

# ETHNOLINGUISTIC DIVISIONS AND ACCESS TO CLEAN WATER IN MEXICO

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*Abstract: The existing literature relating ethnic fragmentation to public good provision sheds little light on inequalities in access to public goods across groups, despite the fact that some of the causal factors underlying the hypothesized relationship seem to predict such inequalities. This article seeks to fill this gap by examining the relationship between ethnic fragmentation and both the level and distribution of access to clean water in Mexico, using regression analysis at both the municipal and individual levels for the period 2000–2005. Using the divide between indigenous and nonindigenous people to measure ethnic fragmentation, the results first replicate the general finding in the literature: more fragmented municipalities have worse access to clean water, all else being equal. However, this worse access is not equally distributed. Instead, there is a systematic gap in water access between indigenous and nonindigenous people, even after controlling for fragmentation and other relevant factors. The findings have important implications for future research regarding ethnic fragmentation and public good provision.*

A large and influential literature in political science and economics has established a negative correlation between ethnic heterogeneity and public good provision. That is, the higher the number of ethnic groups occupying a place, the lower the level of public goods provided. Various causal mechanisms have been set forth to explain this relationship (see Habyarimana et al. 2007), but regardless of the causal underpinnings, ethnically homogenous areas seem to do better than heterogeneous areas in outcomes such as crime, education, health, and economic growth (e.g., Alesina, Baqir, and Easterly 1999; Alesina and La Ferrara 2005; Miguel and Gugerty 2005). As a result of the accumulated empirical and theoretical literature, Banerjee, Iyer, and Somanathan (2005, 639) have called the ethnic fragmentation hypothesis “one of the most powerful hypotheses in political economy.”

By focusing on the empirical implications of some of the causal mechanisms hypothesized to be driving this relationship, this article aims to expand the focus of this literature from the level of public goods provision to the distribution of public goods. In economic theory, a pure public good is both nonrival and nonexcludable, meaning that enjoyment of the good by one person does not impinge on another’s enjoyment, and that no one can prevent another person from

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partaking of the good. For pure public goods, therefore, distributional issues tend not be very important, since everyone has equal access (clean air is a common example). In reality, however, very few goods are purely public. Instead, most “public goods” are enjoyed to different degrees by various members of society. For example, a more educated populace is the result of (among other factors) the public good of the education system, but education systems are usually unequal in quality across neighborhoods and regions.

The existing literature on ethnic fragmentation and public good provision sheds little light on the nature of inequalities in access to public goods, and particularly how ethnicity might determine such inequalities. Though some of the causal mechanisms offered in the literature with regard to the relationship between ethnic fragmentation and public goods implicitly suggest certain distributional effects, existing studies focus almost exclusively on average levels of service provision, not on who actually has access to the service. Explaining average levels of service is of course important, but just as with the difference between a nation’s level of economic development and the economic inequality within that country, explaining average levels of public goods provision takes us only so far.

This article examines these distributional issues with respect to the relationship between ethnic heterogeneity and the public good of clean water. Access to clean water is one of the basic requirements for health and development, yet it remains an underprovided public good in much of the world. Only 54 percent of the world’s population has access to water through a household connection to a piped system; this figure rises to 98 percent when considering only developed countries and drops to 46 percent when considering only developing countries (WHO-UNICEF Joint Monitoring Programme for Water Supply and Sanitation 2008). It is also a highly unevenly provided public good. For example, in 2006, only 31 percent of rural dwellers in the world had access to piped water in the home, compared to 78 percent of urban dwellers (WHO-UNICEF 2008, 28).

This article focuses on ethnic fragmentation and water access in Mexico, a microcosm of the inequality of access to water in the world. According to the country’s Population Survey of 2005, there are only 131 municipalities where more than 90 percent of the households have direct access to water—6 percent of the total 2,454 municipalities.<sup>1</sup> On the opposite extreme, in 531 municipalities (20 percent of municipalities) less than 10 percent of the population has direct access to water. These stark differences are also present along ethnic lines. Data from 2000 and 2005 indicate that municipalities with larger indigenous shares of population tend to have less direct access to water than those with smaller indigenous shares of population.

After providing theoretical background as well as relevant details on ethnicity and water provision in Mexico, I first show that the current literature’s focus on average levels of public good provision seems to fall short in accounting for the full effect of ethnic divisions on the pattern of clean water provision at the

1. Direct access to water refers to a household having a connection inside the dwelling to the water network.

municipal level. For any given level of water access in a municipality, indigenous populations fare worse than nonindigenous populations in terms of water access. In other words, the public good of water access is not distributed evenly. Looking at both the average level of provision as well as which groups in particular have access to it provides a more comprehensive understanding of how ethnic fragmentation affects the provision of public goods and their distribution.

I then explore the relationships between ethnic division and water provision more rigorously, using regression analysis to study the effects of ethnicity first at the municipal level and then at the individual level. Using census data from 2000 to 2005 that provide representative samples at the municipal level, I find, like much of the existing literature, that increasing levels of ethnic fragmentation are associated with worse water access at the municipal level. However, I also show that indigenous populations *within* these municipalities systematically have lower water access than nonindigenous populations, conditional on a given level of fragmentation in the municipality.

In addition to clarifying the explanatory power of ethnic fragmentation with regard to water access in Mexico, the results highlight the theoretical and empirical importance of considering issues of distribution when analyzing the relationship between ethnicity and public good provision. In other words, assuming (as the existing literature does implicitly) that public goods are evenly accessed across the population ignores important variation in water access related to ethnicity.

#### THEORETICAL PERSPECTIVES ON ETHNICITY AND PUBLIC GOOD ACCESS IN MEXICO

While the overall relationship between ethnic fragmentation and public good provision has been studied extensively, less attention has been paid to the causal mechanisms underlying the relationship. Habyarimana and colleagues (2007) summarize the mechanisms in the literature and classify them into three categories. The main argument of the first category—commonality of tastes or preferences—is that the availability of public goods is lower because ethnically different groups care about different types of public goods, such as which language to use in schools or the religious holidays that schools should observe (Miguel 2001). The second category centers on common technologies for collective action—like language, culture, and identity—that ethnically homogenous societies can use and ethnically heterogeneous ones cannot. The last category of mechanisms focuses on social punishing or sanctioning institutions that exist within ethnic groups but are not shared across ethnic groups. For example, Fearon and Laitin (1996) argue that ethnic groups have highly developed social network systems that allow the transmission of information about individuals and their past histories. In this way, within groups, people who “exploit the trust of others can be identified as individuals and sanctioned with relative ease by the response of the ethnic community” (Fearon and Laitin 1996, 719). These types of sanctions are likely to be less prevalent across ethnic groups than within them.

