Birds of a feather, stronger together? Network externalities in NGO cooperation

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Abstract

This paper tests the endogenous formation of a political network of NGOs. A novel network dataset is generated by analysing the homepage content of NGOs involved in European Union policy-making. Estimation results reveal the individual incentives for the formation of collaborative ties. Moreover, NGOs seem to benefit from indirect ties. Positive network externalities emerge from indirect connections to influential NGOs that hold advisory positions in the expert groups of the European Commission.

Keywords: network formation, network externalities, lobbying, nonprofits, civil society, European Union

1. Introduction

Nonprofit organisations often launch joint public campaigns in order to increase their visibility and to make themselves heard by policy makers. But which mechanisms are at work behind political collaborations of NGOs?

Concerning the European Institutions, the landscape of political lobbying and organised interests has changed for NGOs over the last decade: on the one side there is an increased degree of professionalism, higher levels of technical expertise, international scale and larger budgets (Aldashev and Verdier, 2009; Weyrauch, 2007). On the other side, the demands of for instance the European Commission in external expertise and technical information augmented at the same time (Gornitzka and Sverdrup, 2011). Public and scholarly debate is ongoing about the uneven distribution of lobbying power,

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biased towards e.g. multinational corporates (Burley, 2010), national governments (Thomson, 2008) or technocratic experts (Joerges and Neyer, 1997). I do not attempt to make broader judgements in the debate on lobbyism, particular interests and the European governance system. Instead, I would like contribute to the understanding of how civil society organisations (CSOs)[1] operate on their missions within the boundaries of the European Institutions.

As NGOs with mutual interests often join their forces to approach policymakers together, a network theoretical perspective appears to be a promising framework of analysis. I experiment with a novel way of collecting connection data between NGOs. Using the application programming interfaces (APIs) of search engines, I construct a political network of development NGOs with European Union representative offices in Brussels. I investigate the individual drivers in the choice of collaboration partners such as information access. Moreover, I am interested in detrimental factors to collaboration and how competition for example for EU grants potentially influences cooperative behaviour. Beyond individual incentives, I seek to understand the indirect effects, so called network externalities that emerge from the network architecture and the interaction of choices.

This paper is organised as following: Section 2 reviews the related literature. Section 3 provides a short background on institutional features of the EU. Section 4 explains my data collection strategy. It follows section 5, which introduces the connection model and section 6 the econometric model. The estimation results are presented in 7, which are finally discussed in section 8. Section 9 concludes.

2. Related literature

There have been recent advances in modelling the microeconomic behaviour of nonprofit organisations. Aldashev et al. (forthcoming) present an analytical framework to understand the competitive interactions between NGOs in private donation markets. As NGOs impose externalities on each other through their fundraising activities and interactions with private donors,

[1]The terms civil society or nonprofit organisation are used more or less arbitrarily, but the latter term is more established in the economics literature.

there is a strong economic case for strengthening coordination between competing NGOs. The authors study the stability of coordination under various decision rules of coordination in a game-theoretic framework of coalition formation. Full coordination, as it is observed in various nonprofit alliances, is shown to be stable in particular, when postive externalities arise from market interaction with donors.

A survey on the economics literature of nonprofit civil society organisations working on internactional development by Navarra (2013) makes apparent, that economic data on nonprofits is scarce. Concerning cooperative behaviour and coordination between civil society organisations, the Union of International Associations (UIA) provides a global database with information on organisational ties. Murdie and Davis (2012) assemble a network dataset using UIA data to visualise transnational network relations as a bird's eye view on global civil society. Her analysis identifies a divide in global civil society between the North and South, and into two groups with and without exclusive ties to intergovernmental organisations. She finds homophily in the dimension of issue-area foci and interprets the higher Eigenvector Centrality scores of "hybrid" (service and advocacy oriented) NGO as evidence, that they assume "bridging" functions for the network.

The theoretical foundations of this paper lie in the literature of endogenous network formation. There are two strands in the literature. Random network models that originated from physics, but have been adopted by the social sciences more recently (see e.g. Vega-Redondo (2007) for an introduction). And the second strand, which is rooted in game-theoretical approaches, where the bundled works of Jackson (2010) and Goyal (2012) proved to be very influential. Latter authors focussed both on network externalities in theoretical settings that players are exposed to due to specific network structures. My approach follows Jackson's connection model, which provides a suitable analytical framework for analysing network externalities in the context of NGO cooperation (Jackson and Wolinsky, 1996). There have now been plenty of theoretical works been written on endogenous and strategic network formation, but empirical research with micro-evidence is only slowly taken off. The experimental notion of this empirical application for organisational networks should be seen in this context.

3. Lobbying in EU policy-making

The EU is a complex inter-institutional system, characterised by interactions between the EU institutions, administrations from different levels in the national states and organised non-state actors such as corporates, industry associations, trade unions, labor unions, and civil society non-profit organisations. This is probably most obvious in the numerous advisory committees the institutions consult. Special interest has been given by academics in particular to the expert group system of the European Commission (Gornitzka and Sverdrup, 2008). The EC created a system of advisory expert panels across its various policy areas to acquire technical information for their function in the EU institutions to develop political and legal initiatives. The level of transparency in these consultation processes attracted criticism by EU watchdog NGOs and wider public interest, such that the European Parliament pushed for the establishment of a database of these groups (Gornitzka and Sverdrup, 2008). As these expert groups are probably the most important source of technical information for the EC's legal initiatives, a membership in these groups is a priority for lobbyists of all couleurs (Gornitzka and Sverdrup, 2011). I treat the membership of NGOs in an expert group as a variable, which measures the success of their political lobbying and which turns out to be a key driver in the formation process of campaign collaboration networks.

