooperation. Private donations and government funds, the two most important revenue items of NGOs, tend to complement each other in the longer run. In other words, concerns that private donors would regard government funds as perfect substitutes for their own giving appear to be

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<sup>20</sup> See also Cooley and Ron (2002) on the marketization of official NGO support.

<sup>21</sup> However, it is also possible that US-based NGOs engaged in international development cooperation do not fit into the pattern observed by Andreoni and Payne (2003; 2011). As noted in Section 2, different priorities of US-based NGOs and USAID on where to engage limit the substitutability of government grants and private donations (Kerlin, 2006). Consequently, fundraising efforts may remain unaffected by government grants for this particular sample of NGOs.

unjustified. One important question is left open to future research, however. Substitution effects could still undermine foreign aid efforts if the larger role of NGOs in international development cooperation induced governments to cut the overall budgets of official aid agencies. This issue cannot be addressed at the level of individual NGOs, but requires a more aggregate analysis.

Official agencies may find it difficult to prevent cuts in official aid budgets when their political masters realize that delivering foreign aid through NGOs helps mobilize private donations in the longer run. From the development community's perspective, the preoccupation of official agencies with their own budgets would involve the risk that complementarities between government grants and private donations are not fully exploited. Data constraints did not allow us to assess whether complementarities depend on the way in which official agencies co-finance NGOs. It seems likely, however, that complementarities could be strengthened by matching grants, instead of fixed grants, and official seed money and "leadership giving" (Andreoni, 2006). Future research on different forms of co-financing could provide deeper insights once more detailed data become available.

The implications for NGO managers are threefold: First, accepting government grants does not appear to be problematic in the sense of driving private donors away. To the contrary, NGOs can communicate their access to government grants as an official seal of approval signaling the NGO's quality and the worthiness of its cause. This is not to say that such a strategy comes without costs to the NGO. In addition to intensified monitoring and reporting requirements, official co-financing typically implies that the NGO is no longer autonomous in defining its aid portfolio. Second, NGO managers should be aware that, in the longer run, donors rewarding financial self-help of NGOs tend to be outnumbered by donors suspecting "wealthy" NGOs with high commercial revenues to be less deserving of private giving. Experimental studies may provide more detailed insights in this regard, notably on whether this finding depends on the specific source of commercial revenues such as user fees or gift shops. Finally, our findings corroborate earlier studies suggesting that NGOs stop grossly short of using fundraising to an extent that maximizes private donations. As suspected by Andreoni and Payne (2011), it may be due to peer pressure as well as norms and standards set by watchdogs and associations that fundraising expenditures are capped. It might be useful to survey NGO managers in order to address this unresolved issue.