These mechanisms help explain why areas with higher ethnic fragmentation might produce lower levels of public goods, and indeed the literature has been

overwhelmingly focused on these levels (e.g., Miguel and Gugerty 2005; Vigdor 2004; Alesina, Baqir, and Easterly 1999). However, many goods provided as public services, such as clean water, are not public goods in the strict sense. Clean water, for example, is subject both to rivalry and excludability. Given limited quantities of clean water, one person's use of that water lowers its availability to another person. And given the equipment and infrastructure necessary to convey clean water across distances and deliver it into households, it is certainly possible for governments to exclude certain people from access or to privilege others. For example, Castro (2004) has analyzed water access in the Mexico City metropolitan area and found large variation between societal groups, variation he attributes to differences in the political power of those groups.

With this in mind, it is interesting to note that implicit in one of the causal mechanisms mentioned above is the possibility that ethnic groups discriminate against one another. A variant of the first category—focused on preferences—is that people have a “taste for discrimination” (Becker 1957), meaning that they will be unwilling to pay for public goods if they think members of other ethnic groups will benefit from them. Alternatively, if the goods are partially excludable, powerful groups may be able to funnel resources toward goods that benefit themselves more than other groups. In the context of ethnic fragmentation, this implies that a full accounting of the effect of ethnic heterogeneity on public good access must include not only an analysis of how these attitudes of discrimination affect the average level of access, but also how they affect the distribution of access. In fact, if this causal mechanism is actually behind the relationship between fragmentation and public good provision, we would expect differences in the level of provision across groups. However, the empirical literature has not focused on this possibility.

A literature that has focused on these types of distributional issues—and is surprisingly infrequently cited in the literature on ethnic heterogeneity and public goods—is the work on racial and ethnic discrimination. Racial discrimination is the allowance of “racial identification to have a place in an individual's life chances” (Arrow 1998, 91). This literature has emphasized the importance of ethnicity in determining access to public goods, but rather than focus on differences in the levels of public goods in different areas, it has documented how certain ethnic groups have unequal access to publicly provided goods in the same area. Lovell (1993), for example, finds that discrimination against blacks in Brazil varies across regions depending on the racial composition of the regions' populations. While discrimination against blacks in southern Brazil is substantial, in northern Brazil, where blacks are more numerous, there is little evidence of discrimination against them. And, as discussed in greater detail below, much research has shown that indigenous people throughout the Americas have been marginalized as a legacy from the colonial period (e.g., Aguirre Beltrán 1979).

As far as I know, no work has examined how ethnic divisions affect both the level and distribution of public goods, even though one of the key causal mechanisms seems to imply that these divisions should affect both. I now turn to examining this relationship in the context of water access in Mexico.

## ETHNICITY, ETHNIC FRAGMENTATION, AND WATER ACCESS IN MEXICO

Making a link between ethnic fragmentation and provision of a certain public good requires two steps. The first is to establish which ethnic divides in a given country are likely to be important. Ethnicity (or the idea of an ethnic group) is a social construction.<sup>2</sup> The literature on ethnic fragmentation and public goods rightly emphasizes the need to study only salient divisions within societies when considering how these divisions might undermine public good provision (e.g., Laitin and Posner 2001; Chandra and Wilkinson 2008). For example, Mexico's ethnic composition consists of several groups that originate from the mixing of indigenous people, whites, blacks, mestizos, *criollos*, and people of other races. Tensions can occur among any of these groups, and of course within them, too. Analysts of ethnic fragmentation in Mexico must therefore decide which divisions are among the most important.

The second step in making this link between ethnic fragmentation and public good provision is to provide an argument about how ethnic fragmentation might actually affect the policy-making process. For example, as discussed above, several of the causal mechanisms that relate ethnic fragmentation to public good provision revolve around issues of collective action. However, if policy making is delegated to bureaucracies or some other executive authorities, it is not clear how societal characteristics might affect it. In other words, if collective action is not part of the policy-making process, why would we think ethnic fragmentation would matter?

The distinction between indigenous and nonindigenous groups is salient in various countries in Latin America, including Bolivia, Colombia, Ecuador, Guatemala, and Venezuela (Yashar 2005). The same is true in Mexico. The indigenous movement in Mexico originated in the 1970s as a demand for recognition of the presence of indigenous peoples in the national society. In 1992, the Constitution (Article 4) was changed to recognize that Mexico was a territory that had been populated before the formation of the nation-state by groups who had their own identities and cultural characteristics. (Before this, the law considered Mexican citizens as ethnically homogeneous.) However, indigenous groups continue to press their case for recognition as culturally distinct. They push for autonomy, not just material benefits from the state. This is perhaps most dramatically evidenced by the Zapatista uprising in Chiapas in 1994, but it is also true about most specific indigenous demands, such as demands for bilingual, bicultural, or intercultural education and demands to establish autonomous political regimes (Pérez Ruiz 2005).

