ELSEVIER
www.elsevier.com/locate/worlddev

World Development Vol. 66, pp. 645–664, 2015
0305-750X/© 2014 Elsevier Ltd. All rights reserved.

http://dx.doi.org/10.1016/j.worlddev.2014.09.019

Missing Links, Missing Markets: Evidence of the Transformation Process in the Economic Networks of Gambian Villages

DANY JAIMOVICH*
Goethe University Frankfurt, Germany

Summary. — The aim of this paper is to contribute to the empirical analysis of the transformation process in traditional rural societies using a network perspective. A unique database collected in 60 villages in rural Gambia is used to study the ways in which households with links outside the village (a proxy for market connections) behave in the locally available exchange networks for land, labor, inputs, and credit. The econometric results at different levels of disaggregation provide suggestive evidence of substitutability between internal and external economic interactions, particularly in the case of reciprocal exchanges.
© 2014 Elsevier Ltd. All rights reserved.

Key words — social networks, missing markets, gift economy, West Africa, The Gambia

> "The pattern of symmetrical and reciprocal rights is not difficult to understand if we realize that it is first and foremost a pattern of spiritual bonds between things which are to some extent parts of persons, and persons and groups that behave in some measure as if they were things."
>
> [Mauss (1923, "The Gift")]

1. INTRODUCTION

The aim of the present paper is to contribute to the empirical analysis of the process of transformation in traditional rural societies using a network perspective. The behavior of households with economic links outside the village is studied using a unique database of social and economic networks collected in 60 villages in rural Gambia.

The transition from traditional rural economic activities to more complex exchanges that eventually lead to market economies (or to alternative modern economic systems) was a relevant element in the conception of classical economic theory and a key issue for early economic sociologists, as can be seen in the works of Thorsten Veblen, Max Weber and, in particular, Karl Polanyi. In the latter's conception of the *great transformation*, modern societies are shaped through the transition from a network of communitarian reciprocal exchanges to institutionalized market interactions (Polanyi, 1944). The concept of "primitive economies" as reciprocal exchanges is largely based on Malinowski's influential description of the production system of the Trobriand islanders (Malinowski, 1921, 1922), which also provides the foundation for Mauss' analysis of a gift economy. [1]

The transformation process is subsequently formalized by Kranton (1996). In her model, agents can choose either reciprocal gift exchanges with other agents whose preferences, production costs, and other relevant characteristics are known, or market transactions with anonymous agents, using money as a medium of exchange. If the cost of searching for trading partners in the market is higher than the benefit obtained from consumption diversification, then agents will prefer reciprocal exchanges. One of the main results of Kranton (1996) is that reciprocity can be enforced even if markets exist as an alternative for transactions. In particular, she predicts that reciprocal exchanges will be pervasive in settings such as the Gambian villages, where common features of rural societies are predominant, namely high costs to access market exchanges, non-anonymity (therefore high value on the future utility from a relationship), and homogeneous consumption preferences.

The descriptions of ethnographic and anthropological literature and the predictions of models à *la* Kranton (1996) have not been matched with rigorous quantitative evidence about the transformation process. [2] Most of the empirical evidence of behavior under different levels of market exposure has been collected through experimental games across different societies. A robust finding, replicated in experiments played in different groups and contexts, is that communities which are more exposed to markets are *fairer* in transactions with strangers, as measured by the amount of money offered in the *ultimatum game* and the *dictator game* (Henrich *et al.*, 2004, 2010). Indirectly, this result implies that individuals belonging to groups that participate in the market are less likely to get involved in reciprocated transactions.

For the present study I use a different methodological approach, taking advantage of the detailed network information in a dataset from 60 Gambian villages. [3] While most of the households in the data have at least one economic link with their fellow villagers (and in most cases several links),

* I am particularly indebted to Jean-Louis Arcand for inspirational discussions. I thank Jean-Marie Baland, Marc Bellemare, Tessa Bold, Marcel Fafchamps, Simon Heß, Rafael Lalive, Julien Labonne, Matthias Schündeln, Joachim von Braun, the editor of this journal, Arun Agrawal, and three anonymous referees for their thoughtful comments and suggestions. I have also benefited from comments received during my research visit at the CSAE (Oxford) in 2010 and by participants of the NEUDC 2012 conference and the seminars organized by CREI (Barcelona), DIW (Berlin), Goethe University (Frankfurt), Heidelberg University, J-PAL (Santiago), Rigotnomics (Geneva), University of Göttingen, University of Padua, and Universidad de Chile. The data collection was funded as part of the baseline analysis for the World Bank's Community-Driven Development Project for The Gambia. It would have been impossible to gather these data without the collaboration of the inhabitants of the 60 villages we visited and the hard work of Amie Bojang Dibba, Antou Faal, Bakary Baludin, Cheikh Ibrahima Fall DIOP, Lamin Cham, Pa Alieu Fye, Saikou Jawara, Slavica Zec, Yiu Por (Vincent) Chen, Yong HE and people at the Gambia Bureau of Statistics (GBoS) and CDDP-Banjul. Final revision accepted: September 21, 2014.

only a few households have links outside the village. I consider these outside links as proxies for market connections, an assumption supported by observations in the field and by empirical tests provided below.[4] On the other hand, and in line with previous studies described in the next section, the economic links within the village are assumed to represent some kind of "gift" exchange.

Four networks of economic exchange are considered: land, labor, inputs, and credit. While the latter has been studied in great detail in several works describing quasi-credits and risk-sharing arrangements (e.g., Fafchamps, 1999; Platteau and Abraham, 1987), the literature has paid less attention to the other networks. Some exceptions are the work of Krishnan and Sciubba (2009) about labor-sharing arrangements, and particularly Udry and Conley (2004), which is one of the few other contributions where various economic networks are jointly analyzed in rural communities.[5]

Another important assumption behind the study is the idea, first formalized by de Janvry *et al.* (1991), that the problem of missing or failing markets may be better understood as a household-specific instead of a commodity-specific phenomenon. Even if markets exist, transaction costs that exceed the utility gain from the transaction will push a particular household outside the market. In their setting there are general equilibrium effects, in which failures of an important market, such as credit, labor or food, can lead to exclusion from exchanges in other markets. While the predictions of de Janvry *et al.* (1991) are not directly tested, the concept of household-level market exclusion is adopted.[6]

For the empirical analysis, two specific hypotheses derived from previous descriptions of the transformation process will be explored: (i) households with external economic links are less likely to be involved in economic interactions within the village (*substitutability between internal and external exchanges*), and (ii) households with external economic links are less likely to be involved in reciprocated exchanges with fellow villagers (*substitutability between internal reciprocation and external exchanges*). Network-based measures of degree centrality (number of links in each network) and reciprocity are used to quantify economic interactions inside the village. The relationship of these variables with external economic interactions is analyzed in various empirical specifications. Firstly, the predicted probability of external link existence is used to implement a propensity score matching estimator to compare a set of households with similar observed characteristics. The analysis at the household-level is expanded by implementing a specification in the spirit of the recent contributions of Krishnan and Sciubba (2009) and Banerjee, Chandrasekhar, Duflo, & Jackson (2013), where variables gleaned from network measures are included into a linear model. Taking advantage of the network structure of the data, the main hypotheses are further tested at the dyadic (link between households) level, following the specification first proposed by Fafchamps and Gubert (2007).[7] A separate section in the empirical analysis describes the household characteristics related to the existence of external exchanges, providing support to the assumption that these exchanges are likely to be market-like transactions.

In all the econometric specifications I find support for the main hypotheses. External links are negatively related to household degree and link formation, and therefore there is evidence of substitutability between internal exchanges and external links. This effect is observed only within each network and not across networks. In terms of the *substitutability between internal reciprocation and external exchanges* hypothesis, the analysis also provides evidence of less reciprocated exchanges for households with external links, again mainly within each network, but also across networks in some cases. These results are generally robust to the different econometric specifications and alternative methods to control for village- and household-level unobserved heterogeneity, but the effects are not always present for every network. The findings are suggestive in terms of providing empirical evidence for the hypotheses using detailed network data. However, they should not necessarily be interpreted in causal terms given potential endogeneity problems that might remain unsolved with the techniques that the data allow me to use.

The rest of the paper is structured as follows: Section 2 describes the setting and data collection. In Section 3 formal definitions of the network measures are presented. Section 4 introduces the empirical strategy and presents the main empirical results. A final section suggests policy implications of the findings and concludes.

2. CONTEXT AND DATA

(a) *Setting: economic exchanges in rural Gambia*

The setting of the study largely resembles the characteristics of rural West Africa. Gambian villages are mostly engaged in basic subsistence agriculture, combined in some cases with cash crop production, with the use of basic technologies. In our sample, 65% of the respondents mentioned farming as their main activity, but only half of them declare to sell part of their production (this proportion is 41% if the full sample is considered). The main cash crop, groundnuts, is usually sold annually at the end of the rainy season, mainly through intermediaries (Gajigo and Saineb, 2011). Other economic activities mentioned during the survey include fishing, livestock rearing, firewood collection, and petty trade. While many aspects of the life in rural Gambia have remained unchanged for generations, most of the villages are somehow affected by the transition process toward modern economic systems. For instance, the share of rural population in the country has gone from 72% in 1980 to 43% in 2010 (World Bank, 2013). Indeed, in our sample 48% of the households have at least one economic migrant, mainly to the urban areas, and 19% receive remittances which amount to an important part of household's income (this includes 6% receiving remittances from abroad). Another sign of modernization in the villages is the availability of cellphones, since 73% of the respondents use them regularly to communicate with persons outside the village.

In the small villages in which the surveys were conducted kinship relationships are very common and are usually dominated by the lineage of the village founders and the oldest settlers. In our sample, 35% of the respondents declared to be a close relative of the village chief (*Alkalo*). The villages are usually organized into *compounds*, a group of huts surrounded by a grass fence where members of the same family live and organize daily activities together. The majority of labor activities are carried out by compound members organized in one or more *dabadas* or farm production units (Webb, 1989). Most of the time a compound can be identified as a household (this is the case in 84% of our sample), but in some cases there are members identified as independent households inside the compound. Locally, households are called *sinkiros*, and the intra-compound distinction was, in most cases, clear to the *Alkalo* and all other village inhabitants.[8]

While many of the production activities are organized within the compound, there is also an active exchange with other households in the village. The most active period of economic exchanges occurs during the rainy season and the

months immediately before and after it. Even though some exchanges involve a monetary payment, as in the case of petty trade and payments for services such as hut construction or some agricultural tasks, most transactions do not involve any cash payment and are embedded in the traditional social norms and a network of reciprocal exchanges. As described by Shipton (1990) "*in The Gambia, virtually everything is lendable and at times will be lent. This includes nearly all factors of agricultural production land, labor, livestock, seeds, fertilizer, pesticides, and farm tools. Craft tools, vehicles, and household goods are also lent*." This description is very much in line with the situation that we observed during the fieldwork in the 60 villages. During in-depth interviews to interpret the data villagers mentioned several times that the exchanges within the village are governed by two main norms: *Badingya*, "always help your relatives," and *Sinyoyaa*, "neighbors must help each other."

For the present study these exchanges are grouped in four networks—land, labor, inputs (basically tools, seeds and fertilizers), and credit—described in detail below.

Formal land titles are very rare in rural Gambia. Instead, the unwritten rights over land usage are determined by the descendants of the village's founders, generally the *Alkalo* and his direct relatives. In some cases, the *kabilo* (clan) heads, who might not be related to the founder's lineage but represent the descendants of other early settlers, are entitled to permanent usage rights. As noted by Webb (1989), the rights over land are closely related to the old social structure, with the ancient highest castes having the most productive plots. All other villagers must borrow plots on either a seasonal or an annual basis from them, in agreements that can also last for several years (Chavas *et al.*, 2005). While most of the land transactions within the village are based in borrowing arrangements without payment, some rental arrangements and payments in-kind (including sharecropping) occur, usually to individuals outside the village (Freudenberger and Sheehan, 2000).

Labor exchanges between villagers are a usual way to deal with the shortage of family workers, particularly before and during the rainy season. Households invite other villagers or outsiders to help with household tasks in exchange for various kinds of goods, labor, or even a marriage arrangement. Other alternatives available in some villages are the use of *kafos*, an organized workforce of villagers from various households who participate in the provision of public goods but who can also be hired for a fixed wage, and the use of *strange farmers* (Swindell, 1978), individuals from outside the village who provide part-time labor in exchange for the right to use part of the family plot for their own benefit. In the villages surveyed, the hiring of *kafos* was rarely observed (less than 1% of the interviewed households heads declared they borrowed labor from more than five other households) and the use of strange farmers cannot be identified due to data limitations.

The network of inputs is defined in the survey as the exchange of means of production that imply a monetary or opportunity cost for the lender, such as tools, cattle, fertilizer, seeds, and the like. Livestock is usually lent for milk, manure, and transport during long periods, and is sometimes also lent to relatives outside the village, as a means of avoiding the loss of an entire herd in the case of disease or theft (Shipton, 1990). As for other agricultural inputs, the lending can take the form of a bilateral household exchange or a centrally organized process by some of the villager groups. The external links relate to the acquisition and distribution of these inputs from and to other villages, rural markets, or urban centers. For example, one of our respondents declared: "I borrowed a seeder and an animal traction cart from other villagers, but I rented a tractor outside the village". [9]

Credit arrangements generally follow the Islamic precept of not charging any interest rate to the borrower, and are related to risk-sharing activities in support of relatives and friends, enmeshed in the network of mutual obligations created by other types of economic and social exchanges (Shipton, 1990). Therefore, these exchanges must be understood as *quasi-credit*, as defined by Platteau and Abraham (1987) and Fafchamps (1999). Apart from the direct borrowing of money from another household in the village, there is also the possibility of obtaining credit from external sources, both informal, like moneylenders and village savings and credit associations (VISACAs), and formal such as rural development banks and microcredit agencies. Borrowing from these external sources of credit usually involves the payment of an interest rate and sometimes collateral, mostly agricultural tools, is required. During in-depth interviews, respondents declared that in the region of Jarra VISACAs charge a 20% interest rate. [10]

(b) *Data collection strategy*

The data were collected by the author, other researchers, and local collaborators in the context of the baseline survey for the impact evaluation at national level of a Community-Driven Development Program, conducted between February and May of 2009. [11] 60 Gambian villages with populations between 300 and 1,000 inhabitants, mainly in rural areas (just four villages are in semi-urban areas), were randomly selected using area sampling at the ward level, a smaller geographical division that tends to be homogeneous in geographical but heterogeneous in socio-cultural terms.