## Appendix A1. Evolution of the variables, 1983-2005

Figure A1

Private donations by organization over the period 1983-2005,  $Donations_{it}$

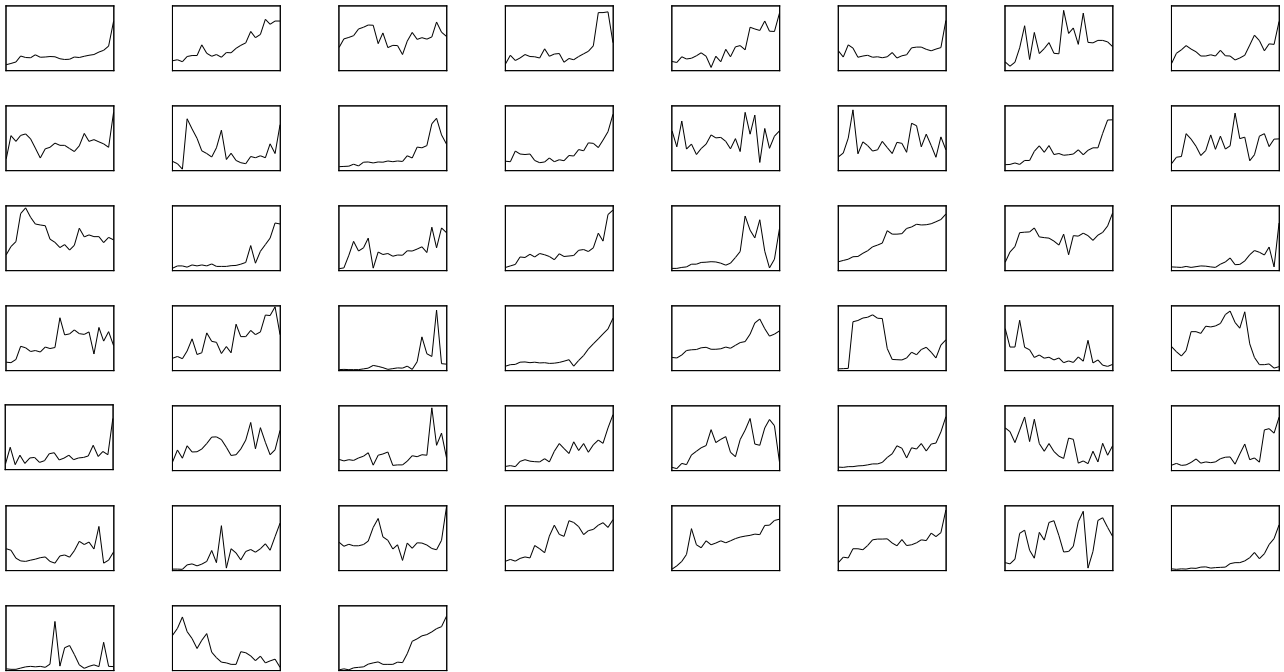


Figure A2

Government grants by organization over the period 1983-2005,  $GovGrants_{it}$

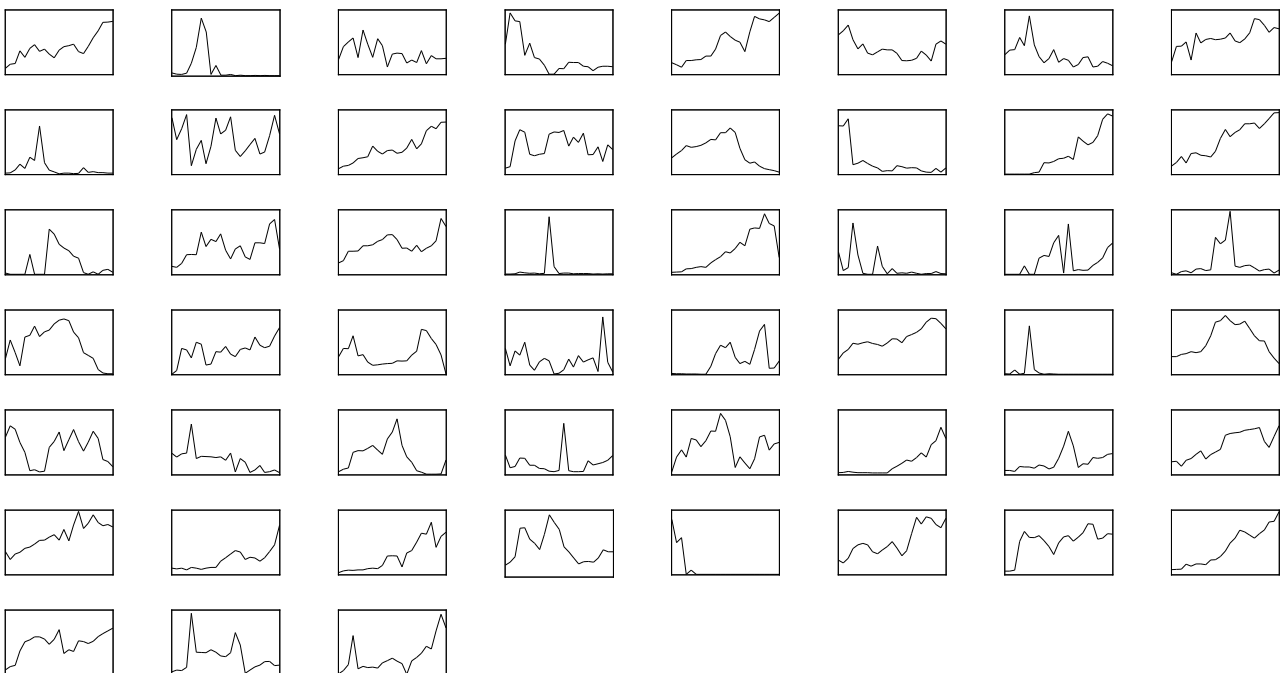


Figure A3