That nonindigenous groups see themselves as culturally distinct from indigenous groups is reflected in a variety of ways. It is revealing that in Mexico, popular usage of the terms *indio* or *india* is pejorative, reflecting not only a sensed

2. Ethnicity is a deeply debated concept, and doing justice to this debate is beyond the scope of this paper. Readers interested in the discussion of ethnicity, its social construction, and how it can be used by the state for the subordination of certain groups may see, for example, Vázquez León 2003; Escalona Victoria 2009; Giménez 2006; Bello 2004; Pérez Ruiz 2005; De la Peña 1995.

difference between indigenous and nonindigenous but nonindigenous superiority (see also Vargas and Flores 2002). In addition, official government agencies implicitly distinguish between indigenous and nonindigenous groups. For example, the Mexican Statistical Agency (INEGI, Instituto Nacional de Estadística y Geografía), in charge of producing the Population and Housing Census, recorded in the 2000 Census whether or not individuals belonged to an ethnic group, but its use of the term *ethnic group* referred only to indigenous groups.<sup>3</sup> In other words, the question implicitly denied that every individual belongs to an ethnic group.<sup>4</sup>

This distinction between indigenous and nonindigenous groups in Mexico has deep historical roots (Yashar 2005; Pérez Ruiz 2005; Otero 2003; Bello 2004; Bello and Rangel 2002; Stavenhagen 2002; Psacharopoulos and Patrinos 1994). Aguirre Beltrán (1979) has argued that race was one of the criteria used for the colonial subjugation of the native population and that despite the great diversity among indigenous groups, a dual society with a dominant (nonindigenous) and a subordinate (indigenous) group emerged from the early colonial system. This societal structure has probably reinforced perceptions of difference over time, as indigenous identity is not only based on self-ascription of an individual's cultural difference but also on definitions imposed by a dominant society (see, e.g., the contributions in Sieder 2002).

A variety of work has documented the inferior socioeconomic position that indigenous people in Latin America have in comparison to nonindigenous citizens, arguing that this difference is the result of discriminatory policies originating in the colonial period (e.g., Bello and Rangel 2002; Delaunay 2007; Stavenhagen 2002). While it is commonly understood that indigenous people during the colonial period faced exclusion, exploitation, and in some cases extermination, it is sometimes underemphasized how they have been continually marginalized since the colonial period. Scholars argue that since the independence period, there have been three main mechanisms through which discrimination against indigenous people has been carried out in Mexico (and in Latin America in general): land distribution policies, the process of state formation, and the developmentalist policies of the new republics (Stavenhagen 2002; Iturralde 2001; Cook and Joo 1995). Each of these has served to maintain the salience of the divide between indigenous and nonindigenous people.

The unequal distribution of land between indigenous and nonindigenous populations was consolidated after independence, when the *criollo* (direct descendants of the Spanish) oligarchies expropriated land from Indian communities

3. The 2000 Population and Housing Census includes the question, "Do you belong to an ethnic group?" (Question 20). However, the census form only included four possible answers: "The individual belongs to an indigenous ethnic group"; "The individual does not belong to an indigenous ethnic group"; "No specific answer"; and "No answer at all." There was no possibility of answering that one was part of a nonindigenous ethnic group.

4. Some studies discuss how the term *étnico* "ethnic" in Spanish has an excluding, discriminatory, and inferior connotation, in the sense that the concept is used to define the others by the ones in a dominant position (Giménez 2006). Pérez Ruiz (2004) discusses how this constitutes a specific type of domination based on cultural differences, justifying the subordination of groups considered culturally different by the dominant groups.

that had previously been allowed to own land for subsistence (Stavenhagen 2002). This resulted in Indians being pushed to remote areas (often arid or mountainous lands or impenetrable jungle), from which they had to migrate in search of temporary jobs as servile labor and peasants.<sup>5</sup> The process of nation building, for its part, included the imposition of foreign cultural values and ways of living, including language, religion, laws, and institutions, and explicit exclusion of Indian cultural and social identity (Hernández Díaz 2009). One example was the imposition of Spanish as the *lingua franca*.<sup>6</sup> Finally, throughout the twentieth century, policies of assimilation and “de-Indianization” were carried out in the name of national development plans, including the imposition of cultural values that denied indigenous people their own cultural identity (Cook and Joo 1995). Rist (2008) argues that from the late 1940s to the late 1970s, the heads of developing countries were eager to become westernized in order to gain access to development, sacrificing self-definition and their own identity. In Mexico, this translated into the indigenous policy of the modernizing period, which focused on ridding indigenous people of their traditions, culture, and language in an effort to assimilate them into the mainstream society (see, e.g., Aguirre Beltrán 1976, 1979).

In recent decades, specifically since the beginning of the 1980s, there has been a turn toward the official recognition of cultural diversity in Mexico, likely as a result of the passage of important international agreements related to respect for the human rights of indigenous peoples (Hernández Díaz 2009; Bengoa 2003; Stavenhagen 2002).<sup>7</sup> However, in a context of marginalization, poverty, and exclusion, the advance of human rights and freedom for indigenous people has been very limited. For example, Delaunay (2007) provides evidence that the large gap in earnings between indigenous and nonindigenous individuals actually increased from 1990 to 2000 in Mexico. Official reports from international development agencies have documented evidence of indigenous groups’ exclusion throughout Latin America in a variety of socioeconomic indicators (see, e.g., CEPAL 2011; PNUD 2010; Hall and Patrinos, 2012; Hopenhayn and Bello 2001).

Why would we expect ethnic fragmentation along these lines to affect water access in particular? The reason lies in the way investments in water infrastructure take place in Mexico. As part of decentralization reform in early 1980s, the federal government transferred the responsibility for water projects and service to states and municipalities. Prior to decentralization the federal government was in charge of all aspects of water service, including financing, construction, technical assistance, administration, operation, and maintenance of water services and projects. Even after decentralization, the federal government still contributes up

5. The Indian peasantry’s landlessness or possession of land only suitable for subsistence agriculture led to agrarian uprisings and revolution in various countries in Latin America in the twentieth century (Stavenhagen 2002).

6. Laitin (2000, 51) argues that the rationalization of language is a part of the Weberian notion of standardization and bureaucratization.

7. This includes the establishment in 1985 of the UN Voluntary Fund for Indigenous Populations, the International Labour Organization’s Convention 169 on Indigenous and Tribal Peoples (which came into force in 1991), and human rights declarations in various United Nations agencies including the UN Declaration on the Rights of Indigenous Peoples adopted in 2007.

to 48 percent of the financing of water infrastructure, given the fact that the reform was not accompanied by decentralization of public finances.<sup>8</sup> Nevertheless, while the federal government's National Water Commission occasionally implements its own projects directly, the predominant way of financing water infrastructure is now through joint projects with states and municipalities. In particular, these joint projects require financial and organizational cooperation from the municipality, providing an arena in which the causal mechanisms discussed above can play out.