4. Data

4.1. Tracing collaborative effort

How can political collaboration between NGOs be measured? Empirical studies on the collaboration of civil society organisations worked almost exclusively with data from the Union of International Associations (UIA)[2]. The UIA database is the most comprehensive global source on information about civil society organisations. They report connections between organisations based on three criteria: structural links (sister or subsidiary organisation, common founders, membership in umbrella organisation), shared resources (joint key staff, financial ties) and joint activities (collection of information and publications)(Katz and Anheier, 2005). However, the UIA does not provide data in this detail and merely indicates a simple binary link variable

[2]See besides aforementioned (Murdie and Davis, 2012) as well (Katz, 2006)

for all possible types of connections. In order to identify collaboration in lobbying a more precise measurement is needed.

This work tries to overcome the previously outlined limitation by screening the content of NGO homepages for possible collaborative activities with other NGOs. The aim is to identify partnering NGOs on publications, press releases, news about joint campaigns, common position papers, conference briefings etc., which all can be found on the official webpage of the NGO. With this approach, the *output* from joint collaborative effort can be traced and identified. Consider the following example which works with most of the conventional search engines. The following syntax performs a search for webcontent from Oxfam's EU office relating to collaborations with Friends of the Earth:[3]

```
"friends of the earth" foe site:http://www.oxfam.org/en/eu/
```

In principle, this query syntax can be used to generate dyadic data for an entire group of NGOs. Since the amount of pair searches $N * (N-1)$ grows exponentially with the number of NGOs N, the search process has to be automated. Fortunately, search engines provide application programming interfaces (APIs) that can be accessed with user-written programmes in Python or similar programming languages, executed via a command-line interface.[4] I design an application that reads out the search terms from a spreadsheet, runs the query with the Bing Search API and returns the number of search hits.[5] Names of the NGOs, abbreviations and urls required to create the collaboration network are taken from the Transparency Register. The register is administered by the European Parliament and contains the self declarations of organised interest groups in Europe. Although it is not mandatory, the fact that it was created upon the initiative of transparency NGOs lends support the argument that it covers the Brussels' NGO landscape well.

[3] Note that in order to not search for single words, quotation marks have to be used around the NGO's name. An abbreviation can be used additionally, as it is done here with "foe".

[4] I take my inspiration from Coscia et al. (2013), who analyze the coordination in a network of donors, countries and development issues created with Google's Search API.

[5] The API can be accessed at: http://www.bing.com/toolbox/bingsearchapi Please see the online appendix for the script of the application and instructions on use.

4.2. Mapping Brussels' development NGO network

I extract only Brussels-based NGOs from the register and concentrate on NGOs working on development issues (140 NGOs). This eliminates already confounding spatial barriers to network formation already. To make use of further information contained in the register such as costs spend on lobbying activities, total budget and other policy fields, I have to restrict my analysis to 90 NGOs.[6] I prepare a dataset of all possible bilateral combinations (90*89 = 8010 dyads), which is taken to the search application.[7]. Running the application, the number of search hits are recorded and stored with the dyadic data.

A closer look at the search results raises two major definitory questions, which are common in network studies. The first question is how to judge the search hits, which do not explicitly describe a collaborative activity? If merely a single NGO reports a campaign of another organisation, there might not actually be an agreement of mutual action. Treating the network as a directed network, might be the more appropriate choice in that case. I work with the assumption that, albeit the one-sided initiative, an unofficial underlying contact occurred which is revealed through such action. Additionally, I rule out the case of 'shaming' and direct criticism towards the cited NGO, given that the sample of results revealed no such case. This work is unfortunately limited in its scope, but future work would have to tackle this question by refining the search algorithm and further categorising the search hits by hand or computer support. The second question is how to interpret explicit collaborations, which are only reported by one single NGO. This is a common problem in empirical social network studies with merged egocentric data, for instance if a 'friendship' link is not reciprocally reported. Frequently, these studies adopt a simplifying assumption, that a non-reciprocated link is treated as measurement error.[8] I argue that the public announcement of collaborative activities requires some form of mu-

[6] Another reason is that Bing, such as other commercial search engines, charge for large numbers of queries and faster searches.

[7] The fact that the application can identify partners in the entire pool of N NGOs is an advantage to for instance the Add Health dataset used in several studies e.g. Liu et al. (2012) or Calvó-Armengol et al. (2009) The dataset of high-shool friends puts a cap on the number of friends of 5, which is not the case here.

[8] For instance Comola (2012) or scholars working with the Add Health dataset.

