

Social Networks among Indigenous Peoples in Mexico

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June 2009



Abstract

This paper examines the extent to which social networks among indigenous peoples have a significant effect on a variety of human capital investment and economic activities, such as school attendance and work among teenage boys and girls, and migration, welfare participation, employment status, occupation and sector of employment among adult males and females. The analysis uses data from the 10 percent population sample of the 2000 Population and Housing Census of Mexico

and an empirical strategy that allows taking into account the role of municipality and language group fixed effects. The authors confirm empirically that social network effects play an important role in the economic decisions of indigenous people, especially in rural areas. The analysis also provides evidence that better access to basic services, such as water and electricity, increases the size and strength of network effects in rural areas.

This paper—a product of the Poverty Reduction Group, Poverty Reduction and Economic Management Network—is part of a larger effort in the network to analyze poverty and monitor and evaluate the effectiveness of poverty reduction programs. Policy Research Working Papers are also posted on the Web at <http://econ.worldbank.org>. The author may be contacted at eskoufias@worldbank.org.

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JEL classification: J15; J71; O12

Keywords: Economic Opportunities, Indigenous Peoples, Mexico, Social Networks.

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Acknowledgements: This paper is extracted from a World Bank Regional Study financed by the Regional Studies Program of the Office of the Chief Economist of the Latin America and Caribbean Region. The team is grateful to Christian Borja-Vega for data support and analysis. The findings, interpretations and conclusions expressed in this paper are entirely those of the authors, and do not necessarily represent the opinions of the World Bank, its Board of Directors or the countries it represents.

1. Introduction

Much of the work aimed at understanding the factors behind the high and stagnant poverty rates among indigenous peoples in Latin America has focused on the unequal distribution of income-generating assets such as physical and human capital (e.g. Hall and Patrinos 2006). In recent years, however, increasing emphasis has been placed on social capital and the cultural assets of indigenous peoples. Social capital, typically defined as “traditional community values and socioeconomic structures” in studies of indigenous peoples, is often referred to as the only productive capital poor people have in abundance (Woolcock and Narayan 2000). Traditional values and structures viewed as typical of indigenous communities include: collective control and sustainable management of natural resources; reciprocal and mutually supportive work systems; strong social organization and high levels of communal responsibility; a deep respect for the knowledge of their elders; and a close spiritual attachment to their ancestors and the earth (Davis and Patrinos 1996; Perafán 2000). Such cultural assets can play a key role in economic entrepreneurship and in strategies to diversify or intensify livelihoods (Stephen 1991; Bebbington 1996, 1999; Bebbington and Perrault 1999). Strong network ties, a strong sense of solidarity, and kinship-based exchange relationships, such as the institution of *compadrazgo*, also play an important role in providing economic security (Collins 1983).

Social capital in these studies is viewed primarily as a community-level variable rather than an individual level variable. At the individual level, networks and contacts are typically viewed as something that is leveraged for material gain, by providing information and access to secure jobs or other economic opportunities. Strong social networks can however also be coercive and a source of strain rather than support. They may for instance isolate members from

information about employment opportunities thus restricting occupational mobility (Reingold 1999; Woolcock 2001; Munshi and Rosenzweig 2006). Others argue that kinship-based systems may act as “instruments of stagnation” by taking collective actions ex-ante that raise exit barriers from the kin group, and thus holding back their members from benefiting from market development (Hoff and Sen 2005). Small communities can also ensure the loyalty of members by “taxing” activities outside the “club,” thus inhibiting innovation (Berman 2000).

The relatively new insights into these potential social network or ‘membership’ effects suggest that conventional market discrimination may be only a part of the problem for disadvantaged groups. The design of effective policies and programs aimed at improving “economic opportunities” for indigenous populations requires a better understanding of the determinants of behavior within indigenous populations. As a consequence, efforts to improve economic opportunities for indigenous people mainly through reducing wage and price discrimination may have little power to reduce the economic gaps between indigenous and non-indigenous groups.