Commercial revenues by organization over the period 1983-2005,  $Com_{it}$

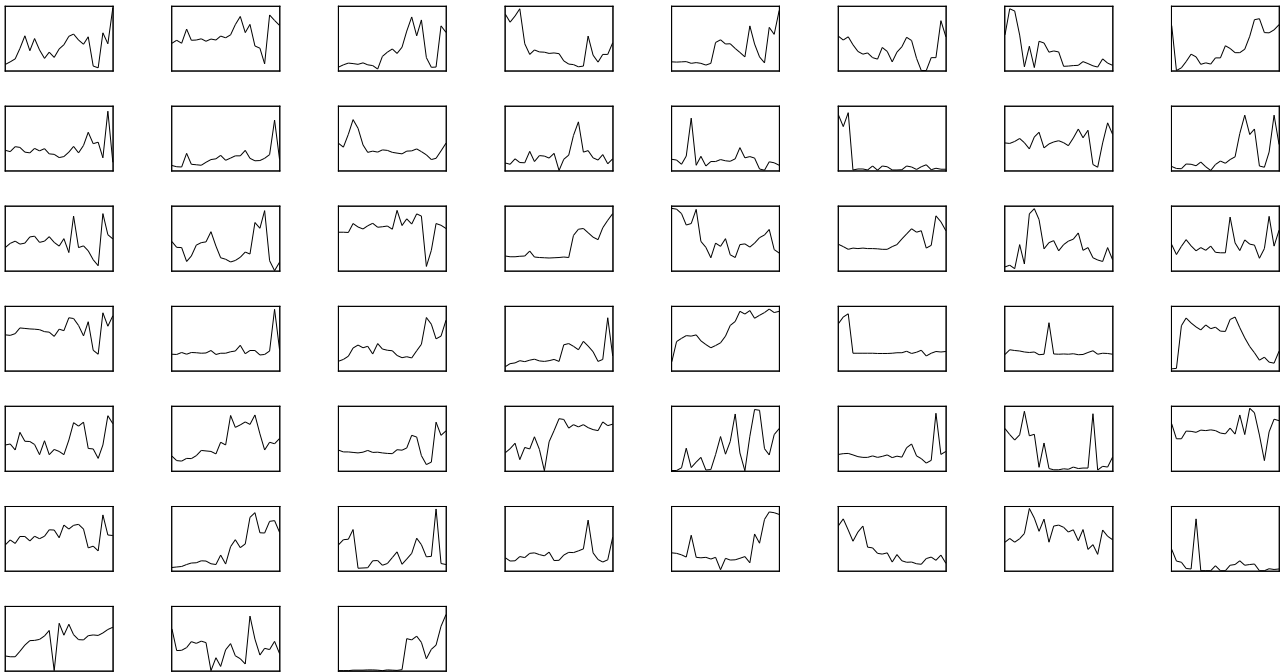
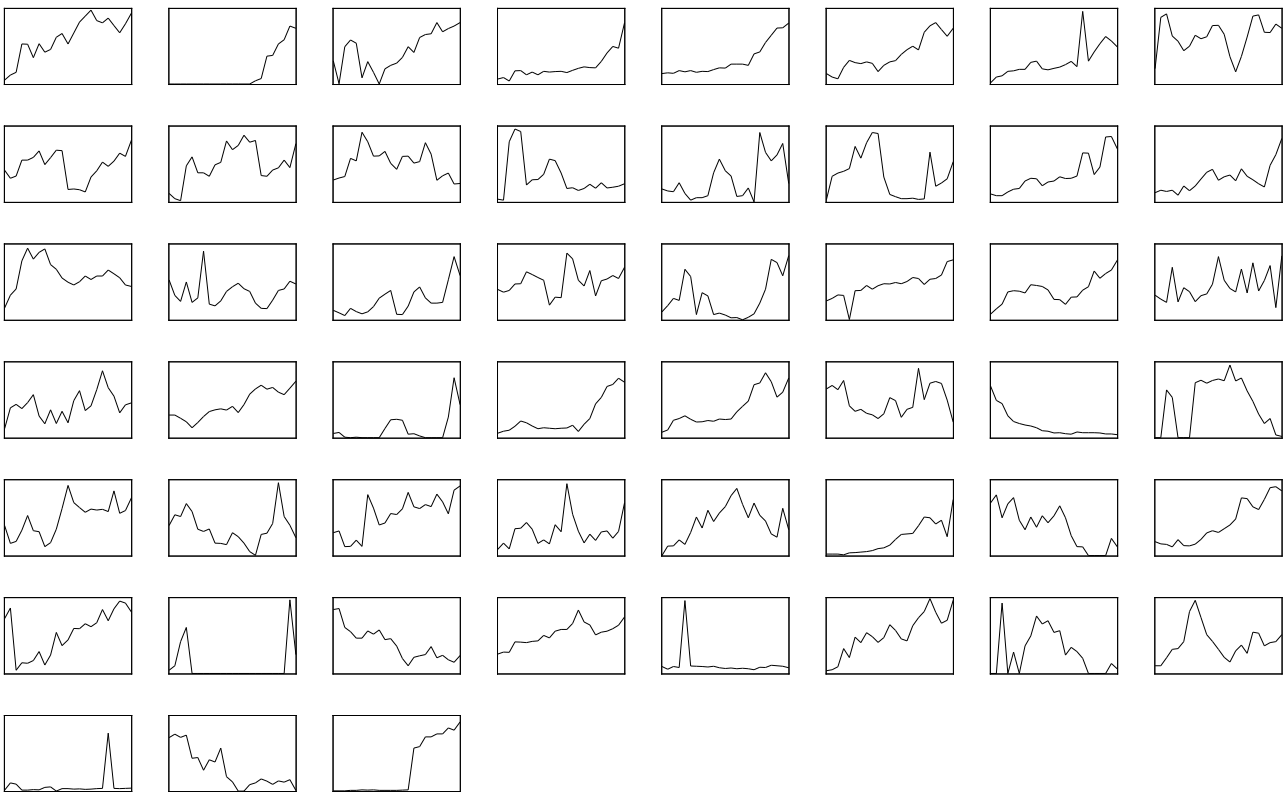