The methodology adopted for the present study differs from that of traditional household surveys in which a random sample of households is collected in each village. Structured group interviews geared to collect quantitative information were implemented instead. [12] Therefore, village censuses were carried out through gatherings co-organized with the *Alkalo* and district-level officers. In such village meetings it was possible to obtain relatively coarse quantitative information—with a particular focus on socio-economic interactions—for almost all households in each village (the median village-level coverage rate is 94%). [13] As a complement to the main survey, during the data collection in some villages focus group discussions were conducted for three sets of villagers, men, women, and youths, with the goal to better understand the structure of each community. Additionally, as part of ongoing work in The Gambia 17 in-depth interviews were conducted in March 2014 with questions related to the interpretation of the economic links for this paper.

This type of group survey has the advantage of minimizing recall bias, since other members of the group will help to answer the questions. A potential problem is, therefore, that the measurement error could be correlated with the composition of the group. This is likely not to be the case in our data for two reasons. Firstly, the groups were randomly formed by the enumerators based on the village taxation list. Secondly, while a typical group in this survey was formed by five to eight persons, many persons from the community were present in the village gatherings where these open surveys were conducted, and it was common that persons outside the group contributed to clarify data that were incomplete or doubtful. Another concern with these open surveys is that individuals may not be willing to reveal some information in front of the community. This is improbable in the setting in which

we conducted the survey, where at least the information related to our main questions (links in the economic networks) was usually observable for community members and therefore common knowledge and not sensitive information, as we could confirm during the pilots and the data collection.[14] Even though information about economic interactions was likely to be revealed in front of the community, it is possible that other kind of information, in particular about income, was more sensitive. Fortunately, from the village taxation list we were able to obtain objective measures of wealth. Moreover, any particular community characteristic which may be correlated with measurement error in the data is not a problem because in all empirical specifications village fixed effects are included. In terms of household characteristics related to the measurement error, in all specifications a rich set of household-level controls are included and household fixed effects are included whenever feasible.

The survey, which was answered by the head of the household,[15] has two sections: a standard (and very lean) household questionnaire designed to collect a vector of household characteristics and a set of questions specifically designed to understand the economic networks in the village. For the latter, the respondents were asked to name villagers with whom they and other members of their households had exchanges, during the past year (from the end of the 2008 dry season to the end of 2009 dry season), in terms of (i) land, (ii) labor, (iii) inputs, and (iv) credit. We also collected information about networks created by kinship and marriages and, importantly for the purpose of the present study, about connections outside of the village in each of these networks.

More details related to the data collection methodology, as well as an extensive analysis of the data can be found in Arcand *et al.* (2010) and Jaimovich (2011).[16]

(c) *Data description*

We finally interviewed 2,886 persons, but the sample is reduced to 2,792 when incomplete data are removed. In Table 1 the main variables of the household questionnaire are summarized. Average household size is 12.7 members, but some households have even more than 50 members (approximately 1% of the sample) a fact explained by the polygamous nature of Gambian rural society, with 45% of household heads declaring to have more than one wife. Population density within the village is high, with an average of 6,900 inhabitants per square kilometer. In contrast, agricultural land was usually very abundant. The average amount of agricultural land per active worker was around two hectares, when land usage rights for the year of the survey were considered, with a great deal of variation given a standard deviation of 7.4 hectares. As is to be expected in West Africa, a very small number of household heads are females (7%), generally represented by widows and mainly concentrated in the semi-urban areas on the outskirts of Banjul (the national capital). These villages also accounted for the few non-Muslims in the sample (4%).

The sample is representative of the ethnic diversity in The Gambia. 41% of the respondents are Mandinka, 26% Fula, 8% Wollof, 7% Jola and 4% Serer, with the rest either belonging to local ethnic minorities or being non-Gambian (these represent 4% of the sample).[17] Twenty one percent of the respondents come from a minority ethnic group in their village, including 16% belonging to groups that represent less than 30% of the total village population.

The economic conditions in the villages in the sample correspond, by and large, to those of traditional rural societies. According to the information from the 2003 Census for The Gambia, only 3% of the households in the sample villages have access to electricity, 88% of households have no access to an improved source of water, while 38% lack access to a private toilet. In our data, 84% of the respondents declared having no formal education, although a substantial fraction of the villagers received some kind of Koranic education and usually master basic Arabic language skills. The average (self-declared) annual income per capita is 3,514 Gambian Dalasis, which corresponds to approximately $380 (in constant 2005 and PPP adjusted dollars from World Development Indicators). The distribution of income is, moreover, not necessarily egalitarian in all villages. Though the average Gini coefficient is 0.34, it reaches 0.5 in some villages. The higher level of inequality reported in some villages seems to be driven by remittances and off-farm jobs.

Another distinctive aspect of our data is that we collected detailed information about traditional roles in the village. The variables capturing those roles are described in the lower panel of Table 1. The *Alkalo* is usually the oldest male descendant of the village founders and is usually both the most respected figure and the one who takes the main decisions at the village level, usually in consultation with the Council of Elders and his assistants. The Village Development Council (VDC), which is the most decentralized part of the Gambian national system of development coordination, links a village with officers at the ward and LGA levels. The VDC is formed by representatives from each *kabilo*, each CBO and other co-opted members. Religious leaders are also an important part

Table 1. *Household descriptive statistics*

Variable	Mean	Std. Dev.	Min	Max
Household characteristics				
Household size	12.67	11.40	1	400
Age of household head	51.70	15.54	15	100
Female household head	0.06	0.25	0	1
Formal education	0.16	0.37	0	1
Compound head	0.84	0.37	0	1
Polygamous	0.46	0.50	0	1
Monogamous	0.48	0.50	0	1
Relatives in the village (%)	0.09	0.09	0	0.73
Non Muslim	0.04	0.19	0	1
Ethnic minority (<30%)	0.16	0.37	0	1
Ethnic minority (between 30% and 50%)	0.05	0.21	0	1
Alkalo's non-relative	0.65	0.49	0	1
Workers in the household	1.27	0.66	0	6
Agricultural land (hectares)	8.06	21.22	0	400
Land per worker (hectares)	2.27	7.40	0	133
Income per capita (GMD)	3,514	4,735	43	125,000
Agricultural income (% of total)	0.12	0.24	0	1
Emigrants	0.48	0.50	0	1
Cash crops sellers	0.41	0.49	0	1
Remittances receivers	0.19	0.39	0	1
Village role				
Alkalo	0.02	0.14	0	1
Alkalo's assistant	0.04	0.20	0	1
VDC member	0.19	0.39	0	1
Elders council member	0.19	0.39	0	1
Traditional healer	0.20	0.40	0	1
Griot (storyteller)	0.01	0.12	0	1
Imam	0.02	0.14	0	1
Marabout	0.02	0.14	0	1

Note: Household-level descriptive statistics. 2,792 observations for each variable.

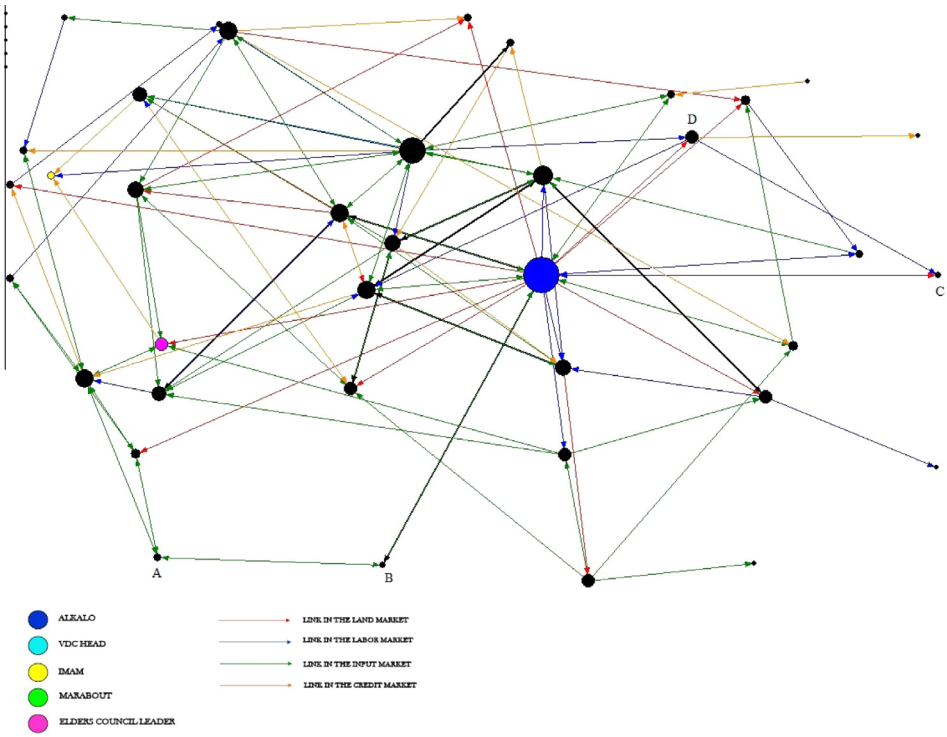


Figure 1. *Graphical representation of the network of economic exchanges in one of the villages of the study. Each node represents a household and the arrows represent a link in each of the four networks considered: land, labor, inputs, and credit. The size of the nodes is proportional to the number of links incident upon it (degree centrality). The colors of the nodes represent traditional positions in the village and the color of the arrows identify the network in which a link was created.*

of the village society. While all villages have at least one Imam who leads prayers, only half have a *Marabout*, a respected Koranic teacher who is sometimes imbued with mystical powers and maintains some syncretic pre-Islamic traditions such as making amulets for good luck. Also it was asked whether respondents had treated other villagers using traditional medicine methods, since the *traditional healer* is a very respected person, as well as the *Griot*, the traditional musician and story-teller.

The most important feature of our data is the detailed information about the networks of economic exchanges. Figure 1 presents a graphical representation of these data for one of the sample villages. It is possible to see that the whole village is linked with economic interactions, with the exception of five households that are in autarky (the five isolated nodes in the upper left corner). The existence of numerous links within the village is further confirmed in the descriptive statistics displayed in Table 2, where data for all villages are considered.

Table 2. *Network descriptive statistics*

Networks	Internal links		Reciprocity (%)		External links (%)		Internal autarky (%)		
	Borrower $d_i^{in}(m)$	Lender $d_i^{out}(m)$	Borrower $Recip_i^{in}(m)$	Lender $Recip_i^{out}(m)$	In $Ext_i^{in}(m)$	Out $Ext_i^{out}(m)$	$Ext_i(m)=0$	$Ext_i^{in}(m)=1$	$Ext_i^{out}(m)=1$
LAND	0.485	0.488	0.205	0.218	0.082	0.055	0.452	0.711	0.465
	(0.754)	(1.627)	(0.380)	(0.361)	(0.274)	(0.228)	(0.497)	(0.454)	(0.501)
LABOR	0.608	0.611	0.348	0.359	–	0.033	0.478	–	0.416
	(1.314)	(0.948)	(0.424)	(0.434)	–	(0.180)	(0.499)	–	(0.494)
INPUT	0.925	0.924	0.499	0.530	0.078	0.031	0.481	0.400	0.416
	(1.290)	(1.484)	(0.462)	(0.451)	(0.268)	(0.174)	(0.499)	(0.490)	(0.495)
CREDIT	0.446	0.437	0.214	0.241	0.122	0.048	0.475	0.471	0.440
	(0.773)	(1.262)	(0.373)	(0.385)	(0.327)	(0.214)	(0.499)	(0.499)	(0.498)
ECONOMIC	–	–	0.316	0.352	0.239	0.171	0.150	0.125	0.070
NETWORKS			(0.371)	(0.384)	(0.427)	(0.376)	(0.357)	(0.331)	(0.254)
MARRIAGE	0.992	1.022	–	–	0.738	0.600			
	(2.951)	(2.631)			(0.440)	(0.490)			

Note: 2,792 observations at the household-level. Sample mean value for each variable, with standard deviation in parenthesis. The first panel describes *in-* and *out-degree* of households in each network; the second panel shows the percentage of reciprocated links over total links of the household; third panel describe percentage of households with external links and the last panel the percentage of households without links in each network (internal autarky). The formal definitions of these network measures are presented in Section 3.

These data support the idea that most of the economic interactions take place within the village instead of outside it. When the four economic networks are taken together (fifth row of Table 2), it can be seen that 76% of the households do not have any links that enable them to bring something from outside the village and 83% do not have links that enable them to send something outside the village (columns 3 and 4 respectively). On the other hand, only less than 15% of the households declare having no links in these networks with fellow villagers (*internal autarky*).

While this database is unique in many aspects, there are limitations that constrain the possibilities of the empirical analysis. In the first place, the data are available only for one period, therefore only a cross-sectional analysis is possible. In particular, dynamic features in household's behavior can not be captured, limiting the observed economic interaction inside and outside the village to those that have taken place in the year before the survey. Another issue with the data is that the relevant unit for economic exchanges is the household, therefore the complexities of intra-households allocation of resources are not captured and the external exchanges of other members apart from the household head can be misrepresented.