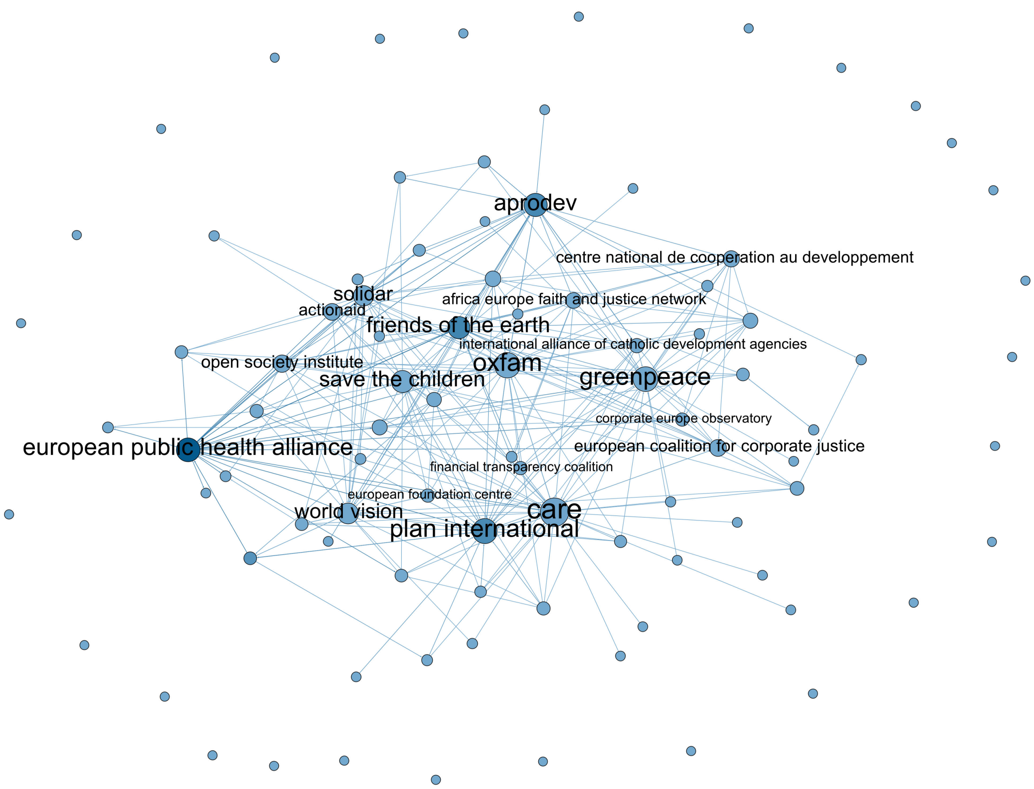


Figure 1: Aerial view on Brussels' development NGOs. Nodes with higher degrees are larger. Not all name labels were attached for lucidity.

tual consent of the other party, even when the other side does remains silent. Along these lines, I interpret searches resulting in more than one hit as an undirected connection between two NGOs.

The resulting interorganisational network exhibits similar empirical properties as large social networks. The diameter, the longest shortest path in the network, is 4 when excluding the non-connected NGOs. The average clustering coefficient is 0.151, which is much higher than would be observed in a random network. Consider therefore the average degree, the average number of connections of every NGO, which is 2.78. The probability to form a link with any random NGO equals the average degree over the number of NGOs $2.78/90 = 0.031$. The clustering coefficient can be imagined as the average over the fraction of all closed triads. In random networks, the probability that triads are being closed is equal to the probability to which the network is wired. Hence, the clustering coefficient is equal to 3.1%, 5 times as low as empirically observed. The average minimum path length is equal to 2.28, which is slightly lower to what would occur at random $\frac{N}{degree} = \frac{ln(90)}{ln(2.78)} = 4.40$. Networks with similar characteristics are called small-world networks, after the famous experiment by Milgram (1967). The NGO network seems to have on average a shorter shortest path length than ownership ties in large German firms in the 1990's (Kogut and Walker, 2001) ($L_{emp} = 5.64$ and $L_{rand} = 3.01$), but comparable to board-to-board ties in a 1999 U.S. firm network (Davis et al., 2003) ($L_{emp} = 2.98$ and $L_{rand} = 2.64$). Figure 1 provides an aerial view on Brussels' development NGO landscape. Table A.2 in the appendix summarises key network metrics for each organisation.

5. Setup of the model

5.1. The NGO connection model

Consider an undirected network defined by (N, g), where N equals the set of NGOs which are connected through the graph g. The graph can be imagined as an adjacency matrix $g = [g_{ij}]$ for every possible dyad $\{ij\}$. Whenever $g_{ij} = 1$, NGO i and NGO j collaborate, otherwise g_{ij} in the adjacency matrix will be 0. For the case of an undirected network, the adjacency matrix is symmetric. I adapt the standard abuse of notation by using g_{+ij} for the network in which a connection between i and j is established, and using g_{-ij} if the bilateral link is severed. Based on Jackson and Wolinsky (1996), I define NGO i's payoff given the network g by

$$\pi_i(g) = \alpha \sum_{l=1}^{N-1} w_l(g) e_l + \sum_{k:dist=1}^{K} \boldsymbol{\beta}_{\mathbf{k}} \mathbf{X}_{\mathbf{ik}}.$$

The 2-term structure is similar to Comola (2012)'s network risk-sharing model. The first component, the network structural component, attaches a geodesic distance weight $w_l(g)$ to the expert status e_l of all $N-1$ NGOs in the network (excluding NGO i itself). The expert status is defined as being either 1 if the NGO advises the European Commission in an expert group or 0 if not (see section 3 for background information). The aggregate measure represents a network externality that emerges from the the 'expert NGOs'. Its strength depends on NGO i's relative distances to these NGOs. The coefficient α captures the magnitude and direction of the effect. The second component is the relational component. It captures the benefits from various relational attributes with its K, direct connection neighbours in the vector $\mathbf{X}_{\mathbf{ik}}$. The vector $\boldsymbol{\beta}_k$ contains coefficients for each attribute of partner NGO k. Hence, the model allows the NGO to benefit *directly* from characteristics that define its relations with its partners. Or *indirectly* from the network externalities, that arise through the expert status of one's partner's partners.