Figure A4

Fundraising expenditures by organization over the period 1983-2005,  $Fundrais_{it}$



## Appendix A2. Panel unit root tests

To examine the time-series properties of  $Donations_{it}$ ,  $GovGrants_{it}$ ,  $Com_{it}$ , and  $Fundrais_{it}$ , we use the panel unit root test of Levin, Lin, and Chu (2002) (LLC). This test is based on the Augmented Dickey-Fuller (ADF) type regression

$$\Delta x_{it} = z_{it}\gamma_i + \rho x_{it-1} + \sum_{j=1}^{k_i} \phi_{ij} \Delta x_{it-j} + \varepsilon_{it}, \quad i = 1, 2, \dots, N, \quad t = 1, 2, \dots, T, \quad (\text{A.1})$$

where  $k_i$  is the lag length,  $z_{it}$  is a vector of deterministic terms, such as fixed effects or fixed effects plus individual time trends, and  $\gamma_i$  is the corresponding vector of coefficients. As Equation (A.1) implies, the LLC unit root test pools the autoregressive coefficients across the cross-sectional units and thus restricts the first-order autoregressive parameters to be the same for all NGOs,  $\rho_i = \rho$ . Accordingly, the null hypothesis is that all time series have a unit root,  $H_0 : \rho = 0$ ; the alternative hypothesis is that no series contains a unit root,  $H_1 : \rho = \rho_i < 0$ , that is, all time series are (trend) stationary processes. To conduct the LLC-test statistic, the following steps are performed. First, the residuals,  $\hat{e}_{it}$ , are estimated from individual regressions of  $\Delta x_{it}$  on its lagged values (and on  $z_{it}$ ),  $\Delta x_{it} = \sum_{j=1}^{k_i} \theta_{1ij} \Delta x_{it-j} + z_{it}\gamma_i + e_{it}$ . Second,  $x_{it-1}$  is regressed on the lagged values of  $\Delta x_{it}$  (and on  $z_{it}$ ) to obtain the (lagged) residuals,  $\hat{v}_{it-1}$ , from this regression,  $x_{it} = \sum_{j=1}^{k_i} \theta_{2ij} \Delta x_{it-j} + z_{it}\gamma_i + v_{it}$ . In the third step,  $\hat{e}_{it}$  is regressed on  $\hat{v}_{it-1}$ ,  $\hat{e}_{it} = \delta \hat{v}_{it-1} + \xi_{it}$ . The standard error,  $\hat{\sigma}_{ei}^2$ , of this regression is then used to normalize the residuals  $\hat{e}_{it}$  and  $\hat{v}_{it-1}$  (to control for heterogeneity in the variances of the series),  $\tilde{e}_{it} = \hat{e}_{it} / \hat{\sigma}_{ei}^2$ ,  $\tilde{v}_{it-1} = \hat{v}_{it-1} / \hat{\sigma}_{ei}^2$ . Finally,  $\rho$  is estimated from a regression of  $\tilde{e}_{it}$  on  $\tilde{v}_{it-1}$ ,  $\tilde{e}_{it} = \rho \tilde{v}_{it-1} + \xi_{it}$ . The conventional  $t$ -statistic for the autoregressive coefficient  $\rho$  has a standard normal limiting distribution if the underlying model does not include fixed effects and individual time trends ( $z_{it}$ ). Otherwise, this statistic has to be corrected using the first and second moments tabulated by Levin et al. (2002) and the ratio of the long-run variance to the short-run variance, which accounts for the nuisance parameters present in the specification. The limiting distribution of this corrected statistic is normal as  $N \rightarrow \infty$  and  $T \rightarrow \infty$ .

However, the LLC test procedure assumes cross-sectional independence and thus may lead to spurious inferences if, due to (unobserved) common factors, the errors,  $\varepsilon_{it}$ , are not independent across  $i$ . Therefore, we also use the cross-sectionally augmented IPS (CIPS) panel unit root test proposed by Pesaran (2007). This test filters out the cross-sectional dependence by augmenting the individual ADF regressions with the cross-section averages of lagged levels and first-differences of



the individual series as proxies for the unobserved common factors. It thus involves estimating separate cross-sectionally augmented ADF (CADF) regressions for each cross-sectional unit, thus allowing for different autoregressive parameters for each NGO. Accordingly, the CADF regression equation is given by

$$\Delta x_{it} = z_{it}\gamma_i + \rho_i x_{it-1} + \sum_{j=1}^{k_i} \phi_{ij} \Delta x_{it-j} + \alpha_i \bar{x}_{t-1} + \sum_{j=0}^{k_i} \eta_{ij} \Delta \bar{x}_{t-j} + v_{it}, \quad (\text{A.2})$$

where  $\bar{x}_t$  is the cross-sectional mean of  $x_{it}$  in year  $t$ ,  $\bar{x}_t = N^{-1} \sum_{i=1}^N x_{it}$ . The null hypothesis is that each series contains a unit root,  $H_0 : \rho_i = 0$  for all  $i$ , while the alternative hypothesis is that at least one of the individual series in the panel is (trend) stationary,  $H_1 : \rho_i < 0$  for at least one  $i$ . To test the null hypothesis against the alternative hypothesis, the CIPS statistic is calculated as the average of the individual CADF statistics:

$$CIPS = N^{-1} \sum_{i=1}^{N_i} t_i, \quad (\text{A.3})$$

where  $t_i$  is the OLS  $t$ -ratio of  $\rho_i$  in the CADF regression. Critical values are tabulated by Pesaran (2007).