In consideration of these issues, this paper focuses on the role of social networks in shaping economic opportunities available to indigenous households. Sociological and ethnographic research has long emphasized the role of nonmarket interactions, through social structure, social networks and social norms, inhibiting upward mobility among segregated and disadvantaged groups of people (Granovetter 1985), economists have only recently begun to examine these topics (Montgomery 1991; Lindbeck 1999; Lindbeck et al. 1997; Loury 2000; Bertrand et al. 2000; Bertrand and Mullainathan 2005; Gibbons 2005; Munshi and Rosenzweig 2006). As Bertrand et al. (2000) point out, social networks can affect the economic opportunities of individuals through two important channels: information and norms. The information channel emphasizes the role of externalities, i.e. how a person’s ability to take advantage of

economic opportunities depends on the behavior and knowledge of others. The social norm channel, on the other hand, emphasizes how a person's preferences themselves may depend on the behavior of others, either directly by affecting tastes or indirectly via social pressure.

From a policy perspective, these social interaction effects may be critical for the success or failure of initiatives aimed at providing economic opportunities for indigenous peoples. Depending on the context, social interactions (or social network effects) can generate spillover or social multiplier effects that strengthen or weaken the effects of a policy intervention. For example, the profitable cultivation of non-traditional agricultural export production by a few small farmers in an indigenous village may have large positive spillover effects through the peer group (or social network effects) on the production choices of other farmers in the same village (or even in other villages nearby) (Hamilton and Fischer, 2003). On the contrary, negative spillover effects arising from social norms about behavior and other community institutions and obligations may contribute to the reproduction of poverty among indigenous individuals and households.

In this paper we provide some of the first quantitative evidence on the potential role of network effects in determining economic behavior among indigenous peoples. Most of the studies to date on the role of social capital are qualitative, based on a small number of communities and the sociological and social norms and social interactions governing day to day life in indigenous communities (e.g., Cleaver 2005; Stephen 1991; Hamilton and Fischer 2003; Korovkin 1998; Bebbington et al. 1993). Such studies typically emphasize specificity at the expense of external validity, in the sense that they do not provide a strong basis for formulating economy-wide policies aimed at providing economic opportunities for indigenous peoples.

We hypothesize that individuals interact mainly with other peers who speak the same language. Therefore, individuals living in an area with more people speaking the same

indigenous language/dialect are assumed to have more available contacts. As in Bertrand et al. (2000), the social network of an individual is characterized by two key dimensions: the quantity and quality of the network. The quantity of the social network or the contact availability is the fraction of the population in the household's community (locality) speaking the same indigenous language as the individual. The quality of the network is the fraction of the indigenous households in the country speaking the same indigenous language and participating in the economic activity investigated. Thus the contacts from the same language group with high participation in any given economic activity (e.g. working in handicrafts, working in agriculture etc.), are likely to have a strong influence on the decision to participate in the same activity. An obvious limitation of the use of language as a proxy for social networks is that it ignores networks defined by characteristics other than language and ethnicity.

This paper identifies indigenous peoples using language which raises theoretic and methodological questions. The use of a cultural trait such as language as an identifier of whether someone is indigenous is problematic because it is subject to changes that may or may not lead to a loss of indigenous identity. The language use definition for instance misses those members of the indigenous population that while indigenous in terms of their origins and/or identity, either (i) deny knowledge of an indigenous language and declare Spanish as their native tongue, or (ii) speak no indigenous language. At the same time, the use of for instance self-identification may also lead to underreporting if and when discrimination and social prejudice lead individuals to deny any affiliation with their native origins or at least to downplay their indigenous origins. Due to the way in which census data is collected in Mexico, language variables are the most reliable and objective proxy for differentiating indigenous and non-indigenous households. Self-identification is thus far not widely used, and indigenous people are typically identified through language use or geographic location.

The evidence reported in the paper suggests social networks play an important role among indigenous peoples. However, our analysis also suggests that social networks (especially social capital) can have pluses and minuses in terms of economic opportunities.

Section 2 of the paper presents the model and the data used, while Section 3 summarizes the results. Section 4 concludes with a summary and a discussion of the policy implications of the findings.