3. DEFINITIONS: NETWORK MEASURES

(a) *Internal exchanges*

Each household will be considered as a node i in one of the economic exchange networks m (*LAND*, *LABOR*, *INPUT*, and *CREDIT*). The internal exchanges consist of a set of nodes in each village v belonging to $n_v = 1, \ldots, N_v$ where n_v is the number of households inside each village. The existence of a link between households i and j in the network m will be measured as a binary variable:

$\ell_{ij}(m) = 1$ if a link is reported in the data, $\ell_{ij}(m) = 0$ otherwise. [18]

Given the directed nature of the data, $\ell_{ij}(m)$ is a link from i to j, which implies that the former *lends m* to the latter. If the opposite is true (i borrows from j), then the link will denoted as $\ell_{ji}(m)$. Following this definition, it is possible to see that in the network shown in Figure 1, household *D* is *lending labor* to household *C*.

While the data do not provide information in terms of the specific type of exchange that a link implies, I will assume that a link in the network of internal economic exchanges constitutes some kind of *gift exchange*. This assumption is largely supported by the description of the economic activities presented in Section 2, as well as the anecdotal observations during the fieldwork.

A basic metric of the level of internal exchanges of a node i in a network m is its *degree centrality*, $d_i(m)$, measured as the number of links involving this particular node. In the data it is possible to make a distinction in terms of the directionality of the link. If the link goes from i to j, then it will be counted in the measure of the *out-degree*: $d_i^{out}(m) = \sum_j \ell_{ij}(m)$, which is related in the economic networks to the position as a lender. When the link goes in the other direction, from j to i, it will be counted as part of the *in-degree* of i : $d_i^{in}(m) = \sum_j \ell_{ji}(m)$, which is therefore a characteristic of i as borrower.

The first panel of Table 2 presents descriptive statistics for the average *degree* of the households in the sample, both as borrowers and as lenders. The average degree for the economic networks is always below 1, indicating that for many households $d_i(m) = 0$ (*internal autarky*). This fact is captured in the fourth panel of Table 2, which indicates that between 40% and 50% of the households do not have any links for each specific network. Households have on average a higher degree in *INPUT* and a lower degree *CREDIT* than in the other economic networks, but these differences are not statistically significant given the large variation in the distribution of degrees.

(b) *Reciprocity*

One of the main characteristics of traditional rural economies, as described by Malinowski (1921) and Mauss (1923), is the reciprocity of exchanges. Reciprocity can be defined in various ways, but basically is linked to the concept of non-pecuniary transactions in which the provision of a good or service is expected to be rewarded in the future. This reciprocity can be expected in the long term, particularly in villages such as those in the present study, where social relations are long-lasting. This is a limitation for the cross-sectional data used in the empirical analysis, but at least it is possible to observe whether an economic exchange was reciprocated within the year before the survey was conducted.

I will limit myself to the description of reciprocity within the economic networks for which detailed information is available. Given that the data about links are directed, it is possible to observe whether any specific link has a counterpart in the opposite direction. If a link is bidirectional, meaning that the lender was also a borrower in a transaction with a given household, this link will be considered as *reciprocated*. In particular, reciprocity in the network m is defined as: $Recip_{ij}(m) = 1 \Longleftrightarrow \ell_{ij}(m) = 1$ and $\ell_{ji} = 1$, where ℓ_{ji} is a link between i and j in any of networks. Therefore, reciprocation can exist within the same network or with another network. For example, in Figure 1 households *A* and *B* have a reciprocal link to exchange inputs, while households *C* and the *Alkalo* have a reciprocated link in which the former lends labor and the latter land.

As in the case of household degree, the reciprocal relation is directional. For each household *i, reciprocal out-degree* is defined as $Recip_i^{out}(m) = \sum_j \ell_{ij}(m)\ell_{ji}$. Similarly, *reciprocal in-degree* is defined as $Recip_i^{in}(m) = \sum_j \ell_{ji}(m)\ell_{ij}$.

The second panel of Table 2 shows a general description of the reciprocal degree of households in the sample, taken as a percentage of household's degree in each network. It is possible to see that many of the internal exchanges were reciprocated within the year of the study. *INPUT* is the network with highest reciprocation, with an average of close to half of the links, followed by *LABOR*, where nearly 35% of the links are reciprocated. In the case of *LAND* and *CREDIT*, on average approximately 20% of the links are reciprocated. Given the unknown nature of the economic exchanges, it is to be expected that these reciprocated links are more likely to represent gift exchanges and therefore be more affected by links outside the village. This assumption is further explored in the empirical analyses below.

(c) *External connections*

The existence of an external link in each economic network m is reported in the data, but not the identity and location of the specific agent with whom villagers have it. Neither the intensity of the link nor the existence of more than one external link in each network is reported. Given these limitations of data, the external link will be taken as a binary variable $Ext_i(m) = 1$ if an external link is reported and zero otherwise. A distinction will be made in terms of external links created to

bring something to the village ($Ext_i^{in}(m)$) or to take something out something from the village $\left(Ext_i^{out}(m)\right)$.

Even though the specific characteristics of the external connection cannot be identified in the data, I will consider the external links as a proxy for a link to a market outside the village. The idea is that economic exchanges outside the village are more likely to be established between anonymous agents, with the purpose of expanding the available set of production inputs or diversifying consumption, and, even if no money is used as a medium of exchange, involving relative prices agreed by the agents. This assumption is supported by the evidence presented below since household-level variables such as number of emigrants, remittance reception, and marriages with outsiders are uncorrelated with the probability of having an external link. On the other hand, households involved in the production of cash crops are more likely to have external connections. Interviews in the field as well as reports provided by the local enumerators also confirm that this assumption is likely to be true.

In the third panel of Table 2, $Ext_i(m)$ is summarized. The description is consistent with the idea that only few economic transactions occur outside the village. Only 24% of the households have an *external-in* link and 17% an *external-out* in any of the four economic networks (fifth row of Table 2). In the case of *LAND*, 5% of the households give out plots to outsiders, while 8% get land from other villages. For *LABOR*, the database only has information about the households with members working outside the village.[19] Just 3% of the households work outside the village. For the links in the *INPUT* network, 8% of the respondents declared getting input from outsiders, just 3% to give out. A similar disproportion is observed for *CREDIT*, where 12% obtained money from outside the village and just 5% acted as money lenders.

4. EMPIRICAL ANALYSIS

The main goal of the empirical analysis is to test the transformation process of rural economies that are exposed to the possibility of more complex types of exchanges outside the village. Using the detailed database about networks of economic exchanges described above, two hypotheses of the transformation process will be tested: (*H1*) Households with external economic links are less likely to be involved in economic interactions within the village (substitutability between internal and external exchanges); and (*H2*) Households with external economic links are less likely to be involved in reciprocated exchanges with fellow villagers (*reciprocation versus market* hypothesis).

In this section I will first present evidence regarding the two aforementioned hypotheses with analysis at both household- and link-levels. Afterward, the household characteristics correlated with the existence of a link to economic exchanges outside the village are described, providing evidence in favor of the assumption that these links are a good proxy for market-like exchanges.

(a) *Household-level analysis: substitutability between internal and external exchanges*

A direct implication of *H1* is that households with economic links outside the village should have a lower degree ($d_i(m)$) in the networks of internal economic exchanges. Figure 2 shows the differences in the mean degree in all economic networks and in each network individually (for both $d_i^{in}(m)$ and $d_i^{out}(m)$) for households with and without external links. When the simple differences are considered, it can be seen that in many cases this difference is negative and statistically significant for external links to bring something to the village $\left(Ext_i^{in}(m)\right)$. For links to take something out of the village $\left(Ext_i^{out}(m)\right)$, no clear trend is observed, and indeed in most of the cases the difference is positive and different from zero at 95% confidence level, which could be taken as evidence against *H1*.

The simple mean comparison is not informative given the set of households with and without external links are unlikely to be directly comparable due to differences in their characteristics. As a first approach to address this concern, I create a balanced comparison group using propensity scores to match households with similar probability of having an external link. In order to do this, I use the predicted values from the estimation of the probability to have an external link where the household characteristics described in Table 1 are used as the explanatory variables (similar to the model of Eqn. (4) presented below). For each household i with $Ext_i = 1$ a comparison group is estimated using households without external links which have a close propensity score. This is implemented only in the subgroup of observations that are in the common support of the propensity scores.[20] When the matched comparison group is considered, the results in Figure 2 show that all the differences are negative in the case of $Ext_i^{in}(m)$, again statistically different from zero in most of the cases. As for $Ext_i^{out}(m)$, all the differences are reduced, and now all those different from zero are actually negative, while no positive and significant differences remain. Therefore, the results of the comparison with the matched group must be taken as preliminary evidence in favor of *H1*.

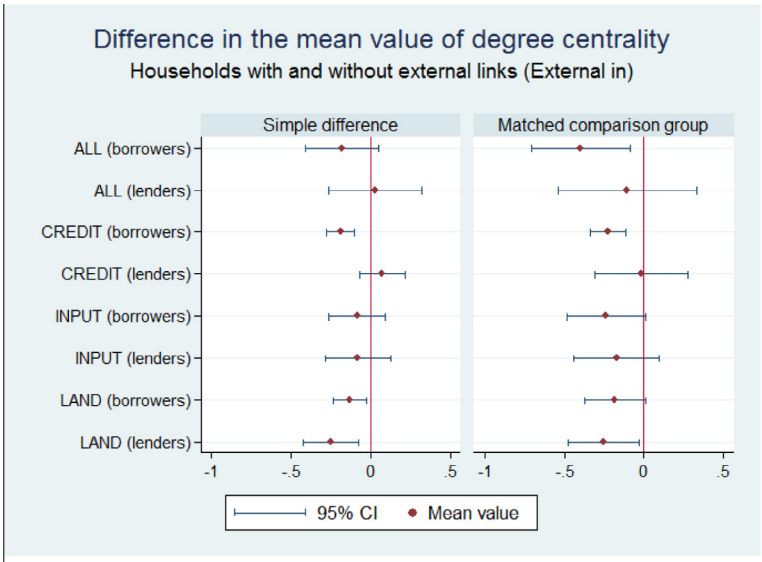
To further analyze *H1* at the household-level, I will follow Banerjee *et al.* (2013), in their reduced-form specification, by using measures of network centrality in a linear specification of the following form:[21]

$$\frac{d_{iv}(m)}{n_v - 1} = \alpha_v^m + X_{iv}\beta_x^m + Ext_{iv}(m)\beta_{ext}^m + e_{iv}, \tag{1}$$

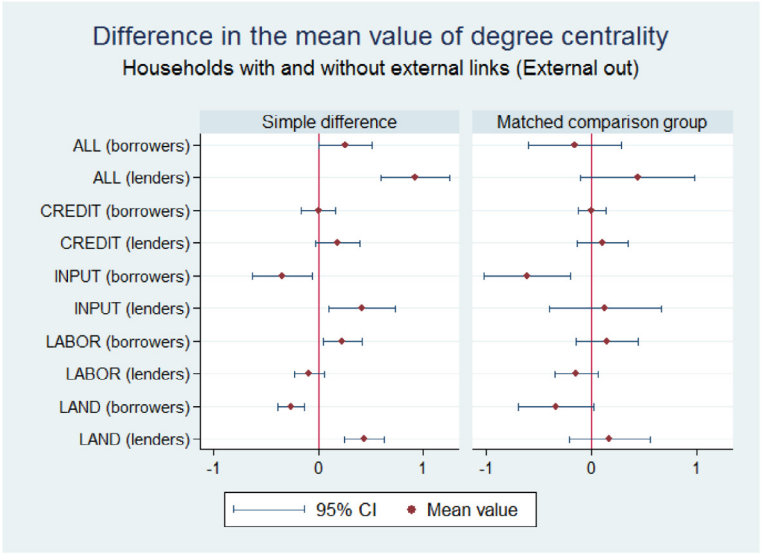
where the dependent variable, household's degree, is expressed in terms of the total possible links that a household can have in each village v.[22] The vector of coefficients of interest is β_{ext}^m, associated with the dummies capturing the existence of an external link in each network m ($Ext_{iv}(m)$). In particular, if there is substitutability between $d_{iv}(m)$ and $Ext_{iv}(m)$, it is expected that $\beta_{ext}^m < 0$. Village-level fixed effects (α_v) are included, as well as X_{iv}, the vector of household-level characteristics already described above. e_{iv} is the disturbance term.

The β_{ext}^m coefficients from the OLS estimation of Eqn. (1) are displayed in Table 3.[23] In the upper panel, $Ext_i^{in}(m)$ and $Ext_i^{out}(m)$ are defined as variables taking the value one if there is an external link in any network, while in the lower panel the external links are defined separately for each network m. The results in Table 3 are in line with those obtained from the comparison of matched samples in Figure 2: external links tend to be negatively related to household's internal degree, a correlation which is particularly strong in the case of $Ext_i^{in}(m)$. β_{ext} are negative mostly within each network m, but unrelated in the rest of the networks. Given the mean values of $\frac{d_{iv}(m)}{n-1}$ (last row of Table 3), the existence of external links is associated to a reduction on internal degree which ranges between 4% and 50%.[24]

Even though in the estimation of the parameters of Eqn. (1) a series of household-level controls are included, it is still possible that unobserved characteristics are related to the existence of links in both internal and external networks, and therefore the estimates would be biased given this potential endogeneity problem. In order to be conservative, the magnitudes of β_{ext}^m must be taken as the conditional correlation



(a) External-in



(b) External-out

Figure 2. *Internal degree for households with and without external links. The matched comparison group is estimated using k-nearest-neighbor matching estimator, with k = 3. In this case, only observations on the common support of the propensity score are considered and the standard errors of the estimated comparison group are bootstrapped. The details of the data used to create this figure can be found in the working paper version of this article (Jaimovich, 2013).*

between internal degree and external connections. Nevertheless, if the unobserved variables affect degree and external links in the same direction, then the bias in the estimates will be upward and the sign of the coefficients in Table 3 is correct, with magnitudes that are upper bounds of its true value (in Appendix Section A this argument is formally explained). This would be the case if the unobserved variables are related to characteristics such as entrepreneurial ability, empathy, or assiduousness. A better way to deal with the problem of unobserved heterogeneity at household level is presented below, since in the estimations using link-level data it is possible to include household fixed effects.