For example, in urban areas (defined as areas that have more than 2,500 inhabitants), only municipalities that have established an "operating body" (*organismo operador*) can receive federal financing.<sup>9</sup> These operating bodies are responsible for water service provision (and sewer and water treatment) as well as the initial financing of operational and maintenance costs. They also need to be capable of financing the costs of the expansion of water infrastructure. In addition to any advantage that municipalities with more resources would have in this process, theories of ethnic fragmentation suggest that collective action and burden sharing within a community would present more of a challenge to heterogeneous communities than homogenous ones.<sup>10</sup>

In the case of rural municipalities, federal guidelines for investment projects require that a Regional Commission be formed, in charge of execution, control, and follow-up of programs of water provision (as well as sewer and water treatment). These commissions also have to solicit the project from the federal government, basically providing evidence that there is demand for the infrastructure. Communities have to approve of the project (through a Community Acceptance Act approved through a community committee). Again, this is an area in which disagreements caused by ethnic heterogeneity would play a role and in which issues of discrimination could arise. To the extent that nonindigenous groups have more power in a municipality, they could use that power to funnel scarce water resources toward their own areas. They also might be particularly advantaged in these sorts of negotiations with state and federal governments, since the documents regarding federal programs (detailing how to apply for programs, and so forth) are produced only in Spanish, not in indigenous languages.

Given the salience of the indigenous/nonindigenous divide and the importance of community processes in water access, is there any evidence to support a link between ethnicity and water access in Mexico? Ethnic fragmentation is com-

8. Federal financing depends on the level of marginalization of the municipality as follows: in municipalities with a high level of marginalization, federal investment is up to 48 percent of total cost; in municipalities with a medium level of marginalization, federal investment is up to 30 percent of total cost; and in those with low levels of marginalization, the federal share is up to 18 percent. See "Reglas de operación del programa de infraestructura hidroagrícola, y de agua potable, alcantarillado y saneamiento a cargo de la Comisión Nacional del Agua," *Diario Oficial de la Federación*, August 2, 1999, 54.

9. The 2004 Economic Census reports that the majority of *organismos operadores* (62 percent of the total) provide service to urban areas, whereas the remaining 37 percent provide services to urban and rural areas, mainly consisting of municipal seats (*cabeceras municipales*) and adjacent localities (INEGI 2004).

10. For an example of collective action with regard to water within a homogeneously indigenous community see González Rivas, forthcoming.



monly measured in the literature by an index of ethnolinguistic fractionalization, or ELF, defined as the likelihood that two people chosen at random will be from different ethnolinguistic groups.<sup>11</sup> In this article I calculate an ELF index using the standard definition, which is a Herfindahl concentration index defined as follows, where  $s$  is the share of the ethnolinguistic group  $i$  in municipality  $j$ :

$$ELF_j = 1 - \sum_{i=1}^n s_{ij}^2$$

The more ethnically heterogeneous a municipality is, the higher will be its ELF index. I use two ethnolinguistic groups to capture the ethnic divide discussed above: people who speak an indigenous language and people who do not.<sup>12</sup> The values of this index for Mexican municipalities in 2005 ranged from zero to 0.499 (0.5 is the maximum possible value of this index using two ethnic groups, representing a municipality split evenly between indigenous and nonindigenous people), with an average of 0.082 and a standard deviation of 0.131. In general, the great majority of municipalities have low levels of ethnolinguistic fragmentation; higher values are found in the south and southeast of the country and in specific areas in states of the north such as Chihuahua, San Luis Potosí, and Michoacán.

Table 1 shows examples of how the ELF measure relates to a measure of the size of the indigenous population, indicating that as the indigenous population rises from zero, the ethnolinguistic divide gets larger until the point at which indigenous and nonindigenous populations are equal. This illustrates that ELF and the indigenous variable are measuring different concepts: one value of ELF could capture two different levels of indigenous population. For instance, a municipality with 30 percent indigenous people and 70 percent nonindigenous people has the same ELF value (.42) as a municipality with 30 percent nonindigenous people and 70 percent indigenous people.

At first glance, Mexico's pattern of water access certainly seems both to have an ethnic dimension and to follow the pattern predicted by the existing literature on ethnic heterogeneity and public goods provision. Figure 1 plots the municipal share of households with direct access to water in 2000 against the municipality's ELF index. The figure indicates that as ethnic diversity increases in a municipality, households' direct access to water decreases. This relationship is of course what existing works on ethnic fragmentation tend to demonstrate.

Furthermore, as table 2 demonstrates, the public good of water access is unevenly distributed in Mexico. The first column shows that the average person in a more ethnically fragmented municipality in 2000 had a lower probability of having direct access to water than the average person in a less ethnically fragmented municipality, as the literature would predict. But if we consider the second and

11. In this article I use the terms *ethnic fragmentation* and *ethnolinguistic fractionalization* interchangeably.

12. INEGI recorded 79 languages, including Spanish, in 2000 and 109 languages in 2005. The Mexican government identifies indigenous people on the basis of language. As a government source puts it: "[Language] is the characteristic that distinguishes the indigenous and gives them identity" (author's translation from the INEGI website, <http://cuentame.inegi.org.mx/poblacion/lindigena.aspx?tema=P>).

Table 1 Examples of ELF values for municipalities by level of ethnic fragmentation in 2000

Name of municipality	State	Indigenous share of the population (%)	Value of ELF index
Asientos	Aguascalientes	0	0
San Vicente Coyotepec	Puebla	11	.11
Champotón	Campeche	14	.21
San Baltazar Loxicha	Oaxaca	27	.31
Playa Vicente	Veracruz	36	.41
Santiago Tilantongo	Oaxaca	56	.49
Coyutla	Veracruz	70	.46
Akil	Yucatán	77	.38
Yutanduchi de Guerrero	Oaxaca	88	.23
San Juan del Río	Oaxaca	97	.06

