THE EFFECTS OF HABITAT ON BASIC INFRASTRUCTURE

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Abstract

The social program Habitat was created to overcome the challenges presented in the marginalized urban areas in Mexico due to high concentrations of poverty. This paper presents the results of an impact evaluation of the effects of Habitat on basic infrastructure during the first two years of implementation using Census data. The evaluation uses a quasi-experimental approach based on propensity score matching to create comparison groups similar to the intervention groups in 3 components: (1) access to drinking water, (2) access to sewage and drainage, and (3) access to electricity. We estimate Habitat's impact using a difference-in-differences estimator for each of the three infrastructure components. We find evidence that Habitat intervention increased access to sewage about 3 percentage points more in the intervention group than in similar comparison polygons, but it did not have a statistically significant effect in access to drinking water or electricity.

I. INTRODUCTION

In the cities and urban areas of Mexico, privileged and developed areas coexist with areas in need of basic infrastructure, which has created socioeconomic differences across these areas The social program Habitat was created to overcome the challenges presented in these marginalized urban areas. The Ministry of Social Development (Secretaría de Desarrollo Social, SEDESOL) has operated the program since 2003. Habitat's goal is to overcome urban poverty by improving basic infrastructure, urban facilities, and public services in poor neighborhoods at the same time that it expands residents' access to social services. The program is based on a *community-driven (bottom-up)* approach, which has been increasingly used in social development programs. First, the program is *demand driven* in the sense that the local goverments propose the projects they want to implement. Second, it functions like a *social investment fund*, since the local goverments and to a lesser extent the beneficiaries match the funds provided by the federal goverment. The idea behind this approach is that when local entities choose the projects to implement, the chances of matching needs to available programs increases, which does not occur with the *top-down* development model.

This paper presents the results of an impact evaluation of the effects of Habitat on basic infrastructure. We used data from the Census 2000 (XII Censo General de Población y Vivienda 2000) and from the Conteo 2005 (II Conteo de Población y Vivienda 2005), which produces basic sociodemographic information between each census. With these data sets, we can evaluate only the first two years (2003 and 2004) of Habitat's implementation and can focus on only three infrastructure components: (1) access to drinking water, (2) access to sewage and drainage, and (3) access to electricity. The evaluation uses a quasi-experimental approach based on propensity score matching to create comparison groups similar to the intervention groups.

Households in poverty are Habitat's target population. To serve this population, the program created groups of neighboring blocks in which the majority of the households were poor and had a deficit of infrastructure services. These groups of neighboring blocks are called *polygons* or *priority attention zones* and are the units eligible to receive program benefits. In 2004, a total of 3,125 polygons were identified in all the cities or metropolitan areas in Mexico, and approximately 30 percent of them have participated in the program. In this evaluation, we use as a potential comparison group all polygons that did not implement any project with Habitat's assistance in 2003 and 2004. We estimate Habitat's impact using a difference-in-differences estimator for each of the three infrastructure components. For example, to assess the impact on access to sewage or drainage, we compare the change from 2000 to 2005 in the percentage of households without connections to sewage in the treatment group and in the selected comparison group.

Section II describes the program in more detail. Section III describes the data available for the evaluations. Section IV describes the methodology, and Section V presents the results. Finally, Section VI presents our conclusions.

II. PROGRAM DESCRIPTION

A. Target Population

Habitat's objective is to improve living conditions of the marginalized urban population. It focuses on cities or metropolitan areas with more than 15,000 people. Within each of these cities, SEDESOL identified polygons or priority attention zones (*Zonas de Atención Prioritaria*, ZAPs) eligible to receive program support. These polygons are groups of neighboring bocks with more than 50 percent of the households living in poverty. In cities in which this condition could not be met, polygons could include neighboring blocks in which 30 percent of the households are considered to be living in poverty. The selection of polygons gave priority to areas with (1) the highest deficit in terms of access to drinking water, drainage, street lighting, paving, and collection and disposal of solid waste; (2) the highest population density; (3) the highest environmental vulnerability; and (4) the most advanced and complete community development plans.

Based on the selection criteria mentioned earlier, in 2003, SEDESOL identified 2,763 polygons eligible to receive program support. In 2004, field studies were conducted to verify the eligibility criteria, and SEDESOL identified 3,125 polygons eligible to receive support. Although polygons are the focus of the program, they are not administrative entities. Therefore, the corresponding municipality is responsible for administering the funds and implementing the projects.

B. Program Structure

Habitat is a comprehensive program that supports actions in areas such as urban development and risk prevention, urban planning, and social and community development. Habitat finances projects in the polygons that fall into eight categories, called modalities:

1. ***Social and Community Development.*** The programs strengthen the social net within the communities.
2. ***Opportunities for Women.*** The goal is to broaden women's access to jobs and to develop their skills.
3. ***Security for Women and the Communities.*** The assistance emphasizes the prevention of violence against women.
4. ***Neighborhood Improvement.*** The goal is to improve basic infrastructure and services.
5. ***Risk Prevention and Environmental Improvement.*** The goal is to reduce the vulnerability of the households to risks from natural disasters.
6. ***Habitat Development Agencies.*** The agencies promote actions to improve the development, sustainability, and security of the cities.