(b) *Household-level analysis: reciprocation versus market*

In the case of *H2* the prediction is that households with external links will have a lower *reciprocal degree*. In Figure 3 the differences in *reciprocal out-degree* ($Recip_i^{out}(m)$) and *reciprocal in-degree* ($Recip_i^{in}(m)$) are compared between households with and without external links, in both the original and the matched comparison group. Similarly as in the case of total degree, it is again possible to see that differences are negative and significant when reciprocation within each network is analyzed for Ext_i^{in}. In the case of Ext_i^{out}, when the matched comparison group is considered the differences are again reduced, but none of them are statistically different from zero.

In the same fashion as in Eqn. (1), the relationship of reciprocation and external connections (*H2*) is tested using the following specification:

$$\frac{Recip_{iv}(m)}{d_{iv}(m)} = \alpha_v^m + X_{iv}\beta_x^m + Ext_{iv}(m)\beta_{ext2}^m + u_{iv}, \quad (2)$$

Table 3. *Household degree centrality: external link*

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	LAND		*LABOR*		*INPUT*		*CREDIT*	
	$d_i^{out}(m)$	$d_i^{in}(m)$	$d_i^{out}(m)$	$d_i^{in}(m)$	$d_i^{out}(m)$	$d_i^{in}(m)$	$d_i^{out}(m)$	$d_i^{in}(m)$
External links in all network								
$Ext_i^{in}(m)$	0.001	−0.000	0.000	−0.001	−0.004**	−0.003**	0.001	−0.002*
	(0.002)	(0.001)	(0.001)	(0.001)	(0.002)	(0.002)	(0.001)	(0.001)
$Ext_i^{out}(m)$	0.004*	−0.003*	0.000	0.002	0.003	−0.001	−0.000	−0.001
	(0.002)	(0.001)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.001)
R^2	0.149	0.084	0.051	0.092	0.136	0.050	0.125	0.057
External link by network								
$Ext_i^{in}(LAND)$	−0.004**	−0.006***	0.002	−0.001	0.002	−0.004**	0.003	0.001
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.003)	(0.001)
$Ext_i^{out}(LAND)$	0.001	−0.007***	0.003	−0.001	0.003	0.001	−0.001	−0.003*
	(0.004)	(0.002)	(0.003)	(0.003)	(0.005)	(0.003)	(0.003)	(0.002)
$Ext_i^{out}(LABOR)$	0.008	0.001	−0.006**	0.001	0.005	0.002	0.000	−0.001
	(0.005)	(0.002)	(0.002)	(0.002)	(0.003)	(0.003)	(0.002)	(0.001)
$Ext_i^{in}(INPUT)$	0.008	0.000	−0.000	−0.000	−0.006***	−0.006**	−0.001	0.001
	(0.005)	(0.002)	(0.002)	(0.002)	(0.002)	(0.003)	(0.002)	(0.001)
$Ext_i^{out}(INPUT)$	−0.007	−0.001	0.002	−0.006*	0.006*	-0.011***	0.003	−0.000
	(0.005)	(0.002)	(0.002)	(0.003)	(0.003)	(0.003)	(0.003)	(0.002)
$Ext_i^{in}(CREDIT)$	0.003	0.001	0.001	−0.001	−0.002	0.001	0.000	−0.004***
	(0.002)	(0.001)	(0.001)	(0.002)	(0.002)	(0.002)	(0.002)	(0.001)
$Ext_i^{out}(CREDIT)$	0.010	−0.002	0.004	0.005	0.002	−0.001	−0.001	−0.000
	(0.007)	(0.002)	(0.003)	(0.005)	(0.003)	(0.002)	(0.002)	(0.001)
Observations	2,792	2,792	2,792	2,792	2,792	2,792	2,792	2,792
R^2	0.160	0.094	0.059	0.094	0.138	0.058	0.127	0.063
Mean dependent variable	0.012	0.011	0.013	0.014	0.022	0.022	0.009	0.009

Note: Standard errors, clustered at village level, in parentheses.
OLS estimation of Eqn. (1). Village fixed-effects and the variables summarized in Table 1 are included in the estimation but not reported.
*$p < 0.1$.
**$p < 0.05$.
***$p < 0.01$.

where the dependent variable is the proportion of reciprocated links over the total links of household i in network m.

The results of the OLS estimation of Eqn. (2), only for β_{ext2}^m, are reported in Table 4. Apart from the estimation of $Recip_i^{out}(m)$ and $Recip_i^{in}(m)$, the proportion of total reciprocated links over total degree, $Recip_i$, is also reported in the third column of each network. The results are in line with *H2*. Most of the statistically significant coefficients are negative, and this is mostly the case when external links exist within each particular network. Additionally, in the lower panel of Table 4 it can be seen that there are some cross-network effects of external links, given that some of the coefficients for networks different than the one considered in the dependent variable are statistically significant, always with a negative sign (except for $Ext_{iv}^{out}(CREDIT)$ in *LAND*).[25]

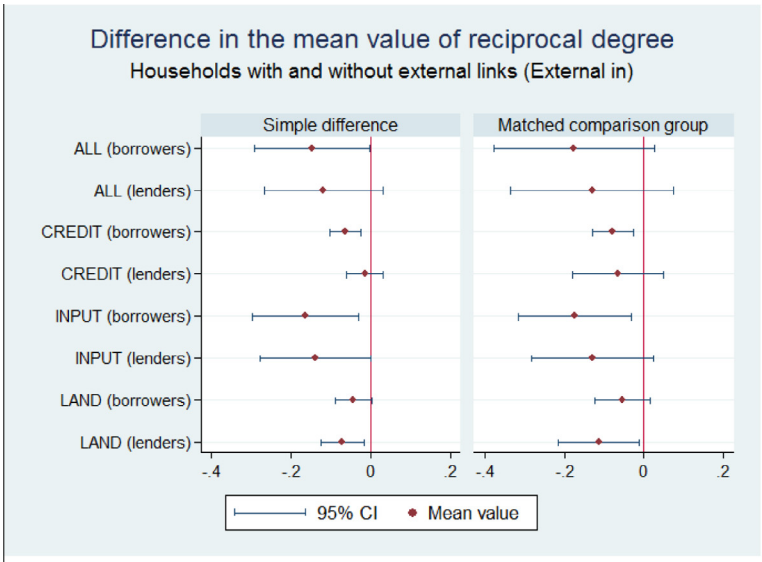
The same concerns as before, with regard to a bias in the OLS estimations given unobserved heterogeneity, are valid in the case of the coefficients displayed in Table 4. The next subsection presents an alternative to deal with this issue.

(c) *Dyadic regressions*

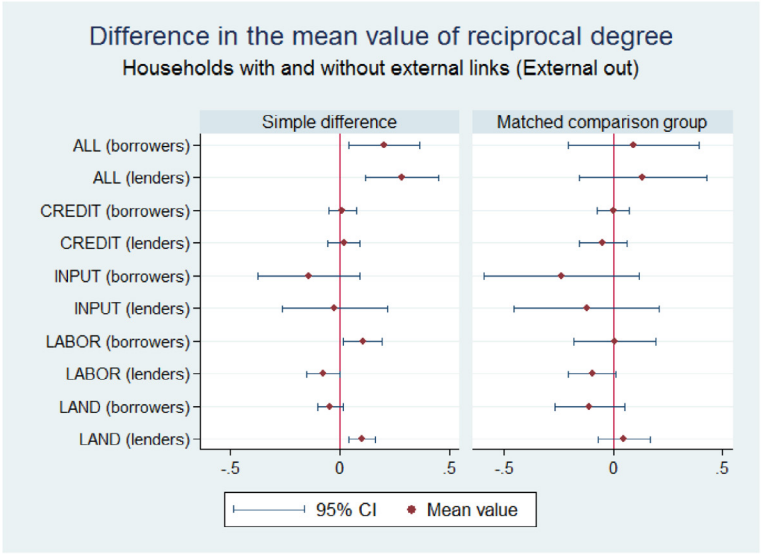
So far, network-based variables have been aggregated at the household level, therefore missing part of the richness of these detailed data. When data are taken at the dyad-level, there are 2,828 links for *LAND*, 3,546 for *LABOR*, 5,401 for *INPUT*, and 2,598 in the case of *CREDIT*. Table 5 presents a detailed summary of all the links registered in the four economic networks, with information disaggregated according to: whether the household that formed the link has external links or not; whether each link was formed to borrow out or lend in within the village economic networks; and whether the link was reciprocated with economic exchanges which took place during the year previous to the interview. Around 65% of the links are formed by households that do not have any external link ($Ext_i(m) = 0$). These households also have more reciprocated links, since they reciprocate around half of the links while those with external links only reciprocate between 41% and 43% (first and second row). The only exceptions are households that are external lenders and internal borrowers, which display even more reciprocity than those only exchanging internally (53.5%).

LAND and *CREDIT* links are reciprocated in less than 30% of the cases on average, while *LABOR* and *INPUT* links are reciprocated in around half of the cases. The latter networks are actively reciprocated within the same network, among them and also with *LAND* and *CREDIT*. In terms of the differences between links created by households with and without external links, the previous evidence is confirmed in various combinations: links created by the former group are, in general, reciprocated less. This is particularly the case when the external link is created to bring something to the village, and the effects are more pronounced for the *LABOR* and *INPUT* networks.

Even though the descriptive statistics of Table 5 provide support for the main hypotheses, dyadic-level characteristics must be controlled for in order to provide a meaningful comparison between those with and without external links. In



(a) External-in



(b) External-out

Figure 3. *Reciprocated links for households with and without external links. The matched comparison group is estimated using k-nearest-neighbor matching estimator, with k = 3. In this case, only observations on the common support of the propensity score are considered and the standard errors of the estimated comparison group are bootstrapped. The details of the data used to create this figure can be found in the working paper version of this article (Jaimovich, 2013).*

order to do this, the formation of a link $\ell_{ij}(m)$ with a fellow villager is estimated using the following dyadic model:

$$\ell_{ijv}(m) = \alpha_i + w_{ijv}\beta_{dyad} + Ext_{ijv}\beta_{extdyad} + (X_{iv} + X_{jv})\beta_{sum} + |X_{iv} - X_{jv}|\beta_{dif} + \mu_{ijv} \quad (3)$$

where the dependent variable is the undirected binary measure of a link between i and j (therefore in this case $\ell_{ijv}(m) = \ell_{jiv}(m)$).[26] To preserve symmetry on the right-hand-side, I follow Fafchamps and Gubert (2007) by specifying: β_{dif} as the coefficient associated with the absolute value of the difference in attributes between i and j and β_{sum} to the sum of their attributes (for variables like household size, head's age, income, etc.), and β_{dyad} as the parameter associated with the variable w_{ijv} that corresponds to common characteristics of i and j (like kinship and ethnic group). The dyadic framework is also helpful for dealing with the problem of potential bias in the estimation given omitted observed and unobserved household characteristics. Since every household i can have links with many fellow villagers j, it is possible to include household fixed effects. For this reason, Eqn. (3) is estimated using a linear probability model (LPM) with household-level fixed effects. While LPM has the well-known problem of predicted values which can be outside the [0,1] interval, it also has several advantages over logit or probit models which are relevant for the estimation of Eqn. (3), namely the possibility to include fixed effects, as well as the use of the full sample (therefore facilitating the comparability of the results)

Table 4. *Household-level reciprocated links over total*

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
	LAND			*LABOR*			*INPUT*			*CREDIT*		
	$Recip_i^{out}$	$Recip_i^{in}$	$Recip_i$	$Recip_i^{out}$	$Recip_i^{in}$	$Recip_i$	$Recip_i^{out}$	$Recip_i^{in}$	$Recip_i$	$Recip_i^{out}$	$Recip_i^{in}$	$Recip_i$
External links in all network												
$Ext_i^{in}(m)$	−0.160***	−0.066	−0.077**				0.022	−0.018	0.009	−0.059	−0.112***	−0.094***
	(0.046)	(0.057)	(0.033)				(0.042)	(0.049)	(0.039)	(0.043)	(0.035)	(0.030)
$Ext_i^{out}(m)$	0.085	0.052	0.048	−0.104	−0.121	−0.113*	−0.132**	0.095	−0.006	−0.092	0.012	−0.020
	(0.074)	(0.081)	(0.056)	(0.075)	(0.079)	(0.057)	(0.063)	(0.068)	(0.049)	(0.058)	(0.064)	(0.045)
R^2	0.046	0.050	0.022	0.045	0.041	0.028	0.050	0.044	0.071	0.046	0.055	0.036
External links by network												
$Ext_i^{in}(LAND)$	−0.143***	−0.071	−0.080**	−0.093	0.079	−0.038	−0.161***	0.081	−0.023	−0.016	−0.028	−0.027
	(0.041)	(0.061)	(0.035)	(0.061)	(0.069)	(0.052)	(0.051)	(0.054)	(0.041)	(0.073)	(0.063)	(0.046)
$Ext_i^{out}(LAND)$	0.089	0.034	0.045	−0.013	0.049	0.014	0.030	0.080*	0.046	0.064	0.005	0.040
	(0.074)	(0.081)	(0.056)	(0.053)	(0.071)	(0.048)	(0.049)	(0.047)	(0.038)	(0.072)	(0.099)	(0.066)
$Ext_i^{out}(LABOR)$	−0.070	−0.075	−0.011	−0.072	−0.134*	−0.106*	−0.007	0.006	−0.026	−0.114	−0.133*	−0.118**
	(0.076)	(0.067)	(0.051)	(0.080)	(0.078)	(0.058)	(0.052)	(0.055)	(0.049)	(0.084)	(0.066)	(0.050)
$Ext_i^{in}(INPUT)$	−0.007	0.013	0.022	−0.037	0.002	−0.003	0.026	−0.019	0.011	−0.071	−0.021	−0.036
	(0.058)	(0.046)	(0.034)	(0.047)	(0.057)	(0.037)	(0.042)	(0.048)	(0.039)	(0.043)	(0.041)	(0.030)
$Ext_i^{out}(INPUT)$	−0.097	0.065	−0.002	−0.149**	0.068	−0.018	−0.133**	0.076	−0.006	0.019	0.032	0.015
	(0.069)	(0.071)	(0.051)	(0.056)	(0.088)	(0.050)	(0.062)	(0.067)	(0.048)	(0.075)	(0.075)	(0.049)
$Ext_i^{in}(CREDIT)$	0.039	−0.001	0.006	−0.056	0.037	−0.013	0.016	−0.032	−0.012	−0.050	−0.106***	−0.088***
	(0.061)	(0.031)	(0.030)	(0.052)	(0.050)	(0.036)	(0.033)	(0.038)	(0.030)	(0.046)	(0.035)	(0.031)
$Ext_i^{out}(CREDIT)$	0.112*	0.159**	0.093*	0.060	0.028	0.048	0.016	0.007	−0.013	−0.101*	0.011	−0.024
	(0.062)	(0.073)	(0.048)	(0.053)	(0.077)	(0.048)	(0.051)	(0.064)	(0.052)	(0.059)	(0.061)	(0.045)
Observations	646	1,029	1,479	1,093	939	1,541	1,182	1,371	1,738	631	881	1,238
R^2	0.058	0.058	0.026	0.055	0.046	0.030	0.061	0.048	0.072	0.053	0.061	0.042
Number of villages	57	57	57	59	59	59	60	60	60	58	58	58
Mean dependent variable	0.219	0.205	0.197	0.359	0.347	0.315	0.530	0.500	0.407	0.240	0.213	0.206