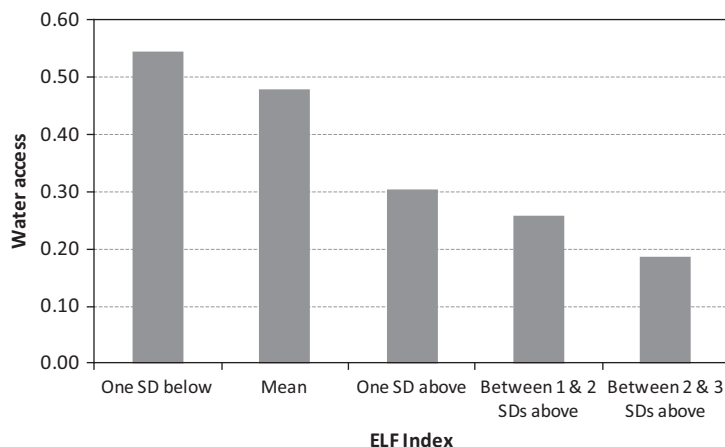


Figure 1 Municipalities' average share of households with direct access to water, by level of ELF index, in 2000. Author's own calculation with data from INEGI, Population and Housing Census 2000.

third columns, which add the dimension of whether or not the individual is indigenous, we can see that the difference in water access between average indigenous vs. nonindigenous people is more than twice the difference attributed to ELF. In fact, the average nonindigenous person living in a highly ethnically fragmented municipality had a higher probability of having access to clean water than the average indigenous person in a more ethnically homogenous municipality. This starkly illustrates the importance of studying distributional issues when analyzing the relationship between ethnic fragmentation and public good provision.

Table 2 Probability of an individual having access to water by individual ethnicity and level of municipal ethnic fragmentation, 2000

Municipal ethnic fragmentation	Average individual	Individual ethnicity	
		Indigenous	Nonindigenous
Above-average fragmentation	0.18	0.12	0.30
Below-average fragmentation	0.37	0.17	0.56

## ANALYSIS OF THE LEVEL OF WATER ACCESS IN MEXICO'S MUNICIPALITIES

This section presents analysis of different factors that potentially determine the level of access to clean water in Mexican municipalities. I analyze the following model, where  $j$  denotes the municipality and  $g$  refers to the state:

$$\text{water}_j = B_1\text{ELF}_j + B_2\text{density}_j + B_3\text{income}_j + B_4\text{migration}_j + B_5\text{indshare}_j + B_6\text{usosycost}_j + B_7\text{president}_j + B_8\text{governor}_g + B_9\text{fais}_j + B_{10}\text{pworks}_j + B_{11}\text{state}_g + \varepsilon_j$$

The dependent variable is the average level of water access in 2000, defined as the percentage of a municipality's households having a connection to the water network inside the dwelling.<sup>13</sup> The independent variables are as follows:

- *ELF* is the index of ethnolinguistic fractionalization, measured in 2000. This term aims to capture the extent of tensions that might exist across ethnically different groups. As discussed above, in this article the ELF index is based on the divide between indigenous and nonindigenous people, measured by spoken language. Based on the existing literature, I expect the coefficient to be negative and significant, showing the negative relationship between ethnic fragmentation and overall access to water in a municipality.<sup>14</sup>
- *density* is measured using the total population in 2000 divided by the area of the municipality in square kilometers. Water infrastructure is expensive, and it tends to be more feasible to provide such infrastructure in areas with highly concentrated populations (Comisión Nacional del Agua 2009, 2010). Thus, it is important to include a variable that captures the effect of population density on progress in water access. The coefficient on population density is expected to be positive and significant.
- *income* is the municipality's average per capita income in 1999, measured using the income from all economic activities captured by the economic census, divided by

13. The average, minimum, and maximum values of municipality water access (the dependent variable) are 32 percent, 0 percent, and 97 percent.

14. Other studies that have linked ethnic groups with better or worse public good outcomes have raised the possibility that results can be due to different preferences among groups (see, e.g., Banerjee and Somanathan 2007). I am not aware of any study that has documented such differences between indigenous and nonindigenous groups. In addition, to the extent that such differences in preference about public goods exist, they reasonably could be expected to be less when dealing with a public good as essential to existence as water (as opposed to schools, roads, etc.).

total population.<sup>15</sup> The positive relationship between income level and infrastructure for water access is a well-known regularity across nations (Briceño Garmendia, Estache, and Shafik 2004). This also seems likely to be true in Mexico, where the level of water access by municipality seems correlated with the state level of per capita income. Thus, the coefficient of the income variable is expected to be positive and significant, indicating that the higher the income in a municipality, the higher the level of water access, all else being equal.

- *migration* is the share of the 2000 population in a municipality that in 1995 lived in a different country. Following the literature on migration (e.g., World Bank 2009, chap. 5), this variable aims at capturing two potentially offsetting effects. On the one hand, out-migration can cause the loss of workers who could increase economic productivity. On the other hand, this loss could be compensated by migrants remaining tightly linked to their home and sending back remittances, information, technology, and good business practices. In addition, if and when they eventually return, migrants bring back expectations of better service provision, because they often have been in places with higher development levels. Therefore, the effect of this variable is difficult to predict.
- *indshare* is the share of indigenous population in the municipality in 2000. This variable is included to control for the fact that municipalities with higher levels of indigenous population tend to have lower levels of water access. Alesina, Baqir, and Easterly (1999) include a similar term (though for African Americans) in their study of ethnic fragmentation in the United States.
- *usosycost* is a dummy variable measuring the *usos y costumbres* governance system in Oaxaca (1 if it is present, zero if not). *Usos y costumbres* is the selection of local leaders via customary rule or traditional electoral practices (as opposed to selection through multiparty systems and secret ballots). In 1995, the state of Oaxaca officially recognized indigenous customary law in municipalities (Eisenstadt 2007). I include this variable to ensure that my measure of the indigenous share of the population is not capturing the effects of indigenous governance practices.
- The model includes two control variables to capture clientelistic dynamics that can affect the provision of water access across municipalities. The first is *president*, which measures the share of municipal votes for Vicente Fox, who became the president of Mexico in the federal election of 2000. Municipalities where a large share of the population voted for the party coming to office may tend to have higher levels of water access than the rest, based on the literature on clientelist governments and patronage, which demonstrates that governments often reward loyal supporters (e.g., Kitschelt and Wilkinson 2007). The second clientelist variable, *governor*, is a dummy measure for whether the state governor belonged to the PAN (Partido Acción Nacional), the party of President Fox. This variable aims to capture the state-level political dynamic that might factor into water provision in municipalities. Specifically, the hypothesis is that federal transfers essential for municipal governments (Hernández Téllez and Villagómez 2000) were distributed favorably to politically loyal municipalities and states (see, e.g., Díaz Cayeros, Estévez, and Magaloni, forthcoming; and Kitschelt and Wilkinson 2007; González Rivas 2012). Thus the coefficients on these two variables are expected to be positive and significant.
- *fais* is the cumulative sum of per capita transfers to municipalities for social infrastructure from the federal government for the period of 1995 to 2000 (FAIS, Fondo de Aportaciones de Infraestructura Social municipal).<sup>16</sup> The aim is to capture the fi-

15. The economic census of 1999 includes the following economic activities: fishing, mining, water-management-related activities, manufacturing, commerce, information, and services.