5.2. Equilibrium conditions

Keeping with Jackson and Wolinsky (1996), I adopt the equilibrium notion of pairwise stability. In this case, a connection between two NGOs will only be established under mutual consent. However, severing a link can be done by only one NGO.

1. $\forall ij$ formed: $\pi_i(g_{+ij}) \geq \pi_i(g_{-ij})$ and $\pi_j(g_{+ji}) \geq \pi_j(g_{-ji})$
2. $\forall ij$ *not* formed: $\pi_i(g_{+ij}) > \pi_i(g_{-ij})$ and $\pi_j(g_{+ji}) < \pi_j(g_{-ji})$

In other words, in the equilibrium network g, no NGO will want to cut off a link and no pair of NGOs will want to add a further link. Every beneficial connection is realised and there is incentive for nobody to discontinue a connection. Rairwise stability does not allow for concerted actions or multiple deviations and consequently any multiple equlibria.

6. Estimation strategy

6.1. Partial observability two-equation model

On the decision level of NGO i, its net gain of forming a connection with NGO j, following the approach of Comola (2012), is equal to the difference:

$$
\begin{aligned}
\pi_i(g_{+ij}) - \pi_i(g_{-ij}) = \alpha \sum_{l=1}^{N-1} w_l(g_{+ij}) e_l + \sum_{k:dist=1}^{K} \boldsymbol{\beta}_{\mathbf{k}} \mathbf{X}_{\mathbf{ik}} \\
- \alpha \sum_{l=1}^{N-1} w_l(g_{-ij}) e_l - \sum_{k \neq j:dist=1}^{K} \boldsymbol{\beta}_{\mathbf{k}} \mathbf{X}_{\mathbf{ik}} \\
= \alpha \sum_{l=1}^{N-1} (w_l(g_{+ij}) - w_l(g_{-ij})) e_l + \boldsymbol{\beta} \mathbf{X}_{\mathbf{ij}}
\end{aligned}
$$

Thus, the benefit for NGO i being linked to NGO j can be attributed to the change in distance to the network's EC experts and from direct gains attributed to a direct partner relation with NGO j. Only direct relational gains from link ij are relevant, since the relational benefits from i's other direct neighbours chancel out with the difference. In other words, the choice to team up with a particular organisation will be influenced by the existing network partners this organisation relies on, and the relational benefits expected from working together.

A connection will be the outcome of a simultaneous link-anouncement game, where two organisations weigh up the costs and benefits of establishing a collaboration link. A pairwise stable connection requires that both players are convinced of the benefits of the link. The second condition that one player can sever a link poses a challenge for estimation. If no link is observed the connection could only be beneficial for one, such that decisions are only partially observed for this case. The link-anouncement decisions are correlated between both agents and it is consequently necessary to estimate both NGO i's and NGO j's decision in a two-equation model simultaneously. A bivariate probit with partial observability as introduced by Poirier (1980) can be used. Two latent binary response variables are defined for NGO i and NGO j's gain of their collaborative connection, y_{ij} and y_{ji} respectively. The probabilities for a potential connection to be established or dismissed are

$$
\begin{aligned}
P(g_{ij} = 1) &= P(y_{ij} = 1 \;\;\&\;\; y_{ji} = 1) \\
P(g_{ij} = 0) &= 1 - P(y_{ij} = 1 \;\;\&\;\; y_{ji} = 1).
\end{aligned}
$$

With the latent variables defined as

$$y_{ij} = \begin{cases} 1 & \text{if } \alpha \sum_{l=1}^{N-1} (w_l(g_{+ij}) - w_l(g_{-ij}))e_l + \boldsymbol{\beta}\mathbf{X_{ij}} > \epsilon_{ij} \\ 0 & \text{if } otherwise \end{cases}$$

$$y_{ji} = \begin{cases} 1 & \text{if } \alpha \sum_{l=1}^{N-1} (w_l(g_{+ji}) - w_l(g_{-ji}))e_l + \boldsymbol{\beta}\mathbf{X_{ji}} > \epsilon_{ji} \\ 0 & \text{if } otherwise. \end{cases}$$

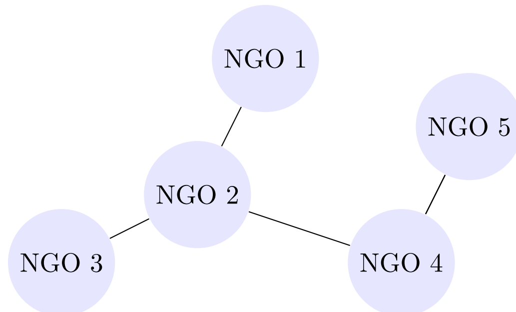
If no link exists between i and j ($g_{ij} = g_{ji} = 0$), partial observability implies in this framework that it is not possible to distinguish between the three different possible cases: either $y_{ji} = 1$ and $y_{ij} = 0$, the other way around that $y_{ji} = 0$ and $y_{ij} = 1$ or both $y_{ij} = y_{ji} = 0$. The coefficients to be estimated α and β are assumed to be equal across the entire population, but it should be noted that they will differ in both binary variable equations.