2. Model and Data

Following Bertrand et al. (2000), it is hypothesized that individuals interact mainly with other peers who speak the same language. Therefore, individuals living in an area with more people speaking the same indigenous language/dialect will have more available contacts. The social network of the household can be characterized by two key dimensions: the quantity and quality of the network. The quantity of the social network or the *contact availability* is the fraction of the population in the household's geographic community speaking the same indigenous language as the individual, and is formally defined as

$$CA_{L,j} = \frac{\frac{N_{L,j}}{N_j}}{\frac{N_L}{N}} \quad (1)$$

where $N_{L,j}$ is the number of individuals in language group L living in municipality j and N_j is the total population of municipality j , expressed as a ratio of the share of people speaking

language L out of the total population in the country ($\frac{N_L}{N}$).^{1, 2} The quality of the network is the fraction of the indigenous households in the country speaking the same indigenous language participating in the economic activity investigated.³ Thus the contacts from the same language group with high participation in any given economic activity (e.g. working in handicrafts, working in agriculture etc.), are likely to have a strong influence on the decision to participate in the same activity. In the empirical analysis, the social network variable is defined as the product of the two variables measuring the quantity and the quality of the network. Specifically,

$$SN_{L,j} = \ln(CA_{L,j}) \times (\bar{Y}_L - \bar{Y}), \quad (2)$$

where the term $(\bar{Y}_L - \bar{Y})$ represents the difference between the fraction of people speaking language L and participating in activity Y , and the fraction of the total population participating in activity Y . With these definitions in mind, the regression model estimated is

$$Y_{L,j}(i) = \alpha_0 + \alpha SN_{L,j} + \beta \ln(CA_{L,j}) + \gamma X(i) + \delta_L + \theta_j + \varepsilon_{L,j}(i), \quad (3)$$

¹ The *Catalogo de Lenguas indigenas* allows for 91 different indigenous codes in Mexico plus 3 additional codes for other indigenous languages unspecified.

² In fact in our regressions we use the log of the ratio of the CA to the share of people speaking language L out of the total population in the country. The use of the log prevents the underweighting of small language groups (see Bertrand et al, 2000).

³ An alternative definition of the quality of the network may be fraction of the indigenous households in the community (instead of the whole country) speaking the same indigenous language participating in the economic activity investigated. Given that this alternative definition takes a more limited view about how information flows within networks it is not adopted.

where $Y_{L,j}(i)$ is a binary variable taking the value 1 if the individual i speaking language L and residing in municipality j participates in the specific activity Y , α_0 , α , β , and γ are parameters to be estimated, $SN_{L,j}$ and $CA_{L,j}$, respectively, are the social network and contact availability variables defined above, and $X(i)$ is a set of variables summarizing observed individual characteristics. The term δ_L denotes the fixed effects for (or set of binary variables used to identify) the language group of the individual, whereas θ_j denotes the fixed effects for the individual's municipality of residence. The language-specific fixed effects absorb all the observed and unobserved characteristics of each language group, such as different levels of discrimination, cultural endowments, and other ethnic-specific attributes different than those related to the networks. The municipality-specific fixed effects absorb all the observed and unobserved characteristics of municipalities, such as access to infrastructure, distance from urban and commercial centers and job opportunities, among others. The last term, $\varepsilon_{L,j}(i)$ is an error term summarizing the role unobservable variables including individual participation in activity Y .

Our empirical analysis of the role of social networks is based on the 2000 Census data from Mexico. One advantage offered by the Census data is that their large sample sizes allow one to construct reliable measures of the quantity and quality of the networks as defines above. This advantage, however, comes at a cost since Census data contain only a limited number of interesting economic activities. With these caveats in mind, the a set of variables summarizing observed individual and household characteristics, i.e., $X(i)$, consists of a person's age, years of schooling, marital status, whether the person speaks Spanish in addition to an indigenous language, characteristics of the residence, (family size, number of rooms, dirt floor, no access to

piped water or sanitary services, no electricity, low quality of fuel for cooking) and household assets (does not own a TV, blender, refrigerator, telephone, automobile, boiler).

The types of economic outcomes summarized by the variable Y in equation (3) are limited by the information collected in the 2000 Population and Housing Census. We use the following outcomes: (i) whether the individual is an internal migrant in the sense that he/she was born in a different state than he/she is currently residing (1=yes, 0=no) ; (ii) whether the individual is receiving cash transfers from PROCAMPO and/or OPORTUNIDADES programs (1=yes, 0=no)⁴; (iii) whether the individual is employed as an employee or laborer (*empleado o obrero*); (iv) employed as a day laborer or unskilled worker (*jornalero o peon*); and (v) self-employed. We also used binary variables identifying some key sectors of employment among indigenous peoples, such as agriculture (code=11) and manufacturing (codes 31-33). For teenagers between 12 and 17 years of age, we also used the information of whether the child is attending school and working.