16. It should be noted that these transfers are meant to fund not only water projects but also general social expenditures such as basic education, health care, social infrastructure, and other municipal so-

financial capacity of municipalities to carry out water projects, since one would expect that municipalities with higher financial capacity would tend to be in better shape to expand their water systems coverage. Therefore the expectation is that the coefficient will be positive and significant.

- *pworks* is a variable that controls for municipal expenditures on general public works for the period 1995–2000. This variable would capture how much municipalities actually spent on public works, including water projects. There is likely to be a correlation between the municipal level of water and municipal spending in previous years, and so the expectation is that the coefficient will be positive and significant.
- Finally, I include a dummy variable for each state, to control for unobserved factors at the state level.

Most data are from the National Population Census of 2000 except *income*, which is from the Economic Census of 1999; the variables *president* and *governor*, which are produced by the Federal Electoral Institute; *usos y costumbres*, which is from Eisenstadt (2011); and the public finance data, which are from INEGI's data set (2012) on public finances in states and municipalities.<sup>17</sup> All variables are in natural log form, except for the state dummies. The model for both years is estimated using ordinary least squares (OLS) estimation.

The results of the regressions regarding the level of water access in 2000 are presented in the first column of table 3. Most important, the variable *ELF* provides evidence supporting the hypothesis that ethnic fragmentation is negatively related to water access at the municipal level, as the coefficient is negative and statistically significant for both years. In terms of substantive effects, an increase of one standard deviation in the *ELF* variable is associated with a decrease of 0.6 percentage points in the level of water access in a municipality.

The coefficient of the population *density* variable is positive and statistically significant for both years, providing evidence consistent with the argument that low population density is a factor that determines water access. The coefficient of the *income* variable is, as expected, positive and significant in both years, reflecting the fact that wealthier municipalities have better water coverage levels. The coefficient of the *migration* variable is also positive and significant in both years, suggesting that the benefits of out-migration outweigh any negative effects on municipalities. The coefficient of the variable *indshare* is also as expected, negative and statistically significant, suggesting that indigenous municipalities have less water access in general. The coefficient of the *usosycost* dummy is not significant. The coefficient of the variable *president* is also positive and significant, providing evidence for a clientelistic benefit in water access, though the coefficient of the variable *governor* is not significant. The coefficient of *fais*, the federal transfers for social infrastructure, is positive and significant, as expected. And finally, the coefficient for the variable of municipal expenditures on public works, *pworks*, was also positive and significant.

To test the robustness of these results, I conducted several additional tests. First, I changed the dependent variable from level of water access in 2000 to level

cial spending (like strengthening local institutions). Data is unfortunately scarce specifically on transfers for water projects.

17. Data were converted to constant 2002 pesos using the Bank of Mexico price index.

Table 3 Results of OLS regression of the level of water access in municipalities

Variable	2000 Coefficient (standard errors)	2005 Coefficient (standard errors)
<i>ELF</i>	-0.037** (0.015)	-0.049*** (0.020)
<i>Density</i>	0.026*** (0.002)	0.025*** (0.003)
<i>Income</i>	0.027*** (0.002)	0.030*** (0.002)
<i>Migration</i>	3.072*** (0.332)	2.94*** (0.421)
<i>Indshare</i>	-0.046*** (0.012)	-0.055*** (0.015)
<i>Usosycost</i>	-0.001 (0.01)	-0.003 (0.012)
<i>President</i>	0.438*** (0.025)	0.437*** (0.032)
<i>Governor</i>	0.069 (0.052)	0.047 (0.066)
<i>Fais</i>	0.003*** (0.001)	0.002* (0.002)
<i>Pworks</i>	0.004* (0.002)	0.006** (0.003)
<i>Constant</i>	0.123 (0.046)	0.184*** (0.059)
R square	0.74	0.67
Observations	2404	2404

Note: Both regressions include state dummies.

\* $p \leq .10$ ; \*\*  $p \leq .05$ ; \*\*\*  $p \leq .01$ .

of water access in 2005.<sup>18</sup> All of the independent variables stayed the same, except for *ELF*, for which data from the Population Survey of 2005 were used. These results are presented in the second column of table 3, and they are largely identical. Second, I changed the dependent variable to the change in water access from 2000 to 2005, and the results were again robust to this specification. Third, using the initial specification, I examined the effects of ethnic diversity in rural versus urban settings (split samples), and the results were similar. Finally, I conducted the analysis using an *ELF* index that accounted for all linguistically different groups (not just indigenous versus Spanish-speaking), and the results were again similar.<sup>19</sup>

In sum, this first set of results demonstrates that even when one accounts for other factors—such as per capita income levels, migration, population density,

18. The average, minimum, and maximum values for this variable in 2005 are 39 percent, 0 percent, and 100 percent.

19. Results are available from the author.

and public finance controls—more ethnically fragmented municipalities experienced lower levels of water access over the period 2000–2005. Before moving to the next section, it is important to note that this represents a significant finding on its own. The literature on ethnic fragmentation has primarily focused on cross-national comparisons of public goods levels. Analyzing the relationship at the subnational level controls for factors that may be unobserved or difficult to measure across countries. Consistent with the cross-national work, the results here confirm the negative relationship between provision of public goods and ethnic fragmentation: municipalities with more homogenous populations have higher levels of water access in Mexico.