The results of the unit root tests with an intercept and intercept and time trend are presented in Table A.1. The unit root hypothesis cannot be rejected for all series, suggesting that the variables are integrated processes.

Table A.1

Panel unit root tests

Variables	Deterministic terms	Levin, Lin, and Chu (2002)	Pesaran (2007)
<i>Donations<sub>it</sub></i>	Intercept	8.87	-1.23
<i>GovGrants<sub>it</sub></i>	Intercept	105.12	-1.00
<i>Com<sub>it</sub></i>	Intercept	3.53	-2.01
<i>Fundrais<sub>it</sub></i>	Intercept	6.00	-1.68
<i>Donations<sub>it</sub></i>	Intercept, trend	13.99	-1.54
<i>GovGrants<sub>it</sub></i>	Intercept, trend	142.96	-0.92
<i>Com<sub>it</sub></i>	Intercept, trend	7.86	-1.99
<i>Fundrais<sub>it</sub></i>	Intercept, trend	6.67	-1.78

Notes: Three lags were selected to adjust for autocorrelation. The test statistics of Levin, Lin, and Chu (2002) are distributed as  $N(0,1)$  under the unit root null hypothesis. The relevant 1% (5%) critical value for the CADF statistic suggested by Pesaran (2007) is -2.76 (-2.62) with an intercept and a trend, and -2.25 (-2.11), with an intercept.

### Appendix A3. Panel cointegration tests

As discussed in Section 3, a set of integrated time series is cointegrated if a linear combination of these nonstationary series is stationary. To tests for a cointegrating relationship between  $Donations_{it}$ ,  $GovGrants_{it}$ ,  $Com_{it}$ , and  $Fundrais_{it}$ , we employ several techniques.

First, we use the Pedroni (1999, 2004) framework which is based on a two-step residual-based procedure. In the first step, the static cointegrating regression

$$Donations_{it} = a_i + \delta_i t + \beta_{1i} GovGrants_{it} + \beta_{2i} Com_{it} + \beta_{3i} Fundrais_{it} + \varepsilon_{it} \quad (A.4)$$

is estimated separately for each NGO. Then, the estimated residuals,  $\hat{\varepsilon}_{it}$ , are tested for stationarity. Pedroni proposes seven statistics. Four of these statistics pool the autoregressive coefficient across different panel members for the unit root tests on the estimated residuals. Pedroni refers to these within-dimension statistics as panel cointegration statistics. The other three test statistics are based on estimators that average the individually estimated autoregressive coefficients for each NGO. Pedroni refers to these between-dimension statistics as group-mean panel cointegration statistics. The first of the panel cointegration statistics is a non-parametric variance ratio test. The second and the third are panel versions of the Phillips and Perron (PP)  $\rho$  statistic and  $t$  statistic, respectively. The fourth statistic is a panel ADF  $t$  test analogous to the LLC (2002) panel unit root test. Similarly, the first of the group-mean panel cointegration statistics is analogous to the PP  $\rho$  statistic, the second is a panel version of the PP  $t$  statistic, and the third is a group mean ADF  $t$  test. The standardized distributions for the panel and group statistics are given by

$$\kappa = \frac{\varphi - \mu\sqrt{N}}{\sqrt{\nu}} \Rightarrow N(0, 1), \quad (A.5)$$

where  $\varphi$  is the respective panel or group statistic, and  $\mu$  and  $\nu$  are the expected mean and variance of the corresponding statistic.