Based on the specification of equation (3), the existence of social networks can be demonstrated by positive estimates of the parameter α ($\alpha > 0$) that are significantly different from zero. These estimates provide evidence on the degree to which of social networks or social ties play a significant explanatory role in the different social and economic outcomes after accounting for the role of other individual socioeconomic characteristics, household assets, access to infrastructure, the type of indigenous language spoken and the municipality of residence. It is important to keep in mind that this empirical approach provides is very

⁴ Oportunidades has a particularly heavy presence among the indigenous. As shown by Ramirez (2006), in 2002 nearly 70 percent of the poorest fifth of the population in indigenous municipalities received Oportunidades, compared to only 42 percent in non-indigenous ones".

conservative estimate of the effect of social networks. Many of the variables that serve as controls in the regression equation (3) may also proxy for networks. For example, the language group and municipality fixed effects also capture some of the network effects at work. These are not counted as part of the network effect summarized by the parameter α , because the impact of these variables is likely to include many other factors in addition to networks.

Finally, the census data and our use of language attributes can only provide a proxy for social networks, and may not be the ideal indicator of networks. While recognizing that this empirical approach cannot completely measure the effects of complex social interactions, we do believe that it contributes to the study of differences in network effects due to unobserved differences between individuals, areas, and ethnic groups.

3. Results

Equation (3) was estimated using a linear probability model (ordinary least squares) on the sample of all indigenous individuals contained in the 10% population sample of the 2000 Population and Housing Census.⁵ To allow for potential differences in the way networks may operate based on the gender of an individual, equation (3) was estimated separately on the sample adult males and females 20-65 years of age as well as for the sample of teenage boys and girls between 12 and 17 years of age. In addition, to allow for possible differences in the role of social network effects across rural and urban areas, the males and females samples were divided further into a rural sample that included individuals residing in localities with less than 2,500 residents, a semi-urban sample that included individuals residing in localities with 2,500-

⁵ The combined number of fixed effects for localities and language groups is prohibitively large to allow estimation of probit or logit model with fixed effects.

15,000 residents, and an urban sample, that included larger localities (more than 15,000 residents).⁶

Table 1
Mexico-Social Network Effects Among Indigenous Males and Females 12-17 years of age

		Males 12-17 yrs old		
		Rural areas	Semi-Urban areas	Urban areas
Attending School		-0.023	0.336	0.326
	t-value	(-0.28)	(2.03)**	(1.84)**
	Adjusted R-squared	0.2988	0.2768	0.3225
	Number of observations	51,111	11,845	3,081
Working		0.018	0.392	0.451
	t-value	(0.20)	(2.12)**	(1.71)*
	Adjusted R-squared	0.2310	0.2185	0.3402
	Number of observations	51,334	11,906	3,089
		Females 12-17 yrs old		
		Rural areas	Semi-Urban areas	Urban areas
Attending School		-0.089	0.002	0.148
	t-value	(1.04)	(0.02)	(0.89)
	Adjusted R-squared	0.3496	0.3104	0.3500
	Number of observations	49,519	11,669	3,793
Working		0.140	.088	-0.234
	t-value	(1.96)**	(0.65)	(-1.16)
	Adjusted R-squared	0.1373	0.1555	0.3636
	Number of observations	49,766	11,740	3,808

Source: Authors' estimates of the social network effect based on the 2000 Population and Housing Census (10% sample).

Notes:

- t-values based on robust standard errors corrected unknown forms of heteroskedasticity
- * p-value < 0.10
- ** p-value < 0.05
- *** p-value < 0.01

The results summarized in Table 1, suggests that strongly positive and significant effects are at work in the decision to attend school and work among male teenagers in semi-urban and urban areas but not for girls. In fact, network effects among teenage males in these areas are equally strong with respect to school attendance as they are for work. In the rural areas, social

⁶ The full set of parameter estimates for all the control variables included in regression equation (3) is not reported here but is available directly from the authors upon request.

networks appear to influence the decision to send girls to work, but not the school attendance of either girls or boys. The consistent absence of social network effects in the school attendance of indigenous teenage boys and girls in rural areas suggests that educational interventions in the rural areas to encourage and support selected teenage boys and girls to attend school are unlikely to have any multiplier effects through “peer effects” or role model for other children.