6.2. Computation of distance weightings

Before the model is taken to the data the computation of the network externalities from 'expert NGOs' should be explained further. As presented, the externality is derived from the proximity to these experts. It is of importance for a new link, how much closer it might localize the decision-taking NGO to (other) NGOs with this status. It is useful to define a distance matrix $\mathbf{D} = [d_{ij}]$, which contains the geodesic distances between all NGOs in the network. Geodesic distances are simply the number of steps along the shortest paths to get on the graph from node i to node j. The distances of NGO i to all other NGOs can be taken from the i-th row or column, since matrix $\mathbf{D}$ is symmetric on undirected graphs. If two nodes are in no possible way connected with each other the element d_{ij} equals infinity. To obtain the distance matrix given an adjacency matrix various algorithms exist. I compute the distance matrizes with the *igraph* package for the statistical software **R**.[9]

Example 6.1. Consider the network g comprising of 5 NGOs. The corresponding adjacency and distance matrix of dimension 5×5 are $\mathbf{G}$ and $\mathbf{D}$.

[9]Paths lengths are often analyzed in undirected networks with the breadth-first search algorithm, which is used by the *igraph* package as well.



$$\mathbf{G} = \begin{pmatrix} 1 & 1 & 0 & 0 & 0 \\ 1 & 1 & 1 & 1 & 0 \\ 0 & 1 & 1 & 0 & 0 \\ 0 & 1 & 0 & 1 & 1 \\ 0 & 0 & 0 & 1 & 1 \end{pmatrix} \quad \mathbf{D} = \begin{pmatrix} 0 & 1 & 2 & 2 & 3 \\ 1 & 0 & 1 & 1 & 2 \\ 2 & 1 & 0 & 2 & 2 \\ 2 & 1 & 2 & 0 & 1 \\ 3 & 2 & 2 & 1 & 0 \end{pmatrix}$$

Based on these distances, weightings are attached to a certain characteristic identified as the source of network externalities. It is important to note, that there is a computational challenge arising from the fact that either a link or no link are actually realised, such that either $w_l(g_{+ij})$ or $w_i(g_{-ij})$ can be observed in the data. Since each dyad in my data rests on two graphs g_{+ij} and g_{-ij}, two distance matrizes $\mathbf{D_{+ij}}$ and $\mathbf{D_{-ij}}$ have to be computed for $\frac{N*(N-1)}{2}$ dyads. I implement a solution of this problem in **R** by simulating an actual and a counterfactual network for every possible connection, keeping all other connections in the network as given. The implementation is based on an adjacency matrix **G**, for each of whose elements g_{ij} I derive two distance matrizes with the actual realised value and counterfactual (so either $g_{ij} = 1$ into $g_{ij} = 0$, or $g_{ij} = 0$ into $g_{ij} = 1$). Because of symmetry, this process is repeated over the diagonal half of the adjacency matrix's values to obtain two distance matrizes for each dyad.[10] The geodesic distances for i can then be taken from the i-th row/column of the distance matrix. I propose a weighting method based on these shortest paths. The benefits of being linked indirectly water down with distance. Therefore, the weighting $w_l(g)$ attached to the expert status to all $N-1$ NGOs should decrease with the geodesic distance d_{il}, they are located away from NGO i. Given that $\mathbf{D_{\pm ij}} = [d_{il}]_{\pm ij}$, the weighting being used is:

[10]The **R** script can be found in the online appendix.

- Inverse distance weighting: $w_l(g_{\pm ij}) = \frac{1}{d_{il}^{\pm ij}}$

Example (6.1. continued)**.** To compute the externality NGO 1 will receive from teaming up with NGO 2 consider distance matrix $\mathbf{D_{+12}}$ generated from adjacency $\mathbf{G}$ with $g_{12} = g_{21} = 1$ and distance matrix $\mathbf{D_{-12}}$ again from adjacency $\mathbf{G}$ but setting $g_{12} = g_{21} = 0$.

$$\mathbf{D_{+12}} = \begin{pmatrix} \boxed{\begin{matrix}0\\1\\2\\2\\3\end{matrix}} & \begin{matrix}1 & 2 & 2 & 3\\0 & 1 & 1 & 2\\1 & 0 & 2 & 2\\1 & 2 & 0 & 1\\2 & 2 & 1 & 0\end{matrix} \end{pmatrix} \rightarrow \mathbf{D_{-12}} = \begin{pmatrix} \boxed{\begin{matrix}0\\\infty\\\infty\\\infty\\\infty\end{matrix}} & \begin{matrix}\infty & \infty & \infty & \infty\\0 & 1 & 1 & 2\\1 & 0 & 2 & 2\\1 & 2 & 0 & 1\\2 & 2 & 1 & 0\end{matrix} \end{pmatrix}$$

The gain with inverted weighting can be calculated by extracting column 1 in both matrizes, taking differences and multiplying by the expert status of all NGOs.[11]

$$\Delta = \sum_{l=1}^{4} \left(\frac{1}{d_{1l}^{+12}} - \frac{1}{d_{1l}^{-12}}\right) e_l \tag{1}$$

My implementation of the weightings computation links inevitably up to issues associated with how I model the network formation process. The main concern lies in the assumption of simultaneity of link formation, which will receive further attention in section 8. It should be noted that, assuming link-announcements between all pairs of players in the network are simultaneous, every player's potential indirect partners cannot be observed as there is no network existing yet. Obviously, there is a logical inconsistency to model agent-level decisions simultaneously, if an agent's decision is supposed to be influenced by yet not existing indirect connections. In other words there is reverse causality. Bilateral decisions are either made sequentially or agents have to form prior beliefs over the architecture of the network irrespective of their decision. A way out could be an empirical assessment of the sequentiality of collaborative links. There are other alternatives proposed by the recent literature, which are discussed in section 8.