However, residual-based (panel) cointegration tests restrict the long-run elasticities to be equal to the short-run elasticities. If this restriction is invalid, residual-based (panel) cointegration tests may suffer from low power (Westerlund, 2007). Another potential problem with the Pedroni approach is that it does not take into account potential error cross-sectional dependence, which could bias the results. To test for cointegration in the presence of possible cross-sectional dependence, we use the error correction model (ECM) cointegration tests recently developed by Gengenbach et al. (2008). This test also allows the long-run effects to differ from the short-run effects and hence does not impose a possibly invalid common factor restriction. Similar to the CIPS test, the Gengenbach et al. procedure involves estimating conditional ECMs for each NGO using

the cross-section averages of the dependent and independent variables as proxies for the unobserved common time effects. Specifically, we estimate the following model:

$$\begin{aligned}
\Delta Donations_{it} &= b_{1i} \overline{Donations}_{it-1} + b_{2i} \overline{GovGrants}_{it-1} + b_{3i} \overline{Com}_{it-1} + b_{4i} \overline{Fundrais}_{it-1} \\
&+ b_{5i} \overline{Donations}_{t-1} + b_{6i} \overline{GovGrants}_{t-1} + b_{7i} \overline{Com}_{t-1} + b_{8i} \overline{Fundrais}_{t-1} \\
&+ \varphi_{1ij} \Delta GovGrants_{it} + \varphi_{2ij} \Delta Com_{it} + \varphi_{3ij} \Delta Fundrais_{it} \\
&+ \varphi_{4ij} \Delta \overline{Donations}_t + \varphi_{5ij} \Delta \overline{GovGrants}_t + \varphi_{6ij} \Delta \overline{Com}_t + \varphi_{7ij} \Delta \overline{Fundrais}_t \\
&+ a_i + \delta_i t + \varepsilon_{it}
\end{aligned} \tag{A.6}$$

where  $\overline{Donations}_t$ ,  $\overline{GovGrants}_t$ ,  $\overline{Com}_t$ , and  $\overline{Fundrais}_t$  are the cross-sectional means of  $Donations_{it}$ ,  $GovGrants_{it}$ ,  $Com_{it}$ , and  $Fundrais_{it}$ . Gengenbach et al. propose two test statistics to test the null hypothesis of no cointegration: the average  $t$  statistic associated with the coefficient of the lagged dependent variable,  $b_{1i}$ , and the average Wald chi-square test statistic of the hypothesis that all coefficients of the lagged levels are zero,  $H_0 : b_{1i} = b_{2i} = b_{3i} = b_{4i} = b_{5i} = b_{6i} = b_{7i} = b_{8i} = 0$ .

The ECM procedure assumes that the explanatory variables are weakly exogenous, which may be incorrect. Therefore, we also test for cointegration using the Larsson et al. (2001) approach. The panel cointegration test of Larsson et al. is based on the time-series cointegration test of Johansen (1988) and thus treats all variables as potentially endogenous (like the Johansen cointegration test). In addition, and more importantly, in contrast to the Pedroni (1999) and the Gengenbach et al. (2008) tests, the Larsson et al. procedure allows the determination of the number of cointegrating vectors.

The Larsson et al. (2001) test involves estimating the Johansen vector error-correction model for each organization separately:

$$\Delta y_{it} = \Pi_i y_{it-1} + \sum_{k=1}^{k_i} \Gamma_{ik} \Delta y_{it-k} + z_{it} \gamma_i + \varepsilon_{it}, \tag{A.7}$$

where  $y_{it}$  is a  $p \times 1$  vector of endogenous variables ( $y_{it} = [Donations_{it}, GovGrants_{it}, Com_{it}, Fundrais_{it}]'$ ,  $p$  is the number of variables) and  $\Pi_i$  is the long-run matrix of order  $p \times p$ . If  $\Pi_i$  is of reduced rank,  $r_i < p$ , it is possible to let  $\Pi_i = \alpha_i \beta_i$ , where  $\beta_i$  is a  $p \times r_i$  matrix, the  $r_i$  columns of which represent the cointegrating vectors, and  $\alpha_i$  is a  $p \times r_i$  matrix whose  $p$  rows represent the error correction coefficients. The null hypothesis is that all of the  $N$  organizations in the panel have a common cointegrating rank, i.e. at most  $r$  (possibly heterogeneous) cointegrating relationships among the  $p$  variables:  $H_0 : rank(\Pi_i) = r_i \leq r$  for all  $i = 1, \dots, N$ , whereas the alternative hypothesis is that all the cross-sections have a higher rank:  $H_1 : rank(\Pi_i) = p$  for all  $i = 1, \dots, N$ .