The next topic of investigation is the role of social network effects among adult males and females between 20 and 65 years of age (see table 2).⁷ Social networks are believed to play a critical role in the decision to migrate since the network of acquaintances one has lowers not only the costs of migration but also the likelihood of getting employment in the destination area. In the case of Mexico, there is plenty of empirical evidence that social network effects play a significant role in migration to the US (see for instance Massey and Espinosa 1997, Orrenius 1999, Munshi 2003). However, little evidence exists on the role of social networks in internal migration. Our indicator of whether an individual is a migrant or not is essentially a measure of internal migration since it is based on a comparison of the current state of residence of the individual with the state that he/she was born.⁸ Our empirical estimates in table 2 confirm that the effect of social networks on internal migration is significant in the rural areas, as well as for adult males in urban areas. Furthermore, the effects are significant for both for males and

⁷ The estimates in table 2 are obtained by constructing the variables CA and SN in equation (3) using the full sample of all adults (irrespective of gender).

⁸ The census allows identification of two additional variables related to migration: an individual specific variable on recent migration by comparing based on a comparison of the current federal state of residence and the state of residence five years ago, and a household level variable identifying the total number of individuals in the household who have migrated overseas.

females with the social network effect being higher for adult males than females in the rural areas.⁹

Our analysis of the role of social network effects in the participation of indigenous peoples in cash transfer programs such as *PROCAMPO* and/or *Oportunidades* reveals that social networks do not play a significant role in the participation these programs. Part of the explanation for this result may rest on the fact that the *Oportunidades* program is targeted in two stages, first at the locality level, and then at the household level with explicit selection criteria that leave little room for self-selection and social network effects to play a role in the participation in this program. It is also possible that the time elapsed between the year of the Census and the start of the program in late 1997 is too short for the social network effects to start having a visible role. These findings contrast with those of Bertrand et al. (2000) who present evidence that social networks based on language spoken at home play a significant role for participation in the US welfare system. It is still possible, however, that high and continuing participation rates in cash transfer programs such as *Oportunidades* have the risk of creating over time a “welfare culture” that could ultimately distort work incentives, inhibit economic mobility, and could perpetuate rather than alleviate poverty.

⁹ Existing evidence on gender differentiated impacts of migrant networks is not conclusive. Empirical analyses based on cross-sectional data from Mexico suggests that male migrant networks are more important determinants for international migration for men than for women (Curran and Rivero-Fuentes 2003), while other studies suggests that young men’s decision to migrate is motivated by a ‘rite of passage’ factor, while kinship ties exert more influence on the migration of young women (Kandel and Massey 2002) .

Table 2
Mexico-Social Network Effects Among Indigenous Adults 20-65 years of age

Dependent variable	Rural areas	Semi-Urban areas	
		Urban areas	
	MALES		
Internal migrant?	0.141	0.017	0.065
t-value	(6.77)***	(0.32)	(1.70)*
Adjusted R-squared	0.5698	0.6344	0.6869
Number of observations	145,464	41,119	25,792
Receiving PROCAMPO/ OPORTUNIDADES?	0.010	0.009	0.001
t-value	(0.43)	(0.27)	(0.14)
Adjusted R-squared	0.2839	0.2421	0.0619
Number of observations	142,962	40,150	25,177
	FEMALES		
Internal migrant?	0.108	0.0271	0.015
t-value	(4.87)***	(0.50)	(0.59)
Adjusted R-squared	0.5104	0.5995	0.7198
Number of observations	155,249	44,501	26,543
Receiving PROCAMPO/ OPORTUNIDADES?	0.004	-0.108	0.004
t-value	(0.15)	(-3.26)**	(0.53)
Adjusted R-squared	0.1761	0.2239	0.0340
Number of observations	152,512	43,224	25,702

Source: Authors' estimates of the social network effect based on the 2000 Population and Housing Census (10% sample)

Notes:

- t-values based on robust standard errors corrected unknown forms of heteroskedasticity
- * p-value < 0.10
- ** p-value < 0.05
- *** p-value < 0.01

As far as employment status, occupation and sector of employment are concerned, social network effects appear to vary by gender and by location.¹⁰ Overall, the results for males suggest that on average, social networks do not facilitate employment in non-traditional sectors, and often strengthen tendencies to engage in traditional sectors such as agriculture.