Note: Standard errors, clustered at village level, in parentheses.
OLS estimation of Eqn. (2). Village fixed-effects always included, as well as the variables summarized in Table 1.
*$p < 0.1$.
**$p < 0.05$.
***$p < 0.01$.

and the easy interpretation of the estimated coefficients (Horrace and Oaxaca, 2006).[27,28]

The main vector of explanatory variables in Eqn. (3) is Ext_{ijv}, for which two kinds of dummies are included: *One* $Ext_{ij}(m)$ when only one household in the dyad has an external link, and *Two* $Ext_{ij}(m)$ when this is the case for both (therefore the comparison group is dyads without external links). The prediction from *H1* is that households with external links will have less interactions within the village. In the dyadic framework, this implies that the expected coefficients for *One* $Ext_{ij}(m)$ is always negative, therefore the probability of establishing a link in the internal economic networks is reduced if one of the households in the dyad has an external link and the other does not. As for *Two* $Ext_{ij}(m)$, the prediction is less clear. If the coefficient is negative, it implies that when both households in the dyad have external links then they will have lower probability of establishing a link than in the case when none of them has a link. This will support *H1*. But if the coefficient is positive, then it will imply that dyads where both households have external links are more likely to create a link between themselves than households without external links. Given few households have external links, a positive coefficient for *Two* $Ext_{ij}(m)$ is not necessarily against *H1*, since it will imply that households with external links mainly exchange internally among themselves.

The estimation of the $\beta_{extdyad}$ parameters of Eqn. (3) are presented in Table 6, in the columns describing the *total* number of links (columns 1, 4, 7, and 10). In the case of *LABOR* and *CREDIT* networks, the variables related to external links are not significant predictors of link formation. For *LAND* and *INPUT* networks, the significant coefficients are always negative, except for the one for *Two* $Ext_{ij}(LABOR)$, which is positive and statistically significant when the labor links are considered.

The results of the estimation of Eqn. (3) provide support for *H1* in some networks, but do not allow to get insights regarding *H2*, which predicts that external links will reduce mainly the formation of reciprocated links. In order to explore this hypothesis, I will re-estimate Eqn. (3) splitting the dependent variable into two sub-samples: one in which the dependent variable takes value one if a link was reciprocated, zero otherwise, which corresponds to the definition of $Recip_{ij}$ presented in Section 3; the other sub-sample corresponds to links which were not reciprocated (during the year previous to the survey), therefore taken value one if the link is unilateral, zero otherwise. These results are presented in Table 6, in the columns labeled as $Recip_{ij}$ and *Unilateral* respectively. Interestingly, for the former there are now also negative and statistically significant coefficients in the prediction of labor and credit links, and the results for the other networks previously found for total links hold. This is in contrast to the results for *Unilateral*, which resemble those of total links, with no predictors of a *LABOR* and *CREDIT* links which are statistically different from zero. I take these results as evidence that external links tend to reduce more pronouncedly reciprocated links.

Table 5. *Link-level descriptive statistics*

External links	$Ext_i(m)=0$		$Ext_i^{in}(m)=1$		$Ext_i^{out}(m)=1$	
Internal links	Borrow	Lend	Borrow	Lend	Borrow	Lend
Links in all economic networks						
Total links	4815	4528	1764	1879	1128	1383
Reciprocated	47.9%	50.9%	43.6%	40.9%	53.5%	43.7%
LAND						
Total links	1305	1228	71	49	38	137
Unilateral	74.9%	74.8%	81.7%	85.7%	71.1%	74.5%
Reciprocated with *LAND*	3.4%	3.6%	0.0%	0.0%	15.8%	4.4%
Other networks	21.70%	21.50%	18.20%	14.30%	13.20%	21.20%
LABOR						
Total links	1664	1711			109	62
Unilateral	53.1%	53.1%			62.4%	69.4%
Reciprocated with *LABOR*	11.6%	11.3%			2.8%	4.8%
Other networks	35.40%	35.70%			34.80%	25.80%
INPUT						
Total links	2452	2396	183	184	61	125
Unilateral	28.9%	27.5%	53.6%	53.3%	18.0%	51.2%
Reciprocated with *INPUT*	47.6%	48.7%	25.7%	25.5%	59.0%	28.8%
Other networks	23.50%	23.80%	20.70%	21.20%	23.00%	20.00%
CREDIT						
Total links	1142	1046	94	173	60	83
Unilateral	69.9%	69.3%	80.9%	79.2%	63.3%	69.9%
Reciprocated with *CREDIT*	2.8%	3.1%	1.1%	0.6%	1.7%	1.2%
Other networks	27.20%	27.60%	18.10%	20.20%	35.00%	28.90%

Note: Summary of the links registered in the four economic networks (*LAND*, *LABOR*, *INPUT* and *CREDIT*). Based on 2,792 households.
When links are described by network, external links are considered only in case a household has links outside the village in that particular network.

It is not possible to directly compare the results from the household-level estimates and those from the dyadic model, but the fact that the negative effect of external links on internal economic interaction is present in both specifications provides further evidence that omitted household-level characteristics may not drive the main results. Nonetheless, it cannot be ruled out that in the dyadic specification household-pair-level unobservable characteristics are introducing biases in the estimates.

(d) *Who has external connections?*

The evidence presented above provides support to the idea that external links tend to be substitutes for internal interactions. As shown in Table 2, actually few villagers have external links. Therefore the question arises, who are these villagers? In this subsection I will explore this question. After identifying the main characteristics related to the existence of external links, and how they provide support to idea that these external links are likely to be market-like exchanges, I attempt to rule out alternative hypotheses which could explain the main results without relying on the transformation process.

In order to understand which household-level characteristics are related to the probability of having an external link ($Ext_{iv}(m)=1$), the following model is estimated:

$$Pr(Ext_{iv}(m)) = \alpha_v + X_{iv}\beta_x + d_{iv}\beta_d + X_{iv}d_{iv}\beta_{xd} + e_{iv} \quad (4)$$

where the dependent variable can be a link to bring something to the village v $\left(Ext_{iv}^{in}(m)\right)$ or to take out something/someone outside $\left(Ext_{iv}^{out}(m)\right)$. In addition to the probability of an external link in each of the networks, the probability of an external link in any of the economic networks will be estimated. X_{iv} is a vector of controls at the household level and d_{iv} is the household degree in all economic networks. Interactions of those terms ($X_{iv}d_{iv}$) are included in some specifications. Given the importance of controlling for village-level unobserved heterogeneity, in all the estimations village fixed effects are included (α_v). The model is estimated as a LPM, but in the working paper version of this paper (Jaimovich, 2013) it is shown that the main results are very similar if logit and conditional logit models are used. One additional advantage of LPM over the alternative models is that interaction terms can be included directly and its coefficients can be easily interpreted.

The results of the estimation of Eqn. (4), when interaction terms are not considered, are presented in Table 7 (only variables that are interesting from an economic perspective and which are statistically significant are shown). Actually, very few of the household characteristics displayed in Table 1 are related to the existence of an external link. Household size (which is included in logs) is positively associated with the existence of an external link for most networks, and the opposite is true in the case of the level of education of the household head. For instance, the result in column 5 suggests that educated individuals are 2.5% less likely to work outside the village, a result that can be explained by the fact that those who have the comparative advantage of basic education inside the village tend to work there, and that a 1% increase in the household size rises in 2.2 percentage points the probability of an external link. As for the self-declared income, cash income per capita is never a significant variable. In terms of the traditional roles, the only significant results relates to the *Alkalo*, who is 18% more likely to have Ext_{iv}^{out} connections (column 2), a result mainly related with the *LAND* and *INPUT*

Table 6. *Dyadic regressions*

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
	$\ell_{ij}(LAND)$			$\ell_{ij}(LABOR)$			$\ell_{ij}(INPUT)$			$\ell_{ij}(CREDIT)$		
	Total	$Recip_{ij}$	Unilateral	Total	$Recip_{ij}$	Unilateral	Total	$Recip_{ij}$	Unilateral	Total	$Recip_{ij}$	Unilateral
One $Ext_{ij}^{out}(LAND)$	−0.001	−0.001	−0.000	−0.003	-0.003	−0.000	0.003	0.001	0.003	−0.001	−0.001	−0.001
	(0.006)	(0.002)	(0.005)	(0.005)	(0.003)	(0.005)	(0.006)	(0.004)	(0.005)	(0.005)	(0.002)	(0.003)
One $Ext_{ij}^{in}(LAND)$	−0.011***	−0.003***	−0.008***	−0.002	−0.001	−0.001	−0.004	−0.002	−0.003	−0.002	−0.001	−0.001
	(0.003)	(0.001)	(0.002)	(0.004)	(0.002)	(0.003)	(0.004)	(0.002)	(0.003)	(0.003)	(0.001)	(0.003)
Two $Ext_{ij}^{out}(LAND)$	−0.020*	−0.005	−0.015	0.002	0.003	−0.001	−0.003	0.006	−0.009	−0.004	0.002	−0.007
	(0.011)	(0.004)	(0.009)	(0.011)	(0.008)	(0.009)	(0.013)	(0.008)	(0.011)	(0.009)	(0.005)	(0.006)
Two $Ext_{ij}^{in}(LAND)$	−0.022***	−0.008***	−0.014***	0.010	0.000	0.010	0.002	0.003	−0.001	0.001	0.001	−0.000
	(0.006)	(0.002)	(0.005)	(0.009)	(0.007)	(0.006)	(0.010)	(0.007)	(0.008)	(0.009)	(0.004)	(0.008)
One $Ext_{ij}^{out}(LABOR)$	0.009	0.003	0.007	0.002	0.001	0.000	0.001	−0.001	0.002	−0.004	−0.000	−0.004
	(0.007)	(0.002)	(0.006)	(0.004)	(0.002)	(0.003)	(0.004)	(0.003)	(0.004)	(0.003)	(0.001)	(0.002)
Two $Ext_{ij}^{out}(LABOR)$	0.030**	0.003	0.029**	0.004	0.004	0.000	0.016	0.000	0.016	−0.001	0.000	−0.001
	(0.014)	(0.004)	(0.012)	(0.010)	(0.005)	(0.009)	(0.015)	(0.008)	(0.012)	(0.010)	(0.005)	(0.008)
One $Ext_{ij}^{out}(INPUT)$	−0.005	−0.002	−0.004	0.003	−0.001	0.005	0.003	0.001	0.002	0.003	0.001	0.001
	(0.006)	(0.002)	(0.006)	(0.005)	(0.003)	(0.005)	(0.005)	(0.003)	(0.004)	(0.004)	(0.002)	(0.003)
One $Ext_{ij}^{in}(INPUT)$	0.009	0.002	0.008	−0.001	0.001	−0.001	−0.004	−0.002	−0.002	−0.002	−0.001	−0.000
	(0.006)	(0.002)	(0.006)	(0.003)	(0.002)	(0.003)	(0.003)	(0.002)	(0.003)	(0.003)	(0.001)	(0.002)
Two $Ext_{ij}^{out}(INPUT)$	−0.037***	−0.009***	−0.029***	−0.014	−0.012**	−0.002	−0.035**	−0.018**	−0.019	0.009	−0.003	0.011
	(0.012)	(0.004)	(0.010)	(0.015)	(0.005)	(0.014)	(0.018)	(0.008)	(0.015)	(0.015)	(0.004)	(0.014)
Two $Ext_{ij}^{in}(INPUT)$	0.012	0.006	0.007	0.008	0.004	0.004	−0.006	−0.004	−0.001	0.007	0.004	0.003
	(0.014)	(0.005)	(0.011)	(0.011)	(0.005)	(0.010)	(0.012)	(0.006)	(0.010)	(0.010)	(0.005)	(0.007)
One $Ext_{ij}^{out}(CREDIT)$	0.009	0.002	0.008	0.005	0.004*	0.002	0.005	0.005*	0.000	−0.000	0.000	−0.001
	(0.008)	(0.002)	(0.007)	(0.004)	(0.002)	(0.003)	(0.004)	(0.003)	(0.003)	(0.003)	(0.001)	(0.002)
One $Ext_{ij}^{in}(CREDIT)$	0.001	0.000	0.000	−0.001	−0.001	−0.001	−0.002	−0.002	0.000	−0.002	−0.002***	0.001
	(0.003)	(0.001)	(0.002)	(0.002)	(0.001)	(0.002)	(0.002)	(0.001)	(0.002)	(0.003)	(0.001)	(0.002)
Two $Ext_{ij}^{out}(CREDIT)$	0.023	0.005	0.019	0.001	0.002	−0.001	−0.022*	−0.001	−0.022***	0.022	−0.001	0.022
	(0.016)	(0.007)	(0.012)	(0.014)	(0.008)	(0.013)	(0.012)	(0.010)	(0.006)	(0.016)	(0.006)	(0.014)
Two $Ext_{ij}^{in}(CREDIT)$	0.008	0.001	0.007	−0.005	−0.002	−0.004	−0.004	−0.004	0.000	−0.002	−0.002	0.000
	(0.007)	(0.002)	(0.006)	(0.005)	(0.003)	(0.004)	(0.007)	(0.004)	(0.006)	(0.006)	(0.002)	(0.005)
Observations	74,957	73,897	74,698	74,957	73,868	74,466	74,957	73,809	74,146	74,957	74,032	74,685
R^2	0.098	0.079	0.091	0.105	0.083	0.088	0.105	0.095	0.086	0.102	0.082	0.087
Households	2,829	2,829	2,829	2,830	2,829	2,829	2,831	2,829	2,829	2,832	2,829	2,829
% outside [0,1]	0.171	0.232	0.187	0.0762	0.161	0.121	0.0551	0.0996	0.0851	0.0902	0.260	0.110

Note: LPM dyadic regression with household-level fixed effects. Two-way (i and j) clustered standard errors in parentheses.
In all estimations, sums and differences of other households characteristics are included in the estimations but not reported.
*$p < 0.1$.
**$p < 0.05$.
***$p < 0.01$.