To test  $H_0$  against  $H_1$ , a panel cointegration rank trace-test statistic is computed by calculating the average of the individual trace statistics,  $LR_{iT}\{H(r)|H(p)\}$ :

$$\overline{LR}_{NT}\{H(r)|H(p)\} = \frac{1}{N} \sum_{i=1}^N LR_{iT}\{H(r)|H(p)\}, \quad (\text{A.8})$$

and then standardizing it as follows:

$$\Psi_{LR}\{H(r)|H(p)\} = \frac{\sqrt{N}(\overline{LR}_{NT}\{H(r)|H(p)\} - E(Z_k))}{\sqrt{\text{Var}(Z_k)}} \Rightarrow N(0, 1). \quad (\text{A.9})$$

The mean  $E(Z_k)$  and variance  $\text{Var}(Z_k)$  of the asymptotic trace statistic are tabulated by Breitung (2005) for the model (with an intercept and a trend) we use.

Table A.2

Panel cointegration tests

Pedroni (1999, 2004)					
Panel $\nu$ statistic				4.15**	
Panel PP $\rho$ statistic				1.42	
Panel PP $t$ statistic				-1.98*	
Panel ADF statistic				-3.60**	
Group PP $\rho$ statistic				2.34	
Group PP $t$ statistic				-5.76**	
Group ADF statistic				-5.53**	
Gengenbach et al. (2008)					
ECM $t$ statistic				-4.25**	
ECM Wald statistic				-62.52**	
		Cointegration rank			
		$r = 0$	$r = 1$	$r = 2$	$r = 3$
Larsson et al. (2001)	Panel trace statistics	12.68**	1.24	-1.88	-3.39

Notes: \*\* (\*) indicate a rejection of the null of no cointegration at the 1% (5%) level. The 1% critical value for the ECM  $t$  statistic is -3.953; the 1% critical value for the corresponding Wald statistic is 25.453 (Gengenbach et al. 2008). All other test statistics are asymptotically normally distributed. The right tail of the normal distribution is used to reject the null hypothesis in the panel  $\nu$  and the standardized panel trace statistics, while the left tail is used for the other statistics. The number of lags for the Pedroni test was determined by the Schwarz criterion with a maximum number of three lags. For each conditional ECM, insignificant short-run dynamics were eliminated. For the Larsson et al. (2001) technique, we used one lag.

However, the Johansen trace statistics are biased toward rejecting the null hypothesis in small samples. As a consequence of this bias, the Larsson et al. test may also overestimate the cointegration rank. Therefore, we compute the standardized panel trace statistics based on small-sample corrected organization-specific trace statistics. Specifically, we use the small-sample correction factor suggested by Reinsel and Ahn (1992) to adjust the individual trace statistics as follows:

$$LR_{iT} \{H(r)|H(p)\} \times \left[ \frac{T - k_i \times p}{T} \right]. \quad (\text{A.10})$$

The results of these tests are presented in Table A2. Five of the seven Pedroni statistics reject the null of no cointegration at least at the 5% level. Specifically, the ADF-type tests decisively reject the null hypothesis. Given that these tests have been shown to have the highest power for smaller sample sizes (such as  $T = 23$ ) (see, e.g., Pedroni 2004), the ADF test results, in particular, provide strong evidence of cointegration. This conclusion is supported by the ECM  $t$ - and Wald statistics which show that  $Donations_{it}$ ,  $GovGrants_{it}$ ,  $Com_{it}$ , and  $Fundrais_{it}$  are cointegrated. Similarly, the standardized trace statistics support the presence of one cointegrating vector, implying that there exists a single long-run relationship between private donations, government grants, commercial revenues, and fundraising expenditures.

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