Social networks among the indigenous have a positive and significant effect on the employment condition of adult males as daily workers (*jornalero o peon*) in rural and urban areas (see tables 3 and 4).¹¹ Social networks appear to play no significant role in the employment conditions of females in the rural areas, though networks appear to be significant in the employment of females in the urban areas as employees (*empleado/obrero*). Networks are particularly important in the employment of females in the rural areas in domestic services. Not surprisingly, social networks play a significant role in being employed in the agricultural sector for adult indigenous males and females in rural areas.

A notable difference is the role of social networks in the employment of males and females in the manufacturing sector. Social networks have a significant role in the employment of female workers in the manufacturing sector irrespective of location (rural or urban areas). In contrast, social networks appear to have no role at all in the employment of male workers in the same sector. This finding may be a local reflection of global trends in which trade liberalization and export promotion has led to a feminization of manufacturing work in developing countries both because female labor supply tends to be more elastic than male labor supply, and because women are disproportionately represented in export-oriented sectors (Wood 1991, Cagatay and

¹⁰ Given that this information is collected only for working adults, the estimates in tables 3 and 4 are obtained by constructing the variables CA and SN in equation (3) using the sample of working adults only.

¹¹ The estimates in tables 3 and 4 are obtained by constructing the variables CA and SN in equation (3) using the sample of all working adults (irrespective of gender). The lower sample size of the regressions for females, table 4 compared to that for males in table 3 and for females in table 2 is due to the lower female participation in labor market activities.

Ozler 1995, Standing 1999). Nationally representative surveys of manufacturing firms in Mexico between 1992 and 2001, show that foreign and export-oriented firms employ significantly more women at every occupational level than nationally-owned firms producing goods for sale in the domestic market (Villarreal and Yu 2007).

Table 3
Mexico-Social Network Effects Among Indigenous Males 20-65 years of age

Dependent variable	Semi-Urban		
	Rural areas	areas	Urban areas
Empleado/Obrero	-0.005	0.022	0.017
t-value	(0.24)	(0.53)	(0.58)
Adjusted R-squared	0.2892	0.3227	0.2729
Number of observations	145,464	41,119	25,792
Jornalero/peon	0.042	-0.008	0.0504
t-value	(1.96)**	(0.24)	(2.50)
Adjusted R-squared	0.2022	0.1983	0.1567
Number of observations	145,464	41,119	25,792
Self employed	0.048	0.050	0.038
t-value	(2.58)***	(1.45)	(1.44)
Adjusted R-squared	0.2086	0.2237	0.1884
Number of observations	145,464	41,119	25,792
Sector of Employment is Agriculture (code=11)	0.032	0.028	0.003
t-value	(2.42)***	(1.17)	(0.24)
Adjusted R-squared	0.3134	0.3535	0.2511
Number of observations	145,464	41,119	25,792
Sector of Employment is Manufacturing (code 31-33)	0.028	-0.041	0.004
t-value	(1.39)	(-0.79)	(0.11)
Adjusted R-squared	0.1486	0.1824	0.0911
Number of observations	145,464	41,119	25,792

Source: Authors' estimates of the social network effect based on the 2000 Population and Housing Census (10% sample)

Notes:

- t-values based on robust standard errors corrected unknown forms of heteroskedasticity
- * p-value <0.10
- ** p-value <0.05
- *** p-value <0.01

