SOCIAL NETWORKS AMONG INDIGENOUS PEOPLES IN MEXICO

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Abstract: We examine the extent to which social networks among indigenous peoples in Mexico 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. Using data from the 10 percent population sample of the 2000 Population and Housing Census of Mexico and the empirical strategy that Bertrand, Luttmer, and Mullainathan (2000) propose, which allows us to take into account the role of municipality and language group fixed effects, we confirm empirically that social network effects play an important role in the economic decisions of indigenous people, especially in rural areas. Our 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.

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; Psacharo-poulos and Patrinos 1994). 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 that poor people have in abun-

dance (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 Perreault 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). Here we examine the extent to which social networks among indigenous peoples in Mexico have a significant effect on human capital investment and a variety of economic activities and outcomes. These activities and outcomes include 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.

Social capital in such 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, such as 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, thus holding back their members from benefiting from market development (Hoff and Sen 2005, 2). 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 to improve 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 nonindigenous groups.

In consideration of these issues, this article 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, in inhibiting upward mobility among segregated and disadvantaged groups of people (Granovetter 1985), but economists have begun to examine these topics only recently (Montgomery 1991; Lindbeck, Nymberg, Weibull 1999; Lindbeck 1997; Loury 1999; Bertrand, Luttmer, and Mullainathan 2000; Bertrand and Mullainathan 2005; Gibbons 2005; Munshi and Rosenzweig 2006). As Bertrand and colleagues (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, in contrast, 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 to provide 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 nontraditional 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 article, 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 that govern day-to-day life in indigenous communities (e.g., Stephen 1991; Bebbington et al. 1993; Korovkin 1998; Hamilton and Fischer 2003; Cleaver 2005). Such studies typically emphasize specificity at the expense of external validity in that they do not provide a strong basis for formulating economywide policies aimed to provide 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 the work of Bertrand and colleagues (2000), the social network of an individual is characterized by two key di-

mensions: the quantity and the 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) 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 article identifies indigenous peoples using language, which raises theoretical 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, though indigenous in terms of their origins and/or identity, either deny knowledge of an indigenous language and declare Spanish as their native tongue or speak no indigenous language. At the same time, the use of, for instance, self-identification may also lead to underreporting if and when discrimination or social prejudice leads individuals to deny any affiliation with their native origins or at least to downplay their indigenous origins. Because of the way in which census data is collected in Mexico, language variables are the most reliable and objective proxy for differentiating indigenous and nonindigenous households. Self-identification has thus far not been widely used, and indigenous people are typically identified through language use or geographic location.

The evidence reported here suggests that 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.

MODEL AND DATA

Following the work of Bertrand and colleagues (2000), 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 will have more available contacts. The social network of the household can be characterized by two key dimensions: the quantity and the quality of the network. The quantity of the social network, or contact availability (CA), is the fraction of the population in the household's geographic community that speaks

the same indigenous language as the individual. It is formally defined as follows:

$$CA_{L,j} = \frac{\dfrac{N_{L,J}}{N_j}}{\dfrac{N_L}{N}}, \tag{1}$$

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 (N_L/N).[1] The quality of the network is the fraction of the indigenous households in the country speaking the same indigenous language that participated in the economic activity investigated.[2] Thus, the contacts from the same language group with high participation in any given economic activity (e.g., working in handicrafts, working in agriculture) are likely to have a strong influence on the decision to participate in the same activity. In the empirical analysis, the social network variable (SN) is defined as the product of the two variables measuring the quantity and the quality of the network. Specifically,

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

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

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

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 previously; and $X(i)$ is a set of variables summarizing observed individual characteristics. The term δ_L denotes the fixed effects for (or set of

1. The *Catálogo de lenguas indígenas* allows for ninety-one different indigenous codes in Mexico plus three additional codes for other indigenous languages unspecified. Also, in our regressions, we use the log of the ratio of contact availability 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).

2. An alternative definition of the quality of the network may be the fraction of the indigenous households in the community (instead of the country) speaking the same indigenous language and 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.

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 from those related to the networks. The municipality-specific fixed effects absorb all the observed and unobserved characteristics of municipalities, such as access to infrastructure and 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. An 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 defined earlier. This advantage, however, comes at a cost, as census data contain only a limited number of interesting economic activities. With these caveats in mind, the 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 (e.g., 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 television, 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: (1) whether the individual is an internal migrant in the sense that he or she was born in a different state from that in which he or she currently resides (1 = yes, 0 = no; (2) whether the individual is receiving cash transfers from Procampo and/or Oportunidades programs (1 = yes, 0 = no);[3] (3) whether the individual works as an employee or laborer (*empleado o obrero*); (4) whether the individual is employed as a day laborer or unskilled worker (*jornalero o peón*); and (5) whether the individual is 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 twelve and seventeen years of age, we also used the information of whether the child is attending school and working.

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

From 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 as to the degree to which 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 indigenous language spoken, and the municipality of residence. It is important to keep in mind that this empirical approach provides a very conservative estimate of the effect of social networks. Many of the variables that serve as controls in the regression equation (3) may also serve as proxies 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 the variables is likely to include many other factors in addition to networks.

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

RESULTS

Equation (3) was estimated using a linear probability model (ordinary least squares) on the sample of all indigenous individuals contained in the 10 percent population sample of the 2000 Population and Housing Census.[4] To allow for potential differences in the way networks operate according to an individual's gender, equation (3) was estimated separately on the sample of adult males and females between twenty and sixty-five years of age as well as for the sample of teenage boys and girls between twelve and seventeen years of age. In addition, to allow for possible differences in the role of social network effects across rural and urban areas, the male and female samples were divided further into a rural sample that included individuals residing in localities with fewer than 2,500 residents, a semiurban sample that included individuals residing in localities with 2,500–15,000 residents, and an urban sample that included larger localities (more than 15,000 residents).[5]

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

5. 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 on request.