[11] Unconnected nodes have a distance of infinity. I use a large number in the computation of the weights, such that the value goes to zero.

7. Estimation results

I estimate a bivariate probit with partial observability as introduced by Poirier (1980). Table 1 shows the estimation results of one of both equations which were estimated simultaneously, taking the correlation between error terms into account $Cov(\epsilon_{ij}, \epsilon_{ji}) \neq 0$. As the coefficients are equivalent for both parallel estimated regressions, only one regression is reported. I included several explanatory variables in order to explain, as best as possible, potential relative characteristics driving (or detering) collaborative effort in advocacy and political lobbying. Table 1 includes the externality variable, a dummy on the expert status of the direct partner, a variable measuring the "policy match" created from the Transparency Register. The difference in total budgets of the Brussels' office as reported in the Transparency Register unfortunately leads to a smaller sample size. Moreover, it includes a variable on the difference of the log sum of grants both NGOs received from the European institutions in 2007 to 2012. It is constructed from budget sheets of the EC provided by its financial transparency system.[12] Table A.3 in the appendix shows the results of a standard probit. The intuition, that coefficients should be downward biased as information on one-sided approaches to link (for $y_{ij} = 1$ & $y_{ji} = 0$ there is $g_{ij} = 0$) are lost, can be verified from a comparison between probit and bivariate probit of the magnitude of the coefficients.

The variable with the highest explanatory power in the first regression, seems to be wether the potential partner NGO has been a member of a European Commission expert group or not. The dummy variable is coded with 1, if the NGO has held multiple memberships as well. It suggests that Brussels' NGOs favor a collaboration with an NGO, whose technical expertise seems to be important for the EC. This property is my major motivation for calculating network externalities in the dimension of the EC expert status.

Concerning the network externalities in the dimension of expert group membership, my results point to an overall positive effect for the entire network. NGOs seem to benefit from the activity of other NGOs with advisory

[12] http://ec.europa.eu/budget/fts/index_en.htm

Table 1: Bivariate probit with partial observability

	(1) link
link	
Expert externality	0.0337^{***} (3.69)
Difference in NGO budgets	-0.364^{***} (-10.53)
Partner NGO is EC expert	0.409^{***} (4.40)
Policy dismatch	-0.533 (-0.44)
Difference in EU grants received in euro	-0.0180^{*} (-1.90)
Constant	0.266 (0.32)
Observations	6320

t statistics in parentheses
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

status at the European Commission and choose their partners accordingly. This could be interpreted as revealed preferences for partner NGOs with, ceteris paribus, many EC-consulting NGO partners. Concerns might be raised about the fact that the expert externality variable might contain the target NGO variable already, by weighting the NGOs one step away from NGO i with distance 1. As the variable represents an aggregate value over $N-1$ values, the effect should be negligible.[13] My results are in line with for instance Goyal and Joshi (2006), who derive positive externalities theoretically in their network model of bilateral trade agreements.

There are obviously costs to direct collaboration. As there were no information on the costs of resources spent in collaborations with other NGOs indicated in the Transparency Register, I rely on a measure of alignment in policy interests. The policy dismatch variable is defined as 1 minus the number of matches in policy fields both NGOs are active in, over the total number of indicated policy fields. Its coefficient is negative (but statistically not significant) and might be interpreted as the costs of dilution of its "own message" the NGO bears through cooperation. The budget variable used in both specifications is supposed to control for the relative difference in size of the NGOs. A large difference in the budget endowments seems to have a

[13]The correlation between both variables is smaller than 0.25.

potential negative impact on the propensity to link. In the tradition of the network literature, these results could be described as signs for homophily in NGO collaboration.[14]

The difference in grants received from the European Institutions provides an interesting insight into the competitive side of lobbying in Brussels. Oxfam International taken as an example is highly diversified in its revenue structure, but the importance for institutional funding is not to be underestimated. In 2012/2013 approximately 43.1% of the revenue was raised through institutions with the European Institutions contributing around 9.5%.[15] The coefficient on the log difference between the grants received in euro is significant on a 10 % level and negative. A possible interpretation might be that collaborations with successful grant recipient NGOs could cast a shadow over collaborators such that they are overlooked in the allocation of grants. This could lend support to the idea of substitutability of institutional fundraising in similiar terms as Aldashev et al. (forthcoming).

8. Discussion

My model entails several econometric features of concern. First, as I model the network formation as a simultaneous link-announcement game, I assume that players know which indirect access they will gain when collaborating with a particular partner. This is obviously a non-sensical assumption, as the endogenous network formation process based on agent-level incentives is undermined by it. It is tricky in various ways to use the realised network as a right hand variable. Recent literature has addressed this issue with Bayesian econometric frameworks. Due to the limited scope of this paper, the adoption of these newly developed approaches are left to future work.

Comola (2012) detects a "logically inconsistent" maximum likelihood estimator using the network realization as explanatory variable and a bivariate probit approach with partial observability similar to mine. She therefore introduces common beliefs of players, incorporating all available information

[14]The network literature uses the proverb "birds of a feather flock together" to describe phenomena of homophily.

[15]http://www.oxfam.org/sites/www.oxfam.org/files/oxfam-annual-report-2012-2013.pdf

before the announcement of links, to predict the equilibrium outcome. She uses a two-step estimator, which defines the expected network equilibrium with a stochastic process. Subsequently, a permutation test is run for the same stochastic process.