#### ANALYSIS OF THE DISTRIBUTION OF WATER ACCESS AT THE INDIVIDUAL LEVEL

If ethnicity affects only the level of public goods provision, then the distribution of that provision should not be influenced by the ethnic identity of potential recipients. This does not seem to be true in Mexico: indigenous people seem to have much worse access to clean water, regardless of the level of ethnic fragmentation in their municipality. This section analyzes this relationship with more rigor, controlling for various other factors that might affect an individual's access to water. In the regressions, I include variables similar to those in the municipal-level model in the previous section, as well as individual characteristics. In particular, the model at the individual level is the following, where  $i$  denotes the individual,  $j$  denotes the municipality, and  $g$  refers to the state:

$$\text{water}_i = B_1\text{ELF}_j + B_2\text{indigenous}_i + B_3\text{income}_i + B_4\text{floor}_i + B_5\text{placesize}_i + B_6\text{migration}_i \\ + B_7\text{president}_j + B_8\text{usosyc}_j + B_9\text{governor}_g + B_{10}\text{fais}_j + B_{11}\text{pworks}_j + B_{12}\text{state}_g + \varepsilon_i$$

The dependent variable is a dichotomous indicator for which 1 means that the individual's home is directly connected to the public water network, and 0 means it is not, for 2000. The regression sample includes only heads of households, to prevent including different members of the same household in the model. The independent variables are at both the municipal and the individual levels.

Five variables measured at the municipality level—*ELF*, *president*, *usosycost*, *fais*, and *pworks*—and two at the state level, *governor* and the state dummies, were included in the previous set of regressions. The theoretical justifications for including them, as well as their predicted effects, are exactly as in the previous section. An additional municipal variable is included in this regression. *Place size* measures the population size of the locality where the individual lives. INEGI (2000) classifies places into seven categories that range from smaller than 2,500 people to above 500,000. Following the argument of the difficulty of reaching small remote areas to provide basic infrastructure, this variable aims at capturing the effect of the size of the population in a locality on improving individuals' direct water access. The expectation is that larger places will tend to have better water access, and therefore the coefficient is expected to be positive and significant.

The rest of the variables are new and measured at the individual level with data from the 2000 Population and Housing Census produced by INEGI:

- *indigenous* is a dummy variable that is coded as a 1 if the individual answered yes to this question on the 2000 Census: "Do you speak a dialect or an indigenous language?" This is the key independent variable in this section, as it identifies indigenous individuals. The expectation is that the coefficient of the *indigenous* variable is negative, following the literature discussed above regarding the lower levels of well-being of indigenous individuals.
- *income* is the individual's total monthly income from labor and other sources. The coefficient of the income variable is expected to be positive and significant, indicating that the higher the income of an individual, the more likely is her/his access to clean water, all else being equal.
- *floor* measures the type of flooring in the house of the individual. It is a dummy variable that is coded as a 1 for housing units with cement, wooden, tile, and other similar flooring materials, and as 0 for housing units with dirt floors. The aim of this variable is to control for the fact that houses with better flooring materials will likely have direct water access; therefore the coefficient of the *floor* variable is expected to be positive and significant.
- *migration* is a variable that captures the place of residence of the individual five years before the census took place. The variable is dichotomous and takes the value of 1 if the individual lived in the United States five years ago. Following the argument of the literature on migration discussed above (and given the results of the previous analysis), the coefficient is expected to be positive and statistically significant, reflecting the increased likelihood that an individual who previously lived in the United States has higher expectations of good governance (World Bank 2009) and therefore is more likely to pressure local government to connect their house to the water network, all else being equal.

The analyses are run separately for each year. The logistic analysis (used because the dependent variable is dichotomous) is conducted with robust standard errors clustered by municipality to control for potential effects from unobserved policies and other factors that might be shared by individuals living within the same municipality. Column 1 of table 4 presents the results for the analysis using Stata 12 MP.

The most important findings for the purpose of this article are the coefficients of the first two variables: *ELF* and *indigenous*. The coefficient of the *ELF* variable is significant and negative, again supporting the hypothesis of the negative relationship between the provision of public goods and ethnic fragmentation. The probability of an individual having direct access to water decreases as the ethnic fragmentation in her municipality increases, when all else is held constant.

While the *ELF* variable corroborates the findings of the previous section, as well as the ethnic fragmentation literature focusing on the level of public good provision, the results for the *indigenous* variable point to the importance of studying the effects of ethnicity on the distribution of public goods. The coefficient on *indigenous* is negative and statistically significant, indicating that indigenous individuals have a lower probability of having direct access to clean water, even when one controls for the level of ethnic fragmentation in the municipality where the individual lives, as well as for other relevant factors. This is a noteworthy finding, as it indicates that ethnic fragmentation affects access to water in Mexico at least at two levels: first at the municipal level affecting the overall level of water access, and then also at the individual level, as access to water is also determined by



Table 4 Results of the logit regression analyses of direct access to water network by the head of households for 2000 and 2005

Variable	2000 Coefficient (robust standard errors)	2005 Coefficient (robust standard errors)
<i>ELF</i>	-0.314** (0.154)	-0.578*** (0.196)
<i>Indigenous</i>	-0.630*** (0.037)	-0.723*** (0.035)
<i>Income</i>	0.045*** (0.001)	
<i>Floor</i>	1.83*** (0.039)	1.74*** (0.04)
<i>Place size</i>	0.912*** (0.032)	1.358*** (0.071)
<i>Migration</i>	0.219*** (0.035)	0.098*** (0.039)
<i>President</i>	1.53*** (0.211)	2.51*** (0.461)
<i>Usosycost</i>	-0.358 (0.100)	0.058 (0.116)
<i>Governor</i>	-0.583*** (0.152)	-0.92*** (0.164)
<i>Fais</i>	0.018* (0.010)	0.40*** (0.016)
<i>Pworks</i>	0.076*** (0.022)	0.028 (0.246)
<i>Constant</i>	-1.650*** (0.183)	-0.872*** (0.203)
Pseudo R square	0.31	0.32
Municipality clusters	2404	2404
Observations	2,069,841	2,925,160

Note: Both regressions include state dummies. Standard errors clustered by municipality.

\* $p \leq .10$ ; \*\* $p \leq .05$ ; \*\*\* $p \leq .01$ .

whether or not an individual is indigenous. The results of the rest of the variables are statistically significant and in the expected directions, with the exception of the control variables *usosycost* and *governor*.