Table 1 Social Network Effects among Indigenous Males and Females

	Males 12–17 years old		
	Rural areas	Semiurban areas	Urban areas
Attending school	−.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 years old		
	Rural areas	Semiurban 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 percent sample).

Note: The t-values are based on robust standard errors corrected for unknown forms of heteroskedasticity.

*$p < 0.10$; ** $p < 0.05$; *** $p < 0.01$.

The results summarized in table 1 suggest that strongly positive and significant effects are at work in the decision of male teenagers, but not female teenagers, to attend school and to work. In fact, network effects among teenage males in these areas are equally strong for school attendance and for work. In the rural areas, social networks appear to influence the decision to send girls to work but not 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 modeling for other children.

The next topic of investigation is the role of social network effects among adult males and females between twenty and sixty-five years of age (see

Table 2 *Social Network Effects among Indigenous Adults 20–65 Years of Age*

Dependent variable	Rural areas	Semiurban 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 or			
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 or			
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 percent sample)

Note: The t-values are based on robust standard errors corrected for unknown forms of heteroskedasticity.

$p < 0.10$; ** $p < 0.05$; *** $p < 0.01$.

table 2).[6] Social networks are believed to play a critical role in the decision to migrate, because one's network of acquaintances lowers not only the costs of migration but also the likelihood of finding 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 United States (see, e.g., 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 or not an individual is a migrant is essentially a measure of internal migration, because it is based on

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6. 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).

a comparison of the current state of residence of the individual with the state in which he or she was born.[7] Our empirical estimates in table 2 confirm that the effect of social networks on internal migration is significant in the rural areas and for adult males in urban areas. Furthermore, the effects are significant for both males and females, with the social network effect higher for adult males than for females in the rural areas.[8]

Our analysis of the role of social network effects in the participation of indigenous peoples in cash transfer programs such as Procampo and Oportunidades reveals that social networks do not play a significant role in participation in 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 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 already be visible. These findings contrast with those of Bertrand and colleagues (2000), who present evidence that social networks based on language spoken at home play a significant role for participation in the U.S. 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 perpetuate rather than alleviate poverty.

As far as employment status, occupation, and sector of employment are concerned, social network effects appear to vary by gender and by location.[9] Overall, the results for males suggest that, on average, social networks do not facilitate employment in nontraditional 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

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

8. 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), whereas other studies suggest that young males' decision to migrate is motivated by a rite-of-passage factor, whereas kinship ties exert more influence on the migration of young females (Kandel and Massey 2002) .

9. Because 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.

Table 3 Social Network Effects among Indigenous Males 20–65 Years of Age

Dependent variable	Rural areas	Semiurban 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/peón	**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 percent sample)

Note: The t-values are based on robust standard errors corrected for unknown forms of heteroskedasticity.

*$p < 0.10$; ** $p < 0.05$; *** $p < 0.01$.

(*jornalero o peón*) in rural and urban areas (see tables 3 and 4).[10] 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 (*empleada/obrera*). 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.

10. 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 smaller sample size of the regressions for females in table 4 compared to those for males in table 3 and for females in table 2 is due to lower female participation in labor market activities.

Table 4 Social Network Effects among Indigenous Females 20–65 Years of Age

Dependent variable	Rural areas	Semiurban 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/peón	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 percent sample)

Note: The t-values are based on robust standard errors corrected for unknown forms of heteroskedasticity.
*$p < 0.10$; ** $p < 0.05$; *** $p < 0.01$.

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 have led to a feminiza-

tion 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 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 do nationally owned firms producing goods for sale in the domestic market (Villarreal and Yu 2007).

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 and electricity in rural areas only.[11] 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 indicating whether the household has no access to piped water inside the premises of its residence or no access to electricity.[12]

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 regression 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 such occupations.

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

CONCLUSIONS AND POLICY IMPLICATIONS

In this article, 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

11. Results using access to sanitation services were very similar to results for access to water; they are not reported here.

12. 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).

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 or 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 (code 41)	**0.028**	**−0.013**	**.0256096**	−.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, and maintenance (codes 52–54)	0.040	−0.019	.0392904	−.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 percent sample)

Note: The t-values are based on robust standard errors corrected for unknown forms of heteroskedasticity.

*$p < 0.10$; ** $p < 0.05$; *** $p < 0.01$.

in 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 effects in the school attendance of indigenous teenage boys and girls in rural areas suggests that educational interventions in 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 modeling for other children.

However, social networks are particularly significant in the decision to migrate in rural and semiurban 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 United States, 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 the reproduction of 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 article 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 indigenous peoples in terms of finding employment especially in off-farm nonagricultural activities (Araujo, de Janvry, and Sadoulet 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 in adopting new production practices, accessing modern health services, and cultivating new crops (e.g., nontraditional 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 such gender differences if they are to be successful.

Last, 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, e.g., Stephen 1991; Bebbington 1996, 1999; Flores and Bello 2003). As such, interventions aimed to increase 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 work only 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 and sociostructural constraints are 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, but it is thick in regions where indigenous movements for local-level political democracy and sophisticated producer and consumer thrive.

The results presented in this article provide evidence of strong social network effects among indigenous peoples in Mexico, especially in rural areas. The findings suggest that pilot interventions aimed to change individual behaviors can have large positive multiplier effects. However, development programs aimed to harness 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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