Table 4
Social Network Effects Among Indigenous Females 20-65 years of age

Dependent variable	Rural areas	Semi-Urban areas	Urban areas
Empleado/obrero	0.006	-0.178	0.089
t-value	(0.14)	(-2.27)**	(2.01)**
Adjusted R-squared	0.3921	0.3921	0.2706
Number of observations	46,153	13,686	12,871
Jornalero/Peon	0.041	0.029	0.005
t-value	(1.23)	(0.59)	(0.35)
Adjusted R-squared	0.2560	0.2560	0.2658
Number of observations	46,153	13,686	12,871
Self employed	0.025	-0.034	0.008
t-value	(0.71)	(-0.55)	(0.21)
Adjusted R-squared	0.2253	0.2527	0.2228
Number of observations	46,153	13,686	12,871
Is occupied in Domestic Services (occupation code=820)	0.454	-0.306	-0.001
t-value	(2.22)**	(-0.93)	(-0.81)
Adjusted R-squared	0.2326	0.2162	0.3421
Number of observations	46,153	13,686	12,871
Sector of Employment is Agriculture (code=11)	0.060	-0.015	-0.010
t-value	(2.19)***	(-0.46)	(-1.60)
Adjusted R-squared	0.4448	0.4532	0.2750
Number of observations	46,153	13,686	12,871
Sector of Employment is Manufacturing (code=31-33)	0.130	0.212	0.130
t-value	(2.15)**	(2.44)**	(2.91)***
Adjusted R-squared	0.3644	0.3317	0.1490
Number of observations	46,153	13,686	12,871

Source: Authors' estimates of the social network effect based on the 2000 Population and Housing Census (10% sample)

Notes:

- t-values based on robust standard errors corrected unknown forms of heteroskedasticity
- * p-value <0.10
- ** p-value <0.05
- *** p-value <0.01

The empirical evidence presented so far sheds little light on the determinants of the strength of social network effects. We investigate this issue in more detail by examining how the

strength of the network effect varies with access to basic services such as water service, and electricity in rural areas only.¹² We do this by including an interaction term in regression equation (3) between the social network variable (SN) summarizing the quantity and quality of the network and a binary variable of indicating whether the household has no access to piped water inside the premises of its residence or no access to electricity.¹³

Table 5
Social Network Effects and Access to Basic Services in Rural Areas:
Indigenous Males and Females 20-65 years of age

Dependent variable	SN	SNx(noWater)	SN	SNx(noElec)
MALES				
Internal migrant?	0.129	0.019	0.130	0.015
t-value	(6.22)***	(4.50)***	(6.19)***	(3.29)***
Adjusted R-squared		0.5699		0.5699
Number of observations		145,464		145,464
Receiving PROCAMPO/ OPORTUNIDADES ?	0.017	-0.026	0.018	-0.020
t-value	(0.74)	(-4.81)***	(0.77)	(-3.56)***
Adjusted R-squared		0.2840		0.2839
Number of observations		142,962		142,962
Occupied in agricultural activities (occup. code=41)	0.028	-0.013	.0256096	-0.0035013
t-value	(2.25)**	(-5.88)**	(2.02)**	(-1.53)
Adjusted R-squared		0.3210		0.3209
Number of observations		145,464		145,464
Occupied in handicrafts, processing, repair & maintenance (occup codes 52-54)	0.040	-0.019	.0392904	-0.0126774
t-value	(1.79)*	(-3.26)***	(1.74)*	(-2.29)**
Adjusted R-squared		0.1700		0.1699
Number of observations		145,464		145,464
FEMALES				
Internal Migrant?	0.093	0.023	0.094	0.018
t-value	(4.32)***	(5.18)***	(4.26)***	(4.04)***
Adjusted R-squared		0.5106		0.5105
Number of observations		155,249		155,249

Source: Authors' estimates of the social network effect based on the 2000 Population and Housing Census (10% sample)

¹² Results using access to sanitation services were very similar to the results for access to water, and they are not reported here.

¹³ The variables summarizing lack of access to basic services are already included the set of controls variables denoted by $X(i)$ in regression equation (3).

Notes:

- t-values based on robust standard errors corrected unknown forms of heteroskedasticity
- * p-value <0.10
- ** p-value <0.05
- *** p-value <0.01

The positive coefficients of the interaction terms between SN and the binary variables indicating no access to water (and/or electricity) reveal that the lack of access to basic infrastructure (see table 5), irrespective of gender, reinforces the effect of social networks in the decision to migrate. In contrast, the negative coefficients of the interaction terms in the regressions equations for male participation in agricultural occupations and other repairs and maintenance occupations and handicrafts suggest that lack of access to basic services in rural Mexico weakens the role of social networks in helping secure employment in these occupations.

Thus, in rural Mexico, investments in infrastructure are not only going to improve rural welfare directly but also have an indirect effect reinforcing the role of social networks in the employment of indigenous households across different sectors.