Table 7. *Probability of external links*

Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	Economic networks		*LAND*		*LABOR*	*INPUT*		*CREDIT*	
	Ext_{iv}^{in}	Ext_{iv}^{out}	Ext_{iv}^{in}	Ext_{iv}^{out}	Ext_{iv}^{out}	Ext_{iv}^{in}	Ext_{iv}^{out}	Ext_{iv}^{in}	Ext_{iv}^{out}
Household size	0.056***	0.046**	0.025**	0.012	0.021**	0.016	0.013	0.032**	0.019*
	(0.017)	(0.018)	(0.012)	(0.008)	(0.010)	(0.011)	(0.008)	(0.014)	(0.010)
Education	−0.049*	−0.048**	−0.030**	−0.003	−0.023*	−0.028*	−0.021**	−0.007	−0.014
	(0.028)	(0.023)	(0.012)	(0.014)	(0.013)	(0.014)	(0.010)	(0.021)	(0.016)
Income per capita	0.001	0.002	0.001	0.000	0.001	0.000	0.000	0.000	0.002
	(0.002)	(0.002)	(0.001)	(0.001)	(0.001)	(0.001)	(0.000)	(0.002)	(0.002)
Cash crop seller	0.037*	0.062**	0.033**	0.039***	0.034*	0.016	0.005	0.036*	0.012
	(0.021)	(0.024)	(0.014)	(0.013)	(0.019)	(0.017)	(0.009)	(0.018)	(0.013)
Alkalo	−0.078	0.183***	−0.014	0.154***	0.023	−0.008	0.099*	−0.071*	−0.017
	(0.051)	(0.065)	(0.025)	(0.052)	(0.043)	(0.034)	(0.052)	(0.038)	(0.031)
Non-*Alkalo* relative	0.054***	0.051**	0.019*	0.005	0.022	−0.015	0.010	0.051***	0.034**
	(0.017)	(0.021)	(0.011)	(0.010)	(0.016)	(0.014)	(0.009)	(0.015)	(0.013)
Ethnic minority (<30%)	0.012	−0.017	0.019	−0.029*	0.012	0.026	0.017*	−0.014	−0.009
	(0.026)	(0.022)	(0.017)	(0.016)	(0.019)	(0.017)	(0.009)	(0.025)	(0.014)
Remittances receiver	−0.011	−0.002	−0.012	0.003	0.003	−0.006	0.001	0.003	−0.019**
	(0.024)	(0.022)	(0.011)	(0.010)	(0.017)	(0.013)	(0.011)	(0.018)	(0.009)
Emigrants	−0.028	−0.005	−0.004	−0.010	−0.017	−0.010	−0.003	−0.031*	0.017
	(0.025)	(0.022)	(0.009)	(0.010)	(0.015)	(0.018)	(0.012)	(0.018)	(0.014)
$Ext_{iv}^{in}(MARRIAGE)$	0.023	0.019	−0.010	−0.009	0.012	0.023*	0.011	0.021	0.008
	(0.020)	(0.019)	(0.010)	(0.011)	(0.012)	(0.013)	(0.007)	(0.017)	(0.011)
$Ext_{iv}^{out}(MARRIAGE)$	−0.037	0.017	0.002	0.016*	0.020**	−0.019*	−0.006	−0.022	−0.007
	(0.022)	(0.014)	(0.008)	(0.009)	(0.009)	(0.012)	(0.008)	(0.017)	(0.008)
d_{iv}^{in}	−0.010**	−0.006	−0.006*	−0.004*	0.000	−0.004	−0.005***	−0.007**	−0.003
	(0.004)	(0.004)	(0.003)	(0.002)	(0.003)	(0.003)	(0.002)	(0.003)	(0.002)
d_{iv}^{out}	0.002	0.006*	0.002	0.002	0.002	0.002	0.001	0.004	0.006***
	(0.004)	(0.003)	(0.002)	(0.002)	(0.003)	(0.003)	(0.001)	(0.003)	(0.002)
Observations	2,792	2,792	2,792	2,792	2,792	2,792	2,792	2,792	2,792
Within R^2	0.039	0.058	0.036	0.051	0.038	0.021	0.036	0.045	0.036
Between R^2	0.124	0.162	0.164	0.178	0.104	0.006	0.084	0.129	0.010
% outside [0,1]	0.003	0.028	0.048	0.118	0.126	0.045	0.176	0.051	0.135

Note: LPM estimates, using village, ethnicity, and economic activity fixed effects (Eqn. (4)). Robust standard errors in parenthesis.
Other household-level variables displayed in Table 1 were included in the estimation but are not reported since they are not statistically or economically significant.
*$p < 0.1$.
**$p < 0.05$.
***$p < 0.01$.

networks. The *Alkalo* has also a 7% lower probability to have a $Ext_{iv}^{in}(CREDIT)$ link.

The results in Table 7 provide support to the idea that the external links in the four economic networks are a proxy for market exchanges, where interactions with anonymous agents prevail. Most of the variables measuring the existence of relatives and friends outside the village—as is the case for number of emigrants, the reception of remittances and marriage ties outside the village (to bring and send family members)—are either statistically insignificant or have a negative coefficient as determinants of the probability of an external link.[29] Additionally, households that produce some kind of cash crop, and therefore are more likely to be involved in market exchanges, indeed have a higher probability of an external link (even though this is not always statistically significant).

The two main hypotheses that I have tested in the previous sections suggest a causality from the existence of an external link to the degree in the networks of economic exchanges. Nonetheless, given the descriptive nature of the present study, the reverse causality cannot be ruled out and therefore I have included total *in-degree* $\left(d_{iv}^{in}\right)$ and *out-degree* $\left(d_{iv}^{out}\right)$ in the four economic networks as additional explanatory variables in Eqn. (4). These coefficients are shown at the bottom of Table 7. In the case of d_{iv}^{in}, the partial correlation coefficients are always negative and usually statistically significant. For d_{iv}^{out} the only result that is statistically different from zero is a positive correlation with $Ext_{iv}^{out}(CREDIT)$.

Furthermore, the inclusion of the total *in-* and *out-degree* as a right-hand side variable allows me to explore alternative hypotheses about the nature of external links, in particular through the interaction terms with the other explanatory variables. One such alternative explanation can be that some groups of households which are in a less favorable position inside the village tend to look for external instead of internal economic interactions.[30] If this is true, the assumption that external transactions are more market oriented is not invalidated, but the reasons underlying its potential substitutability with internal interactions will not be related to the transformation process. To explore this alternative mechanism, I will take three possible groups which may be in a less favorable position within the village: those who belong to an ethnic minority (smaller than 30% of the total village population), those with a household head which is not a relative to the *Alkalo*, and those with few relatives in the village. Indeed, the results in Table 7 show that the households which are not direct relatives to the *Alkalo* tend to be 5% more likely to have external links

than the rest of the villagers (columns 1 and 2), a result related to the credit network mainly. In the case of the minority ethnic groups, there are no significant partial correlations when all economic networks are considered, but a positive relation in the case of $Ext_{iv}^{out}(INPUT)$ and a negative relation for $Ext_{iv}^{out}(LAND)$. As for the variable *% of non-relatives in the village*, it was never a significant predictor (therefore the results are not included in 7).

If less favored groups tend to search for external connections because they have fewer opportunities within the village, then is to be expected that those with lower internal degree will be in particular the ones with more external links. The results in Table 8, where the interaction terms have been included, show that, apart from some exceptions, this is not the case. For the interactions of ethnic minority and d_{iv}^{in} (second row), most of the coefficients are not significant, with the only exception of the one for *CREDIT*, which is negative. Nevertheless, the effect is the opposite when the interaction with d_{iv}^{out} is taken into account (third row), with a positive and significant coefficient which is also present in *LABOR* (columns 5), indicating that the economically more active households from ethnic minorities may be the ones with external links.[31] In the case of households which are not relative to *Alkalo*, most of the results for the interactions are not statistically significant, with the exception of the interaction terms of d_{iv}^{in} with $Ext_{iv}^{out}(LAND)$ and $Ext_{iv}^{in}(INPUT)$ which have negative coefficients. Similarly, the interactions terms with % of non-relatives in the village is mostly statistically indistinguishable from zero, except for a positive coefficient in columns 1 and coefficients with opposite signs for the interaction with d_{iv}^{in} and d_{iv}^{out} in column 7.

Overall, the results in Table 8 show that only in few cases the potentially less-favored groups that have a reduced number of internal exchanges tend to search links outside the village, and this hypothesis is unlikely to explain the results found in previous sections.

5. CONCLUSIONS

A long tradition of anthropological studies has described the characteristics of traditional rural economies based on reciprocal exchanges, known as gift economies, and how these type of transactions tend to be reduced when more complex exchange mechanisms exist. This transformation process is formalized in the model introduced by Kranton (1996). Nevertheless, little rigorous empirical evidence has been provided to support the qualitative evidence and the predictions from the model. In order to fill this gap, the present study takes advantage of a unique dataset of social and economic networks collected in 60 rural Gambian villages to analyze the ways in which households with links outside the village (interpreted as a proxy for market connections) behave in the locally available exchange networks for land, labor, inputs, and credit.

The main results, from econometric specifications at both household- and dyadic-levels, provide evidence supporting the predictions of the transformation process. In particular,

Table 8. *Probability of external links: interaction terms*

Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	Economic networks		*LAND*		*LABOR*	*INPUT*		*CREDIT*	
	Ext_{iv}^{in}	Ext_{iv}^{out}	Ext_{iv}^{in}	Ext_{iv}^{out}	Ext_{iv}^{out}	Ext_{iv}^{in}	Ext_{iv}^{out}	Ext_{iv}^{in}	Ext_{iv}^{out}
Ethnic minority (<30%)	−0.035	−0.004	0.010	−0.008	0.010	0.025	0.018	−0.046	−0.005
	(0.040)	(0.024)	(0.025)	(0.016)	(0.024)	(0.020)	(0.014)	(0.040)	(0.016)
Ethnic minority* d_{iv}^{in}	0.013	−0.012	0.004	−0.004	−0.008	−0.007	−0.000	0.008	−0.010*
	(0.014)	(0.010)	(0.007)	(0.004)	(0.007)	(0.007)	(0.004)	(0.013)	(0.005)
Ethnic minority* d_{iv}^{out}	0.010	0.008	0.000	−0.006	0.011*	0.008	−0.000	0.008	0.009*
	(0.007)	(0.007)	(0.004)	(0.004)	(0.006)	(0.008)	(0.002)	(0.005)	(0.005)
Non-*Alkalo* relative	0.077***	0.067***	0.034**	0.033***	0.018	0.000	0.023**	0.053**	0.015
	(0.025)	(0.023)	(0.016)	(0.012)	(0.019)	(0.018)	(0.011)	(0.020)	(0.014)
Non-*Alkalo* relative* d_{iv}^{in}	−0.008	−0.006	−0.005	−0.010**	−0.000	−0.011**	−0.004	0.001	0.004
	(0.008)	(0.007)	(0.006)	(0.004)	(0.006)	(0.005)	(0.003)	(0.007)	(0.004)
Non-*Alkalo* relative* d_{iv}^{out}	0.001	0.001	−0.000	0.000	0.002	0.005	−0.001	0.001	0.004
	(0.005)	(0.005)	(0.004)	(0.003)	(0.004)	(0.004)	(0.003)	(0.005)	(0.003)
% Non-relatives	−0.228	−0.223	−0.122	−0.199	−0.035	0.101	−0.109	−0.005	−0.065
	(0.163)	(0.225)	(0.111)	(0.123)	(0.153)	(0.132)	(0.093)	(0.121)	(0.131)
% Non-relatives* d_{iv}^{in}	−0.017	0.001	−0.016	0.020	0.004	−0.025	0.042**	0.002	−0.011
	(0.029)	(0.041)	(0.020)	(0.019)	(0.026)	(0.026)	(0.017)	(0.019)	(0.031)
% Non-relatives* d_{iv}^{out}	0.044*	0.011	0.024	0.010	−0.011	0.017	−0.037**	0.012	0.023
	(0.025)	(0.029)	(0.018)	(0.017)	(0.021)	(0.015)	(0.017)	(0.017)	(0.022)
d_{iv}^{in}	0.009	−0.002	0.009	−0.015	−0.003	0.025	−0.038**	−0.008	0.006
	(0.027)	(0.034)	(0.017)	(0.016)	(0.022)	(0.023)	(0.014)	(0.018)	(0.026)
d_{iv}^{out}	−0.037*	−0.004	−0.018	−0.005	0.009	−0.018	0.032**	−0.008	−0.017
	(0.020)	(0.024)	(0.015)	(0.014)	(0.017)	(0.014)	(0.014)	(0.014)	(0.018)
Observations	2,792	2,792	2,792	2,792	2,792	2,792	2,792	2,792	2,792
Within R^2	0.043	0.064	0.039	0.056	0.046	0.027	0.040	0.050	0.041
Between R^2	0.130	0.150	0.194	0.156	0.093	0.008	0.089	0.100	0.012
% outside [0,1]	0.004	0.031	0.048	0.127	0.130	0.053	0.182	0.052	0.127

Note: LPM estimates, using village, ethnicity, and economic activity fixed effects (Eqn. (4)). Robust standard errors in parenthesis.
Other household-level variables displayed in Table 1 were included in the estimation but are not reported.
* $p < 0.1$.
** $p < 0.05$.
*** $p < 0.01$.

it is found that: (i) households with external economic links are less likely to be involved in economic interactions within the village (substitutability between internal and external exchanges); and (ii) households with external economic links are less likely to be involved in reciprocated exchanges with fellow villagers (*reciprocation versus market* hypothesis). In the case of the substitutability between internal and external exchanges, the results are mainly driven by within-network effects, given that cross-network coefficients are statistically insignificant (e.g., an external link in the network of inputs of production is a substitute of an internal link in the inputs exchange but this is not the case for the other economic exchange networks). In terms of *reciprocation versus market*, the analysis also provides evidence of within-network substitution, but jointly with some cross-network effects. The results are robust to different econometric specifications and alternative methods to control for unobserved heterogeneity at the village- and household-level, but the effects are not always present in every network.