Figure 2 demonstrates how the predicted probability of having water access depends on whether or not one lives in an ethnically fragmented municipality and on whether or not one is indigenous. Based on the results of the regression, the graph shows that, at all potential levels of *ELF* in a municipality, an indigenous individual has a lower probability of having water access than a nonindigenous individual. Although this gap decreases slightly as the level of *ELF* increases, the striking pattern revealed in table 2 still holds even when one controls for other factors: the average nonindigenous individual living in the most ethnically fragmented municipality has a higher probability of having water access than the

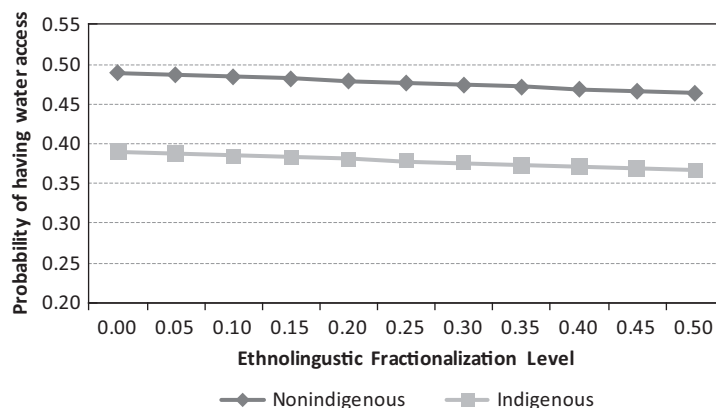


Figure 2 Predicted probability of having water access by level of ethnic fragmentation, 2000. Author's own calculation based on regression in column 1 of table 3.

average indigenous individual in the least ethnically fragmented municipality. In other words, inequality across ethnic groups is more important in determining individual access to water than municipal heterogeneity.

As in the previous section, I ran a series of robustness checks. First, I ran the same regression for 2005, using the 2005 Population Survey produced by INEGI. The only difference in this regression is that *income* was not measured in that survey, so it is not included in the regression. The results are reported in column 2 of table 4, and they are very similar. Second, for the 2000 regression, I use an alternative coding of *indigenous*. The 2000 Census records the answer to the question "Do you belong to an ethnic group?" As discussed above, the operationalization of this question means that it is essentially asking if the person is indigenous. Using this variable instead of the indigenous language variable yields similar results. Finally, as with the municipal regression, I examined the potential differences that might arise from using an ELF index that captures all language groups instead of only indigenous vs. nonindigenous. The findings, again, are very similar.<sup>20</sup>

## CONCLUSION

The literature on ethnic fragmentation and public goods has focused on the average level of public goods provision. While important, this approach has ignored the possibility that public goods may be distributed unequally in ways also affected by ethnicity. This article provides evidence of the usefulness of looking at the effects of ethnic divides on both the average levels and the distribution of public goods, looking specifically at the case of water access in Mexico.

The findings confirm what most of the existing literature has established: mu-

20. Results are available from the author.

municipalities with higher levels of ethnic fragmentation have lower levels of water provision. However, in contrast to much of the literature, I also demonstrate that certain groups systematically have worse access to these varying levels of provision. Controlling for a variety of other relevant factors, I have shown that indigenous populations experience lower levels of water access than nonindigenous people. While this is not technically evidence of discrimination, it does indicate a process that negatively affects only the indigenous group.<sup>21</sup> These sorts of processes have been absent in the analysis of ethnolinguistic fractionalization in the literature to date. Yet the results here indicate that if one is to identify the effects of ethnic divisions on public good provision at the individual level, one must take these inequalities into account.

While this study has focused on Mexico, there seems little theoretical reason to think that similar dynamics would not be at work in other countries. As mentioned above, the indigenous/nonindigenous distinction is salient in some other Latin American countries, and to the extent that indigenous groups have historically been disadvantaged in those countries, one would expect dynamics similar to those seen in Mexico; this obviously warrants further study. However, it is important to note that the general theoretical point of this article is broader than the indigenous/nonindigenous divide. While the indigenous/nonindigenous split may not be salient in many countries, multiethnic countries almost always have hierarchies among ethnic groups (e.g., Stewart 2008). The message of this article is that if the literature on ethnic fragmentation is to fully address the effects of fragmentation on individuals in different countries, it will need to address these inequalities.

In particular, the results here point to the importance of conducting research on the mechanisms by which indigenous populations and other groups continue to be disadvantaged with respect to public good provision. In particular, future research should focus on how public resources are distributed for public works and infrastructure within municipalities, and to what extent local government decision making is discriminatory. If ethnic fragmentation reduces public good provision, the results here suggest that those lower levels are not distributed evenly throughout the population. How are these decisions made, and what factors result in more even divisions across groups? These are essential questions for which there are not good answers in the literature.

These questions are also critical for policy recommendations arising out of the ethnic fragmentation literature. The literature has tended to be somewhat vague about policy conclusions, perhaps partly because the exact mechanisms causing the negative correlation between fragmentation and lower public good provision have been unclear. As research continues into these mechanisms, policy recommendations should improve. Habyarimana and colleagues (2007), for example, suggest that their experimental results support rejecting measures to separate ethnic groups and instead adopting policies to facilitate repeated interactions and

21. As Arrow (1998) points out, the passage of legislation that prohibits any form of discrimination—while potentially improving the conditions of groups in a society—makes it more difficult to directly observe discrimination, because people make efforts to hide discrimination.

improved flow of information among ethnic groups. While this approach represents an important advance in policy recommendations for improving public good provision in ethnically heterogeneous environments, it ignores the possibility of systematic differences between ethnic groups in access to the policy-making process. The effects of improving the flow of information between two groups are likely to be quite different in scenarios in which those groups are equal in terms of their power, and scenarios in which they are not. In cases in which they are not, additional policies may be necessary to ensure that power asymmetries are reduced and that inequalities in provision are corrected. In Mexico, for example, it may be helpful for the government to encourage more interaction between indigenous and nonindigenous groups. Arguably more important, the government should also take direct measures to ensure that indigenous groups are players in the policy process equal to their fellow nonindigenous citizens.

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