7. *Land for Housing and Urban Development.* This program supports the regularization of land and acquisition of land appropriate for housing development.

8. *Urban Development and City Image.* The goal is to support the preservation or rehabilitation of historic landmarks.

C. Funds Allocation

Program resources (federal funds) are allocated annually in two stages. The first stage is distribution by state and by city. Habitat resources are initially distributed among the 31 states and the Federal District according to a formula based on need (poverty index by city, services deficit, and level of urbanization). The funds authorized in the preceding year and the area's performance are also taken into account. The cities that received program support in the preceding year have priority in the allocation for a three-year period. The border cities have a separate share of the funds assigned to them, and within them the same allocation process is followed.

The program requests that either state or municipal governments provide comparable funding. Therefore, in the second stage, after funds have been assigned to the cities, representatives of the federal, state, and municipal governments negotiate the final subsidies the municipalities will have for implementing projects in the polygons. These negotiations include consideration of previous support, demographic indicators, marginalization, and the availability of comparable funds from the local government.

D. Investment Development

Habitat was first implemented in 2003. Table II.1 presents the program's investment evolution during the first four years of operation disaggregated by modality. We can see that the program has concentrated its spending in improvement of neighborhoods (59 percent) and to a lesser extent in community development (10 percent), urban equipment (9 percent), and land for housing (9 percent). These data indicate that the program has focused on satisfying the infrastructure needs of the communities.

The improvement of neighborhoods modality includes projects to improve the access to drinking water, electrification, sewage and drainage, pavement, sports facilities, and preservation and ecological protection of the polygons. Table II.2 presents the distribution of the investments within the improvement of neighborhoods modality. We can see that this modality has concentrated almost 60 percent of its resources in pavement and urbanization programs and almost 25 percent in sewage or drainage, drinking water, and electrification programs. During 2003 and 2004, almost 18 percent of Habitat's total expenditure went for the three types of projects we will evaluate in this study (drinking water represents around 5.5 percent of the total, sewage 10.1 percent, and electrification 2.2 percent).

TABLE I.1

TOTAL REAL INVESTMENT BY MODALITY, HABITAT 2003–2006

	2003		2004		2005		2006		2003–2006	
	Pesos	Percentage	Pesos	Percentage	Pesos	Percentage	Pesos	Percentage	Pesos	Percentage
Agencies of Habitat Development	43,668	2.2	82,836	2.2	96,885	2.4	88,160	2.4	311,549	2.3
Social and Community Development	157,843	8.0	242,588	6.3	498,743	12.1	497,802	13.7	1,396,976	10.3
Urban Equipment and City Image	N.A.	N.A.	340,790	8.9	425,994	10.4	403,697	11.1	1,170,481	8.7
Improvement of Neighborhoods	1,064,083	54.2	2,313,932	60.3	2,411,847	58.7	2,122,477	58.6	7,912,339	58.5
Opportunities for Women	124,608	6.3	144,588	3.8	213,278	5.2	174,019	4.8	656,494	4.9
Risk Prevention and Environmental Development	86,229	4.4	191,488	5.0	274,190	6.7	181,234	5.0	733,140	5.4
Security for Women and its Communities	N.A.	N.A.	N.A.	N.A.	74,575	1.8	89,002	2.5	163,576	1.2
Land for Social Housing and Urban Development	486,918	24.8	519,603	13.5	111,513	2.7	66,880	1.8	1,184,914	8.8
Total	**1,963,349**	**100.0**	**3,835,825**	**100.0**	**4,107,025**	**100.0**	**3,623,271**	**100.0**	**13,529,470**	**100.0**

Sources: Habitat projects data base 2003, Habitat projects data base 2004, Habitat projects data base _2005, Habitat projects data base _2006.

Note: Total real investment reflects the sum of federal, state, municipal and other actors contributions. All units are thousands of pesos of 2005, deflected using the price index implicit from GDP.