As two identical NGOs could be embedded differently in network structures in the equilibrium, it might be due to network externalities or simply omitted variables. Calvó-Armengol et al. (2009) use network component fixed effects to account with endogeneity issues. A potential fixed effect for my framework could represent the use of country of origin of the NGO. Unfortunately, I did not have this information for the entire sample such that endogeneity concerns cannot be satisfactorily dismissed.[16] A promising approach for further research could make use of homepage searches by date. A network panel dataset would represent a leap forward in overcoming these issues.

9. Conclusion

This paper develops and tests an empirical model of endogenous network formation of an NGO network engaged in lobbying policy makers in the European Institutions. An innovative network dataset is compiled by identifying collaborative actions between NGOs from information the organisations convey on their homepages. The model is based on a connection model with two parts: first, a network structural part, where NGOs benefit through indirect connections from positive externalities arising from NGOs with advisory status at the European Commission. Second, a relational part, through which NGOs benefit from direct relational characteristics with their directly connected partners. The incentives on the decision level of the NGO are estimated using a bivariate probit with partial observability under the equilibrium conditions of pairwise stability. The results suggest that there are positive externalities from NGOs appointed to expert groups at the European Commission. There is some statistical evidence that the competition

[16] Table A.4 in the appendix reports a panel with fixed effects for NGO i. This will only achieve that unobserved characteristics of only one party chancel out. A component-level fixed effect would be necessary to control for unobserved characteristics between partnering NGOs.

for EU grants, that is to say the fundraising behaviour of partner NGOs, might deter the willingness to enter joint collaborations with them.

Both, the application of network theory to organisational network structures of firms, governments or nonprofits such as the empirical literature on network formation are still in their infancy. Hence, there is substantial room for technical improvement of the results presented in this paper. Moreover, my thesis only scratches the surface of the political economy of lobbying. I am confident that widening this analysis to more than one dimension of organised interests would set a fascinating research agenda for the future.