4. Conclusions and Policy Implications

In this paper we have provided new quantitative evidence on the role of social interactions in the labor market and other economic activities of indigenous peoples. In accordance with much of the qualitative literature emphasizing the role of social capital in indigenous communities and other ethnic groups around the world, our results confirm that social network effects are strong among indigenous peoples in Mexico, especially in the rural areas. Our estimates also reveal that social network effects differ depending on gender, area of residence and economic activity.

The consistent absence of social network effect in the school attendance of indigenous teenage boys and girls in rural areas suggests that educational interventions in the rural areas encouraging and supporting selected teenage boys and girls to attend school are unlikely to have any multiplier effects through “peer effects” or role model for other children. However, social networks are particularly significant in the decision to migrate in rural and semi-urban areas. Also, social networks do not appear to have a multiplier effect on the participation of the indigenous in government cash transfer programs through facilitating the flow of information about these programs. Thus, contrary to the case of the US, at least among the indigenous of Mexico, network effects do not appear to be a critical factor for the creation of a “welfare culture.” Overall, the principal effect of networks on adult employment and sector choices is to reproduce current patterns. One notable exception is the role of social networks in the employment of adult women in the manufacturing sector in both urban and rural areas.

The evidence presented in this paper suggests that social networks play an important role in helping indigenous people access employment opportunities. However, most of the employment opportunities are in agriculture and self-employment, activities that are typically associated with poverty and low welfare. Some authors go as far as to argue that the role of peer effects can be relatively more important than what education brings for the indigenous peoples in terms of finding employment especially in off-farm non-agricultural activities (Araujo *et al.*, 2004). Developing policy instruments that increase the inclusiveness and effectiveness of social network effects is thus advisable. Pilot programs providing examples of a few success cases adopting new production practices, accessing modern health services, cultivating new crops (such as non-traditional agricultural exports) are likely to have large positive multiplier effects through social networks and thus help equalize opportunities for indigenous peoples.

Our analysis also revealed that the extent to which social networks are helpful at increasing the mobility of the indigenous peoples into different or new types of economic activities varies by gender. Networks for example, have no significant role in the employment of males in the manufacturing sector, but they do have an important function in helping adult women secure employment in the manufacturing sector in both rural and urban areas. These findings suggest that interventions steering the power of social networks of the indigenous in new directions have to take into account these gender differences if they are to be successful in their objective.

Lastly, our analysis also provides solid evidence that increased access to basic services such as water, sanitation and electricity is associated with a stronger social network effect. This implies that interventions targeted to indigenous communities that improve access to basic service needs not only improve rural welfare directly but also have an indirect effect by reinforcing the role of social networks in the employment of indigenous households across different sectors.

When discussing policy implications, we recognize the limitations of a networks-based view of social capital. For one, it tends to ignore the potential “public good” nature of social capital (Woolcock and Narayan 2000). Our analysis focuses solely on individual economic behavior, yet case studies from indigenous and rural communities in Latin America suggest that strong social networks can play an important role in mobilizing members for collective interests, including economic ones (see, for instance, Stephen 1991; Bebbington 1996; 1999; Flores and Bello 2003). As such, interventions aimed at increasing social capital and agency among indigenous peoples also deserve serious consideration.

Promoting participation, institutional engagement, and the formation of social capital to address the disadvantaged situation of indigenous peoples will only work where there is a deeper consideration of structural disadvantages and existing constraints to agency. Any given group's ability to act for the common good depends on the nature and quality of the institutions that surround it (North 1990). Cleaver (2005), for instance, suggests that if the lack of physical and material assets, as well as socio-structural constraints, is not addressed before advancing the agency of the poor, social relationships, collective action and local institutions may in fact reproduce the exclusion of the poorest. Structural constraints vary both between and within countries. In the case of rural Mexico, Fox (1996) notes great variation within the broad category of indigenous social capital. Civil society is thin in regions where citizens are subordinated and divided by authoritarian and clientelistic power relations, while it is thick in regions where indigenous movements for local-level political democracy and sophisticated producer and consumer thrive.

The results presented in this paper provide evidence of strong social network effects among indigenous peoples in Mexico, especially in the rural areas. These findings suggest that pilot interventions aimed at changing individual behaviors can have large positive multiplier effects. However, development programs aimed at harnessing this social capital more broadly, for instance by strengthening indigenous peoples' agency, need to understand interactions with less observable factors such as local culture, politics and other context-specific factors best captured by qualitative methods.

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