The findings suggest some important policy implications. The goal of many rural development programs is the integration of isolated communities into market transactions. In other words, using a network framework, there is an effort to create external links that connect currently missing markets. To explain why many of these programs fail, theoretical models have proposed that the benefits of market transactions may not be enough to abandon the traditional means of exchange and production (de Janvry *et al.*, 1991; Kranton, 1996). Therefore, it is necessary to consider the complexities of community exchanges in order to understand the effects of market-oriented interventions. For instance, von Braun and Webb (1989) and Carney and Watts (1990) have shown how in The Gambia many programs that attempted to increase agricultural productivity and cash crop production failed because the traditional distribution of land was not considered in the design. The results I have presented suggest that the existence of external links is related to a decrease in the exchanges within the village, and particularly of reciprocated exchanges with fellow villagers. If policies oriented to the creation of external links are implemented, undesired effects, such as the reduction in community interactions and the isolation of villagers not willing to abandon the gift exchange system, can be the source of renewed failures in attempts at rural development.

The study of the transformation of rural societies using a network perspective have the potential to improve the understanding of the overall economic development process. For instance, the methodology applied in the present study may provide a useful guidance to measure both the degree of connection to external markets and the level of interactions within a community. If a rural development program which aims at increasing market interactions is implemented, a baseline measure of the networks of exchanges can provide information on the number of links outside the village and how they change after the project is implemented (as a long as a comparable control group is available, for instance through a randomized control trial). Similarly, the measures of degree and reciprocity in the economic networks utilized in this study can be analyzed as outcome variables of the project, possibly measuring undesired effects which include the reduction of the internal interactions. Indeed, these economic interactions can be taken as part of an empirical measure of the social capital within the community.

Other fruitful avenues for future research can be the replication of the main results in different settings as well as the implementation of new methods for data collection and analysis to overcome the limitations of the present study, particularly in terms of the causal interpretation of the results.

NOTES

1. A comprehensive review of the concepts of gift economy and reciprocity from the perspective of different disciplines can be found in Kolm and Ythier (2006).

2. A summary of studies focusing on the influences of markets on behavior and preferences is provided by Bowles (1998). More related to the framework of the present study, Barrett (2008) reviews the literature related to market participation of smallholders in Africa.

3. Some recent studies have also used a network perspective to analyze the process of integration to markets in rural societies. Baird and Gray (2014) find a negative correlation between the traditional social networks of exchange and livelihood diversification among Maasai communities in northern Tanzania. Di Falco and Bulte (2013) show that in villages with access to external credit internal kinship networks are less important for risk management strategies than in villages without access to credit market. In those studies only proxies for networks are used instead of the much more detailed data available for the present paper.

4. The idea of considering transactions in the market as a network of buyers and sellers that establish a link between each other is theoretically developed by Kranton and Minehart (2001).

5. Takasaki *et al.* (2014) provide a recent review of labor-sharing arrangements and how this and other networks of economic exchanges are scarcely explored in the economic literature as compared to informal risk-sharing arrangements.

6. Most of the previous applied econometric studies specifically dealing with the issue of market participation are efforts to test models in the spirit of de Janvry *et al.* (1991). Goetz (1992) combines bivariate probits and 2SLS in a sample of Senegalese rural households and finds some differences in the determinants of grain market participation for buyers and sellers. Using structural estimation, Key *et al.* (2000) show the importance of transaction costs in data for Mexican *ejidos*. Bellemare and Barrett (2006) use an ordered Tobit model to show the sequentiality in the decisions of market entry and volumes to be transacted for rural households in East Africa.

7. To my knowledge, the only study that analyzes reciprocity in rural societies in a dyadic framework is the recent contribution by Schechter and Yuskavage (2012).

8. A detailed description of the organization of activities within compounds is provided by Carney and Watts (1990) and von Braun and Webb (1989).

9. The quote is a translation from Mandinka of an interview with a household head in Jarra West region, March 2014.

10. Four in-depth interviews conducted in Jarra LGA, March 2014.

11. This period of the year was chosen because it is the time when farm work is less intensive, and therefore it was easier to reach all village household heads for the group surveys.

12. This type of approach is common in ethnographic research and is related to the *rapid rural appraisal* methodology that has been successfully used in the past for quantitative analysis in different disciplines (Chambers, 1994)

13. Having census network data implies that in the empirical analysis there is no need for the adjustment in the estimates that are necessary in sampled networks proposed by Chandrasekhar and Lewis (2011).

14. During the pilots we were initially reluctant to ask information about credit links (money exchange), thinking that it might be perceived as being disrespectful and that this information would not be revealed. On the contrary, it was found that villagers were in general willing to respond to this question. The clue to understand this behavior was given by one of the local enumerators: "*In Islam there is no interest rate. If you lend money it means that you are helping at the moment when the other really needs it, so you are doubly blessed. While usually lenders will not reveal the information, grateful borrowers will.*"

15. In some limited cases the household head was absent and his or her replacement answered the questionnaire.

16. Jaimovich (2011) is a working paper largely based on chapters of my PhD dissertation. Some of the results discussed there are also reported in the present study.

17. Compared with the data for rural areas of the 2003 Census for The Gambia, the sample overrepresents Mandinkas (33%) and under-represents Wollof (15%).

18. A link is recorded in the data if at least one of the two villagers of the dyad mention the existence of a link.

19. The lack of information related to external hiring is unfortunate, because the use of *strange farmers* is an important way of dealing with labor shortages (Swindell, 1978). In terms of the definition of households working outside the village, the original question was "*Did you, or any members of your household, work for other households during the last year (2008–09)? If yes, how many days?*" Only households that worked at least one week during the last year outside the village are considered as having an external link.

20. For the main results, the k-nearest neighbors matching estimator is reported, with $k = 3$ (Abadie *et al.*, 2004), and the standard errors are bootstrapped to take into account the fact that values are estimated. If different number of k are used or if the kernel matching estimator is implemented instead, the results (available upon request), even though different in magnitude, have a similar interpretation. The details of the data used to create Figure 2 can be found in the working paper version of this paper (Jaimovich, 2013).

21. Banerjee *et al.* (2013) use the eigenvector centrality in their study of microfinance diffusion in Indian villages, and show that their results are different if degree centrality is used instead. This is the case given their data are for (subsamples) of networks with many more nodes than the network data from Gambian villages. Given networks are much smaller for the latter, and therefore indirect connections are not so relevant, eigenvector and degree centrality are very similar (Borgatti, 2005).

22. If instead $d_{iv}(m)$ is used as the dependent variable, the main results are unchanged.

23. To account for the fact that observations are likely to be correlated within each village, the standard errors are clustered at the village-level.

24. A potential concern with the estimation of Eqns. 1 and 2 is the fact that the dependent variable is a fraction that can take values between 1 and 0, but the predicted values from an OLS estimation can lie outside this interval. To check if this poses a problem, I will follow Papke and Wooldridge (2008) in implementing a version of these equations with a probit specification estimated using quasi-maximum likelihood and controlling village unobserved heterogeneity by using the *Mundlak–Chamberlain device*. Therefore, instead of the α_v vector, the average of all the village-variant variables ($\overline{X_v}$ and $\overline{Ext_v}$) are included. Using this specification has no effect on the interpretation of the main results when compared to the OLS estimates, in terms of the sign and statistical significance of β_{ext}, and therefore I will prefer the OLS estimation (which coefficients are easier to interpret). The results of the Mundlak–Chamberlain estimates are reported in Appendix Table 9

25. In Table 10 of Appendix is possible to see that the main results do not change if the fractional linear model is estimated using the specification of Papke and Wooldridge (2008).

26. The directed probability of link formation can also be estimated, but given the interest in this case is to study the existence of an economic exchange within the village, the undirected measure has a more direct interpretation.

27. In these estimations, the disturbance terms are allowed to be correlated across observations involving the same individual using the two-dimensional clustering methodology proposed by Cameron *et al.* (2011). Also, the percentage of predicted variables that are outside the [0,1] interval is reported as a measure of the potential bias of using LPM estimations (Horrace and Oaxaca, 2006).

28. In the working paper version of this paper (Jaimovich, 2013) it is shown that the main results are very similar when logit and conditional logit are used to estimate Eqn. (3).

29. The only exceptions are for $Ext_{iv}^{in}(MARRIAGE)$ in column 6 and $Ext_{iv}^{out}(MARRIAGE)$ in columns 4 and 5.

30. I am grateful to an anonymous referee for this suggestion.

31. This is in line with the results of Arcand and Jaimovich (2014), which have shown that ethnic diversity does not affect economic interactions in rural Gambian villages.

REFERENCES

Abadie, A., Drukker, D., Herr, J. L., & Imbens, G. W. (2004). Implementing matching estimators for average treatment effects in Stata. *Stata Journal, 4*(3), 290–311.

Arcand, J.-L., Chen, Y.-P., He, Y., Diop, C. I. F., Wouabe, E. D., Garbouj, M., *et al.* (2010). *The Gambia CDDP baseline: rural household survey, qualitative survey, village network survey*, Tech. rep. The Graduate Institute, Geneva.

Arcand, J.-L., & Jaimovich, D. (2014). *Does ethnic diversity decrease economic interactions? Evidence from exchange networks in rural Gambia*. Manuscript. Goethe University Frankfurt.

Baird, T. D., & Gray, C. L. (2014). Livelihood diversification and shifting social networks of exchange: A social network transition? *World Development, 60*, 14–30.

