

# Supplemental Material: Reciprocity supports cooperation in real-world economic interactions

Taylor Z. Lange<sup>ab\*</sup> taylor.z.lange@maine.edu  
Marco Smolla<sup>cd</sup> marco\_\_smolla@eva.mpg.de  
Timothy M. Waring<sup>ef</sup> timothy.waring@maine.edu

<sup>a</sup> Ecology & Environmental Sciences, University of Maine, Orono, ME 04469, United States

<sup>b</sup> Center for the Advancement of a Steady State Economy, 4601 Fairfax Dr. Arlington VA, 22207,  
United States

<sup>c</sup> Department of Biology, University of Pennsylvania, Philadelphia, PA, 19104, United States

<sup>d</sup> Department of Human Behavior, Ecology and Culture, Max-Planck Institute for Evolutionary  
Anthropology, Am Deutschen Platz 6, Leipzig, Germany

<sup>e</sup> Mitchell Center for Sustainability Solutions University of Maine, Orono, ME 04469, United States

<sup>f</sup> School of Economics, University of Maine, Orono, ME 04469

\*Corresponding Author: taylor.z.lange@maine.edu

Table 1: Reciprocal Edge Classifications and Coefficients of Variation

Club	Orders	Members	Percent of Total Edges				Coefficient of Variation			
			DWR	DBR	IWR	IBR	DWR	DBR	IWR	IBR
1	59	23	0.71	0.12	0.03	0.03	28.77	78.05	120.88	147.78
2	11	10	0.65	0.00	0.06	0.00	73.43		331.66	
3	22	28	0.67	0.08	0.06	0.05	19.21	91.81	87.29	112.77
4	27	18	0.62	0.08	0.07	0.06	68.37	154.02	137.39	172.58
5	69	9	0.57	0.15	0.03	0.06	63.31	147.32	281.49	242.32
6	15	4	0.63	0.14	0.05	0.06	81.21	146.99	273.94	230.75
7	93	8	0.64	0.16	0.02	0.07	79.24	150.72	450.82	271.84
8	64	66	0.54	0.15	0.10	0.04	43.17	109.03	93.08	172.86
9	48	26	0.46	0.12	0.10	0.07	59.34	152.03	132.13	216.36
10	91	122	0.58	0.12	0.10	0.04	13.53	40.11	39.79	86.51
11	67	31	0.58	0.12	0.07	0.04	43.81	91.61	109.77	135.80
12	10	27	0.72	0.11	0.07	0.02	9.65	37.65	28.08	56.07
13	69	51	0.58	0.15	0.07	0.05	27.74	55.13	56.51	96.41
14	80	46	0.55	0.18	0.07	0.05	33.05	75.29	102.94	103.74
15	80	144	0.52	0.10	0.11	0.07	24.58	51.12	52.48	58.61
16	76	78	0.58	0.13	0.09	0.04	22.30	49.65	58.45	92.28
17	30	9	0.55	0.22	0.04	0.04	41.59	59.62	160.40	175.02
18	46	6	0.56	0.06	0.02	0.06	62.84	173.14	368.19	227.58
19	20	3	0.68	0.15	0.00	0.06	83.63	183.90		324.63
20	14	9	0.58	0.20	0.03	0.03	21.63	49.64	136.29	138.62
21	52	66	0.61	0.15	0.07	0.03	12.20	35.95	48.67	63.86
22	95	66	0.66	0.14	0.05	0.01	23.07	51.71	55.79	393.82
23	100	141	0.74	0.08	0.06	0.02	22.59	52.21	72.25	296.70
24	34	45	0.64	0.08	0.09	0.02	6.35	37.19	23.71	75.64
25	30	80	0.64	0.06	0.09	0.02	8.67	37.68	24.51	88.82
26	5	7	0.54	0.04	0.06	0.06	40.61	142.88	100.33	189.81
27	34	7	0.72	0.08	0.01	0.07	52.25	198.15	329.63	245.41
28	17	23	0.61	0.14	0.06	0.07	20.82	54.33	99.73	98.16
29	67	34	0.61	0.19	0.05	0.04	19.04	49.68	77.84	94.82
30	17	4	0.67	0.00	0.00	0.10	55.08			209.44
31	44	7	0.36	0.34	0.05	0.16	112.18	102.91	277.17	158.48
32	37	7	0.60	0.07	0.04	0.03	70.79	168.90	215.30	270.34
33	5	11	0.47	0.00	0.15	0.01	7.86		25.75	124.32
34	6	6	0.61	0.09	0.04	0.00	16.16	89.78	78.31	
35	62	16	0.44	0.03	0.11	0.01	19.25	90.96	61.45	296.87
<b>Totals</b>										
	1596	1238	0.60	0.12	0.06	0.05	39.64	94.04	136.73	171.79

Table 2: Mixed Effects Model

	<i>Dependent variable:</i>	
	All Edges	Out Degree Singular Assistance Edges
	(1)	(2)
Global Mean Intercept	25.936*** (9.869)	4.006*** (1.199)
In Degree	0.882*** (0.009)	0.457*** (0.011)
Random Effects:		
Clubs	35	13
Standard Deviation	36.36	6.71
Observations	1530	1702
REML	21098.26	8248.94
AIC	21106.26	8256.94
<i>Note:</i>		*p<0.1; **p<0.05; ***p<0.01

Table 3: SPR Cluster Centers

Club	Beneficiary	Reciprocator	Helper
1	-0.880	0	0.836
2	-0.742	0	0.783
3	-0.977	0	0.868
4	-1.160	0	0.905
5	-1.033	0	0.706
6	-0.805	0	0.766
7	-0.730	0	0.864
8	-1.033	0	1.037
9	-1.053	0	0.956
10	-1.403	0	0.816
11	-1.059	0	0.948
12	-1.707	0	0.467
13	-1.125	0	0.904
14	-1.062	0	0.873
15	-1.180	0	0.904
16	-1.083	0	0.871
17	-0.888	0	0.878
18	-0.904	0	0.761
19	-0.573	0	0.678
20	-0.970	0	0.707
21	-1.063	0	0.695
22	-0.885	0	0.745
23	-1.527	0	0.537
24	-0.999	0	0.688
25	-1.633	0	0.586
26	-0.981	0	0.798
27	-0.621	0	0.733
28	-0.922	0	0.731
29	-0.952	0	0.864
30	-1.134	0	0.505
31	-0.952	0	0.747
32	-0.920	0	0.709
33	-1.969	0	0.663
34	-0.761	0	0.847
35	-1.527	0	1.007

Table 4: Count of Member Types

Club	Beneficiaries	Reciprocators	Helpers	Unclassified*
1	0	21	2	4
2	2	8	0	2
3	3	22	3	7
4	1	14	3	9
5	1	7	1	1
6	1	3	0	10
7	2	6	0	4
8	7	49	10	11
9	3	19	4	6
10	9	87	26	25
11	3	22	6	6
12	3	19	5	3
13	3	35	13	13
14	5	31	10	10
15	16	97	31	46
16	13	52	13	11
17	1	6	2	3
18	1	4	1	11
19	0	2	1	5
20	1	6	2	1
21	11	43	12	2
22	5	47	14	6
23	10	85	46	41
24	5	27	13	6
25	3	48	29	16
26	1	4	2	3
27	0	4	3	2
28	5	13	5	6
29	3	19	12	5
30	0	2	2	1
31	1	3	3	1
32	1	3	3	3
33	1	4	6	8
34	1	2	3	2
35	2	4	10	2
<b>Totals</b>	124	818	296	292

*Note:*

\* Members who only participate in one order do not have a Markov matrix and thus remain unclassified