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Appendix A. Tables

	NGO Name	Degree	Eccentricity	Closeness Centrality	Betweenness Centrality	Clustering Coefficient	Eigenvector Centrality
1	*care*	33	3	1,651	488,878	0,071	0,874
2	*oxfam*	28	2	1,603	177,798	0,188	1,000
3	*greenpeace*	27	3	1,746	358,422	0,088	0,786
4	*plan international*	27	3	1,746	162,327	0,134	0,854
5	*european public health alliance*	25	3	1,698	212,405	0,169	0,833
6	*aprodev*	24	3	1,825	154,823	0,161	0,735
7	*friends of the earth*	22	3	1,937	121,201	0,170	0,659
8	*save the children*	22	3	1,889	158,398	0,110	0,742
9	*world vision*	20	3	1,810	127,999	0,161	0,717
10	*solidar*	19	3	1,825	102,956	0,175	0,723
11	*open society institute*	14	3	1,841	28,927	0,321	0,667
12	*actionaid*	13	3	1,825	45,530	0,295	0,652
13	*european coalition for corporate justice*	13	3	1,984	16,421	0,291	0,530
14	*centre national de cooperation au developpement*	12	3	1,889	22,805	0,341	0,588
15	*africa europe faith and justice network*	11	3	1,921	30,775	0,345	0,556
16	*concord europe*	11	3	2,063	42,517	0,300	0,510
17	*koepel van de vlaamse noord-zuidbeweging*	10	3	1,937	18,421	0,378	0,502
18	*northern alliance for sustainability*	10	3	1,921	43,701	0,250	0,404
19	*european ngos for sexual and reproductive health*	9	4	2,159	30,259	0,222	0,359
20	*international alliance of catholic development agencies*	9	3	1,984	10,359	0,304	0,410
21	*business network for corporate social responsibility*	8	3	2,032	49,598	0,214	0,347
22	*amnesty international*	7	4	2,111	15,943	0,238	0,342
23	*bahrain international community*	7	3	2,048	9,321	0,381	0,391
24	*corporate europe observatory*	7	3	2,365	1,564	0,400	0,258
25	*european foundation centre*	7	3	2,079	8,041	0,267	0,297
26	*financial transparency coalition*	7	3	2,016	8,218	0,357	0,393
27	*european association for the education of adults*	6	3	2,143	10,132	0,300	0,286
28	*european bureau for conservation and development*	6	3	2,302	64,693	0,150	0,181
29	*european parliamentary forum on population and development*	6	4	2,270	4,233	0,300	0,215
30	*no peace without justice*	6	4	2,127	2,169	0,433	0,326
31	*social economy europe*	6	4	2,333	6,549	0,250	0,213
32	*conservation international europe*	5	3	2,095	3,922	0,500	0,312
33	*european movement international*	5	3	2,317	7,037	0,350	0,231
34	*latin american association of development organizations*	5	4	2,317	4,043	0,250	0,179
35	*accion colombia*	4	4	2,333	3,412	0,250	0,175
36	*international road transport union permanent delegation to the eu*	4	3	2,127	5,035	0,250	0,241
37	*world wildlife fund*	4	3	2,286	18,092	0,333	0,189
38	*acp local government platform*	3	4	2,302	1,171	0,333	0,172
39	*european council for non-profit organisations*	3	4	2,524	0,760	0,333	0,131
40	*european forum of technical and vocational education and training*	3	4	2,333	1,859	0,333	0,140
41	*quaker council for european affairs*	3	4	2,603	0,766	0,333	0,117
42	*stop aids alliance*	3	4	2,460	1,825	0,667	0,144
43	*veterinaires sans frontieres*	3	4	2,429	0,000	0,500	0,148
44	*association of charity lotteries in the eu*	2	4	2,476	0,687	0,000	0,113
45	*eu-cord*	2	4	3,000	0,000	0,500	0,064
46	*eu40*	2	4	2,937	0,333	0,000	0,040
47	*eurogeosurveys*	2	4	3,286	0,000	0,000	0,014
48	*transparency international*	2	4	2,492	0,447	0,000	0,101
49	*vlaamse interuniversitaire raad*	2	4	2,302	2,229	0,000	0,124
50	*world youth alliance*	2	4	2,492	0,000	0,500	0,118
51	*zimbabwe europe network*	2	3	2,556	0,000	0,500	0,121
52	*association europeenne des agences de developpement*	1	4	2,635	0,000	0,000	0,065
53	*c.r.e.a.m. europe*	1	4	2,635	0,000	0,000	0,065
54	*coordination europeenne des comites et associations pour la palestine*	1	4	2,810	0,000	0,000	0,054
55	*council for european palestinian relations*	1	4	2,873	0,000	0,000	0,055
56	*europe against drugs*	1	4	2,683	0,000	0,000	0,061
57	*european dignity watch*	1	4	2,730	0,000	0,000	0,058
58	*european hydrogen association*	1	4	2,730	0,000	0,000	0,058
59	*european new towns & pilot cities platform*	1	4	2,635	0,000	0,000	0,065
60	*european projects association*	1	4	2,635	0,000	0,000	0,065
61	*federation internationale des corps et associations consulaires*	1	4	2,730	0,000	0,000	0,058
62	*federation internationale des vehicules anciens*	1	4	2,635	0,000	0,000	0,065
63	*partenalia*	1	4	2,730	0,000	0,000	0,063
64	*partners for euro-african green energy*	1	4	2,921	0,000	0,000	0,048
65	*action for a world community for food reserves*	0	0	0,000	0,000	0,000	0,000
66	*adventist development and relief agency*	0	0	0,000	0,000	0,000	0,000
67	*association europeenne des institutions d'amenagement rural*	0	0	0,000	0,000	0,000	0,000
68	*christian action research & education for europe*	0	0	0,000	0,000	0,000	0,000
69	*conexx*	0	0	0,000	0,000	0,000	0,000
70	*consortium of european taxonomic facilities*	0	0	0,000	0,000	0,000	0,000
71	*don bosco international*	0	0	0,000	0,000	0,000	0,000
72	*european alliance for responsible tourism and hospitality*	0	0	0,000	0,000	0,000	0,000
73	*european coalition for israel*	0	0	0,000	0,000	0,000	0,000
74	*european intermodal association*	0	0	0,000	0,000	0,000	0,000
75	*european landowners organisation*	0	0	0,000	0,000	0,000	0,000
76	*european network of implementing development agencies*	0	0	0,000	0,000	0,000	0,000
77	*european technology platform plants for the future*	0	0	0,000	0,000	0,000	0,000
78	*european young professionals mission foundation*	0	0	0,000	0,000	0,000	0,000
79	*fair trade advocacy office*	0	0	0,000	0,000	0,000	0,000
80	*friends of the countryside*	0	0	0,000	0,000	0,000	0,000
81	*global legislators organisation for a balanced environment*	0	0	0,000	0,000	0,000	0,000
82	*global water institute*	0	0	0,000	0,000	0,000	0,000
83	*intercultural dialogue platform*	0	0	0,000	0,000	0,000	0,000
84	*international council for human rights*	0	0	0,000	0,000	0,000	0,000
85	*johanniter international*	0	0	0,000	0,000	0,000	0,000
86	*knowledge4innovation*	0	0	0,000	0,000	0,000	0,000
87	*le congres de la societe democratique kurde en europe*	0	0	0,000	0,000	0,000	0,000
88	*new women for europe*	0	0	0,000	0,000	0,000	0,000
89	*office de communication d'azerbaidjan*	0	0	0,000	0,000	0,000	0,000
90	*ucee*	0	0	0,000	0,000	0,000	0,000

Table A.2: NGOs and key metrics of the network.

Table A.3: Probit regression with clustered errors.

	(1) link	(2) link	(3) link
Expert externality	0.0395**	0.0405**	0.0362*
	(3.13)	(3.13)	(2.34)
Partner NGO is EC expert	0.517***	0.525***	0.514***
	(6.89)	(6.55)	(5.66)
Policy dismatch	−1.935***	−1.892***	−1.966***
	(−3.88)	(−3.87)	(−3.41)
Difference in NGO budgets		0.0136	0.0344
		(0.57)	(1.28)
Difference in EU grants received in euro			−0.0460*
			(−2.35)
Constant	−0.379	−0.401	−0.368
	(−0.99)	(−1.06)	(−0.86)
Observations	4005	3828	3081

t statistics in parentheses
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table A.4: Panel regression with fixed effects for NGO i

	(1) Connection
Connection	
Expert externality	0.0495**
	(2.78)
Difference in NGO budgets	−0.283***
	(−7.75)
Partner NGO is EC expert	0.981***
	(7.64)
Difference in # of policy interests	0.0454***
	(4.93)
Difference in EU grants received in euro	−0.125***
	(−5.77)
policydismatch	−4.501***
	(−5.58)
Observations	4424

t statistics in parentheses
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$