Banerjee, A., Chandrasekhar, A. G., Duflo, E., & Jackson, M. O. (2013). The diffusion of microfinance. *Science, 341*(6144).
Barrett, C. B. (2008). Smallholder market participation: Concepts and evidence from eastern and southern Africa. *Food Policy, 33*(4), 299–317.
Bellemare, M. F., & Barrett, C. B. (2006). An ordered tobit model of market participation: Evidence from Kenya and Ethiopia. *American Journal of Agricultural Economics, 88*(2), 324–337.
Borgatti, S. P. (2005). Centrality and network flow. *Social Networks, 27*(1), 55–71.
Bowles, S. (1998). Endogenous preferences: The cultural consequences of markets and other economic institutions. *Journal of Economic Literature, 36*(1), 75–111.
Cameron, C., Gelbach, J., & Miller, D. (2011). Robust inference with multiway clustering. *Journal of Business and Economic Statistics, 29*(2), 238–249.
Cameron, C., & Windmeijer, F. (1997). An R-squared measure of goodness of fit for some common nonlinear regression models. *Journal of Econometrics, 77*(2), 329–342.
Carney, J., & Watts, M. (1990). Manufacturing dissent: Work, gender and the politics of meaning in a peasant society. *Africa: Journal of the International African Institute, 60*(2), 207–241.
Chambers, R. (1994). The origins and practice of participatory rural appraisal. *World Development, 22*(7), 953–969.
Chandrasekhar, A, & Lewis, R. (2011). *Econometrics of sampled networks*. Unpublished manuscript, Massachusetts Institute of Technology.
Chavas, J.-P., Petrie, R., & Roth, M. (2005). Farm household production efficiency: Evidence from The Gambia. *American Journal of Agricultural Economics, 87*(1), 160–179.
de Janvry, A., Fafchamps, M., & Sadoulet, E. (1991). Peasant household behaviour with missing markets: Some paradoxes explained. *Economic Journal, 101*(409), 1400–1417.
Di Falco, S., & Bulte, E. (2013). The impact of kinship networks on the adoption of risk-mitigating strategies in Ethiopia. *World Development, 43*, 100–110.
Fafchamps, M. (1999). Risk sharing and quasi-credit. *Journal of International Trade & Economic Development, 8*(3), 257–278.
Fafchamps, M., & Gubert, F. (2007). The formation of risk sharing networks. *Journal of Development Economics, 83*(2), 326–350.
Freudenberger, M. S. & Sheehan, N. A. (2000). *Tenure and natural resources in The Gambia: Summary of research findings and policy options, Land Tenure Center*, University of Wisconsin-Madison Working Papers 40.
Gajigo, O., & Saineb, A. (2011). The effects of government policies on cereal consumption pattern change in the Gambia. *Review of African Political Economy, 38*(130), 517–536.
Goetz, S. (1992). A selectivity model of household food marketing behavior in Sub-Saharan Africa. *American Journal of Agricultural Economics, 74*, 444–452.
Henrich, J., Boyd, R., Bowles, S., Camerer, C., Fehr, E., & Gintis, H. (Eds.) (2004). *Foundations of human sociality: Economic experiments and ethnographic evidence from fifteen small-scale societies*. Oxford University Press.
Henrich, J., Ensminger, J., McElreath, R., Barr, A., Barrett, C., Bolyanatz, A., *et al.* (2010). Markets, religion, community size, and the evolution of fairness and punishment. *Science, 327*, 1480–1484.
Horrace, W. C., & Oaxaca, R. L. (2006). Results on the bias and inconsistency of ordinary least squares for the linear probability model. *Economics Letters, 90*(3), 321–327.
Jaimovich, D. (2011). *Macrostructure and microstructure: Evidence from overlapping village networks in The Gambia*, MPRA Paper 38932.
Jaimovich, D. (2013). *Missing links, missing markets: Evidence of the transformation process in the economic networks of Gambian villages*, MPRA Working Papers No. 55758, 2013.
Key, N., Sadoulet, E., & de Janvry, A. (2000). Transactions costs and agricultural household supply response. *American Journal of Agricultural Economics, 82*(2), 245–259.
Kolm, S.-C., & Ythier, J. M. (2006). *Handbook of the economics of giving, altruism and reciprocity: Foundations* (Vol. 1). Amsterdam, The Netherlands: Elsevier.
Kranton, R. E. (1996). Reciprocal exchange: A self-sustaining system. *American Economic Review, 86*(4), 830–851.
Kranton, R. E., & Minehart, D. F. (2001). A theory of buyer–seller networks. *American Economic Review, 91*(3), 485–508.
Krishnan, P., & Sciubba, E. (2009). Links and architecture in village networks. *Economic Journal, 119*(537), 917–949.
Malinowski, B. (1921). The primitive economics of the Trobriand islanders. *Economic Journal, 31*(121), 1–16.
Malinowski, B. (Ed.) (1922). *Argonauts of the Western Pacific: An account of native enterprise and adventure in the archipelagos of Melanesian New Guinea*. London, England: Routledge, Kegan Paul.
Mauss, M. (1923). Essai sur le don: Forme et raison de l'échange dans les sociétés archaïques. *Année sociologique*, 1923–1924.
Papke, L. E., & Wooldridge, J. M. (2008). Panel data methods for fractional response variables with an application to test pass rates. *Journal of Econometrics, 145*(1–2), 121–133.
Platteau, J.-P., & Abraham, A. (1987). An inquiry into quasi-credit contracts: The role of reciprocal credit and interlinked deals in small-scale fishing communities. *The Journal of Development Studies, 23*(4), 461–490.
Polanyi, K. (1944). *The great transformation: The political and economic origins of our time*. New York, NY: Farrar and Rinehart.
Schechter, L., & Yuskavage, A. (2012). Inequality, reciprocity, and credit in social networks. *American Journal of Agricultural Economics, 94*(2), 402–410.
Shipton, P. (1990). *How Gambians save and what their strategies imply for international aid*. World Bank Policy, research and external affairs working papers, WPS 395.
Swindell, K. (1978). Family farms and migrant labour: The strange farmers of The Gambia. *Canadian Journal of African Studies/Revue Canadienne des Études Africaines, 12*(1), 3–17.
Takasaki, Y., Coomes, O. T., Abizaid, C., & Brisson, S. (2014). An efficient nonmarket institution under imperfect markets: Labor sharing for tropical forest clearing. *American Journal of Agricultural Economics, 96*(3), 711–732.
Udry, C. & Conley, T. (2004). *Social networks in Ghana*. Yale University Economic Growth Center, Discussion Paper no. 888.
von Braun, J., & Webb, P. (1989). The impact of new crop technology on the agricultural division of labor in a West African setting. *Economic Development and Cultural Change, 37*(3), 513–534.
Webb, P. (1989). *Intrahousehold Decision-making and Resource Control: The Effects of Rice Commercialization in West Africa*. International Food Policy Research Center, Working Papers on Commercialization of Agriculture and Nutrition. Number 3.
World Bank (2013). World Development Indicators [Data file], retrieved from http://data.worldbank.org/data-catalog/world-development-indicators.

APPENDIX A. POTENTIAL BIAS OF THE LINEAR MODEL

The estimation of Eqn. (1) using OLS yields β_{ext}^{m} that are consistent estimators of the effect of external links on the degree of internal exchanges when $cov(Ext_{iv}(m), e_{iv}) = 0$ and $cov(X_{iv}, e_{iv}) = 0$. Nonetheless, it is likely that household unobserved characteristics are related to the existence of links in both internal and external networks, and therefore $cov(Ext_{iv}(m), e_{iv}) \neq 0$. If μ_i denotes the omitted variable, household-level unobservable characteristics, then the disturbance term in Eqn. (1) can be re-written as:

$$e_{iv} = \mu_i \sigma + u_{iv}, \tag{5}$$

where u_{iv} is *iid* and σ is the coefficient that captures the effect of μ_i on the dependent variable. In the case when $Ext_{iv}(m)$ is one variable (to avoid assumptions related to the covariances within $Ext_{iv}(m)$ when taken as a vector), if the usual OLS assumptions hold (including $cov(X_{iv}, e_{iv}) = 0$) and X_{iv} relates to $Ext_{iv}(m)$ only through its relationship with unobservables,

then plim $\widehat{\beta^m_{ext}} = \beta^m_{ext} + \sigma \frac{cov(Ext_{iv}(m),\mu_i)}{var(Ext_{iv}(m))}$. Therefore, if it is expected that μ_i will affect degree and external links in the same direction (σ and $cov(Ext_{iv}(m), \mu_i)$ have the same sign), for example through entrepreneurial ability, empathy or assiduousness, then $\widehat{\beta^m_{ext}}$ will be upward biased. In this case, if in the estimation of Eqn. (1) $\widehat{\beta^m_{ext}} < 0$ is obtained, then β^m_{ext} is indeed negative and the coefficient obtained is an upper bound of its true magnitude. It is more difficult to think in terms of cases when it is expected that μ_i affects internal and external exchanges in opposite directions (maybe some kind of asymmetric information problem in which villagers know that i is dishonest but people outside do not), but if this is the case then $\widehat{\beta^m_{ext}}$ will be downward biased and when negative coefficients are found it is not possible to know if the sign is only due to the bias or not.

The same concerns in terms of the endogeneity of the external links variables are valid for Eqn. (2). The sign of the coefficients can only be interpreted in a causal way if μ_i is correlated with both $Recip_i(m)$ and $Ext_{iv}(m)$ in the same direction (and the other assumptions stated above also hold), and consequently $\widehat{\beta^m_{ext2}} < 0$ is an upper bound of the true unbiased value. It is again reasonable to expect that this assumption holds. If the unobservable characteristics mentioned above are associated with the fact that a household has an external link and also to a higher degree in the internal networks, it is likely that, in the context of a gift economy, they also relate to active reciprocated exchanges with fellow villagers. Nevertheless, if μ_i affects $Recip_i(m)$ and $Ext_{iv}(m)$ in opposite ways, the sign of the coefficients may be driven by the inconsistency of the estimators.

Ideally, an instrumental variable will be used to deal with this potential endogeneity problem, but it is extremely unlikely to find in the data a household-level variable z_i that will credibly meet the requirements of $cov(z_i, e_{iv}) = 0$ and $cov(z_i, Ext_{iv}(m)) \neq 0$. Household-specific random effects are not feasible either, because the likely endogeneity of the external links implies that it will be correlated with the random effects. Therefore, if the expected result $(\beta^m_{ext} < 0)$ is obtained, its sign can be interpreted in a causal way only if the assumption of unobservable characteristics to be related with internal and external exchanges in the same direction holds.

APPENDIX B. ROBUSTNESS CHECKS FOR MAIN RESULTS

Tables 9 and 10.

Table 9. *Fractional probit: household's degree centrality and external links*

$Ext_i(m)$	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	LAND		*LABOR*		*INPUT*		*CREDIT*	
	$d_i^{out}(m)$	$d_i^{in}(m)$	$d_i^{out}(m)$	$d_i^{in}(m)$	$d_i^{out}(m)$	$d_i^{in}(m)$	$d_i^{out}(m)$	$d_i^{in}(m)$
$Ext_i^{in}(LAND)$	−0.602**	−0.626***	0.138	−0.002	0.138	−0.242**	0.311	0.117
	(0.246)	(0.206)	(0.145)	(0.198)	(0.129)	(0.111)	(0.249)	(0.161)
$Ext_i^{out}(LAND)$	0.209	−0.729***	0.223	−0.075	0.131	0.081	0.032	−0.324
	(0.176)	(0.273)	(0.142)	(0.161)	(0.142)	(0.123)	(0.227)	(0.199)
$Ext_i^{out}(LABOR)$	0.234	0.077	−0.352**	0.013	0.134	0.085	−0.118	−0.094
	(0.157)	(0.159)	(0.159)	(0.120)	(0.121)	(0.094)	(0.203)	(0.084)
$Ext_i^{in}(INPUT)$	0.352**	0.011	−0.003	0.015	−0.236***	−0.297**	−0.211	0.045
	(0.173)	(0.144)	(0.122)	(0.131)	(0.085)	(0.125)	(0.215)	(0.121)
$Ext_i^{out}(INPUT)$	-0.456	−0.098	0.157	−0.544**	0.096	−0.568***	0.267	0.027
	(0.280)	(0.182)	(0.159)	(0.247)	(0.121)	(0.150)	(0.173)	(0.221)
$Ext_i^{in}(CREDIT)$	0.086	0.071	0.072	−0.021	−0.081	0.025	0.207	−0.520***
	(0.138)	(0.132)	(0.098)	(0.107)	(0.123)	(0.088)	(0.193)	(0.147)
$Ext_i^{out}(CREDIT)$	0.459***	−0.152	0.296*	0.206	0.183	0.008	0.068	0.022
	(0.160)	(0.181)	(0.158)	(0.216)	(0.113)	(0.098)	(0.190)	(0.161)
Observations	2,792	2,792	2,792	2,792	2,792	2,792	2,792	2,792
$R^2_{deviance}$	0.442	0.352	0.351	0.373	0.438	0.434	0.370	0.337

Note: Standard errors, clustered at village level, in parentheses.
Fractional panel probit estimation (Papke and Wooldridge, 2008) of Eqn. (1), where the average of all the village-variant variables ($\overline{X_v}$ and $\overline{Ext_v}$) are included.
The model includes variables summarized in Table 1.
The goodness of fit measure reported is the one recommended by Cameron and Windmeijer (1997) for this kind of non-linear model, based on deviance.
*$p < 0.1$.
**$p < 0.05$.
***$p < 0.01$.

Table 10. *Fractional probit: household-level reciprocated links over total*

$Ext_i(m)$	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
	LAND			*LABOR*			*INPUT*			*CREDIT*		
	$Recip_i^{out}$	$Recip_i^{in}$	$Recip_i$	$Recip_i^{out}$	$Recip_i^{in}$	$Recip_i$	$Recip_i^{out}$	$Recip_i^{in}$	$Recip_i$	$Recip_i^{out}$	$Recip_i^{in}$	$Recip_i$
$Ext_i^{in}(LAND)$	−0.692***	−0.464**	−0.459***	−0.052	0.217	−0.035	−0.373**	0.112	−0.125	0.141	−0.169	−0.023
	(0.245)	(0.236)	(0.167)	(0.169)	(0.194)	(0.159)	(0.154)	(0.179)	(0.133)	(0.223)	(0.279)	(0.195)
$Ext_i^{out}(LAND)$	0.278	−0.091	0.044	−0.007	0.067	0.013	0.098	0.036	0.110	0.070	−0.001	0.090
	(0.238)	(0.252)	(0.189)	(0.183)	(0.207)	(0.144)	(0.166)	(0.135)	(0.123)	(0.201)	(0.351)	(0.216)
$Ext_i^{out}(LABOR)$	−0.310	−0.148	−0.044	−0.221	−0.322	−0.283	−0.109	0.098	−0.043	−0.316	−0.469*	−0.414*
	(0.256)	(0.283)	(0.199)	(0.254)	(0.229)	(0.179)	(0.171)	(0.167)	(0.154)	(0.314)	(0.260)	(0.220)
$Ext_i^{in}(INPUT)$	−0.020	0.070	0.106	−0.024	0.041	0.019	0.031	0.009	0.061	−0.271	−0.042	−0.125
	(0.189)	(0.169)	(0.125)	(0.146)	(0.166)	(0.116)	(0.138)	(0.146)	(0.121)	(0.181)	(0.158)	(0.120)
$Ext_i^{out}(INPUT)$	−0.243	0.309	0.025	−0.347*	0.125	−0.005	−0.258	0.022	−0.041	0.071	0.072	0.019
	(0.319)	(0.221)	(0.174)	(0.210)	(0.244)	(0.147)	(0.180)	(0.239)	(0.163)	(0.225)	(0.290)	(0.165)
$Ext_i^{in}(CREDIT)$	0.165	0.092	0.090	−0.152	0.096	−0.011	0.134	−0.141	0.009	−0.284*	−0.535***	−0.473***
	(0.219)	(0.115)	(0.111)	(0.130)	(0.128)	(0.094)	(0.120)	(0.125)	(0.091)	(0.157)	(0.165)	(0.131)
$Ext_i^{out}(CREDIT)$	0.424**	0.513**	0.326**	0.219	0.121	0.191	0.106	0.004	−0.066	−0.283	−0.008	−0.090
	(0.190)	(0.221)	(0.157)	(0.139)	(0.200)	(0.131)	(0.166)	(0.208)	(0.161)	(0.188)	(0.210)	(0.165)
Observations	646	1,029	1,479	1,093	939	1,541	1,182	1,371	1,738	631	881	1,238
$R^2_{deviance}$	0.244	0.214	0.184	0.235	0.234	0.188	0.457	0.404	0.326	0.255	0.225	0.240

Note: Fractional panel probit estimation (Papke and Wooldridge, 2008) of Eqn. (2), where the average of all the village-variant variables ($\overline{X_v}$ and $\overline{Ext_v}$) are included.
The model includes variables summarized in Table 1.
The goodness of fit measure reported is the one recommended by Cameron and Windmeijer (1997) for this kind of non-linear model, based on deviance.
* $p < 0.1$.
** $p < 0.05$.
*** $p < 0.01$.

Available online at www.sciencedirect.com

ScienceDirect