TABLE I.2

REAL TOTAL INVESTMENT WITHIN IMPROVEMENT OF NEIGHBORHOODS BY PROJECTS, HABITAT 2003–2006

	2003		2004		2005		2006		2003–2006	
	Pesos	Percentage	Pesos	Percentage	Pesos	Percentage	Pesos	Percentage	Pesos	Percentage
Environmental Protection and Preservation	30,428	2.9	40,281	1.7	154,793	6.4	106,747	5.0	332,249	4.2
Drinking Water	136,322	12.8	205,842	8.9	175,905	7.3	137,100	6.5	655,169	8.3
Sewage	161,789	15.2	389,177	16.8	325,753	13.5	178,084	8.4	1,054,803	13.3
Urbanization	185,162	17.4	534,714	23.1	580,187	24.1	493,628	23.3	1,793,690	22.7
Paving	315,117	29.6	817,495	35.3	822,642	34.1	887,958	41.8	2,843,212	35.9
Electrification	60,570	5.7	84,165	3.6	59,606	2.5	56,407	2.7	260,748	3.3
Sports Infrastructure	51,508	4.8	75,235	3.3	53,508	2.2	79,525	3.7	259,776	3.3
Social Assistance and Community Services	84,222	7.9	167,023	7.2	234,452	9.7	182,076	8.6	667,773	8.4
Urban Development	38,966	3.7	N.A.	N.A.	5,000	0.2	952	0.0	44,919	0.6
Total Improvement of Neighborhoods	**1,064,083**	**100.0**	**2,313,932**	**100.0**	**2,411,847**	**100.0**	**2,122,477**	**100.0**	**7,912,339**	**100.0**

Sources: Habitat projects data base 2003, Habitat projects data base 2004, Habitat projects data base _2005, Habitat projects data base _2006.

Note: Total real investment reflects the sum of federal, state, municipal and other actors contributions. All units are thousands of pesos of 2005, deflected using the price index implicit from GDP.

III. DATA

This evaluation is based on Mexican census data. Baseline data come from the Census 2000 (*XII Censo General de Población y Vivienda 2000*) and follow-up data come from the Conteo 2005 (*II Conteo de Población y Vivienda 2005)*. The impact indicators for drinking water, sewage, and electricity were based on information from these two sources, as described in Table III.1. The unit of evaluation is the polygon. To construct the impact indicators at the polygon level, we used census data at the block level (*manzana*) and aggregated the information of all the blocks belonging to each polygon. SEDESOL updated the polygon definition from 2003 to 2004 as a result of more accurate information. Therefore, in this evaluation we used the 2004 polygon definition, which is the one currently used by Habitat.

TABLE III.1

VARIABLES FROM THE CENSUS 2000 AND CONTEO 2005
THAT WERE USED TO CONSTRUCT THE IMPACT INDICATORS

Access to	Variables from the Census 2000 and Conteo 2005	Impact Indicator
Drinking Water	Percentage of households without drinking water inside the house	Change in the percentage of households without drinking water inside the house from 2000 to 2005
	Percentage of households without drinking water within the property	Change in the percentage of households without drinking water within the property from 2000 to 2005
Sewage or Drainage	Percentage of houses without sewage connection	Change in the percentage of houses without sewage connection from 2000 to 2005
Electricity	Percentage of households without electricity	Change in the percentage of households without electricity from 2000 to 2005

Treatment or intervention groups were defined based on information from the Integral System of Information of Social Program Interventions (*Sistema Integral de Información de Programas Sociales, SIIPSO*), which provides information related to the projects supported by Habitat. We identified the polygons that received support to implement projects related to drinking water, sewage, and electrification during 2003 or 2004.[1] Using the 2004 polygon definition, we identified 217 polygons that implemented projects related to drinking water, 306

[1] Since the Conteo de Población was implemented in October 2005 and Habitat assigned the funds for its 2005 operation during the summer, the projects implemented by Habitat in 2005 were not included in the evaluation since it is unlikely that we would see any effect of these projects by October 2005.

polygons that implemented projects related to sewage, and 139 polygons that implemented projects related to electricity.[2] Table III.2 presents sample sizes of the intervention groups.

TABLE III.2

SAMPLE SIZES OF THE INTERVENTION GROUPS

	Drinking Water Intervention Group	Sewage Intervention Group	Electricity Intervention Group
Number of polygons supported by Habitat only in 2003	46	46	35
Number of polygons supported by Habitat only in 2004	141	228	91
Number of polygons supported by Habitat in 2003 and 2004	30	32	13
Total number of polygons intervened	**217**	**306**	**139**

[2] Not all the polygons defined in 2003 were so defined in 2004. To identify the polygons that had implemented projects in 2003 using the definition of 2004, we assumed that if a polygon had implemented a project in 2003 then all the blocks received the intervention. Using the definition of 2004, we generated the percentage of blocks intervened in 2003. We classified a polygon as intervened in 2003 if 100 percent of the blocks belonging to it were intervened. Most of the polygons had either 0 percent or 100 percent intervention in 2003, only seven fell in a mid range, and none of them had intervention in drinking water, sewage, or electricity. Therefore, they were classified as non-intervened.

IV. METHODOLOGY

The goal of this evaluation is to measure Habitat's impact on access to drinking water, sewage, and electricity. We analyzed each of these interventions separately. To measure Habitat's impact on households within polygons that received its assistance, we need to compare what happened in these areas after the intervention with what would have happened in these areas without Habitat's assistance. This last scenario, the counterfactual, is unobserved. Hence, in this evaluation, we selected a comparison group similar to the group that received the intervention to represent the counterfactual.

For each of the three interventions studied, we selected a comparison group similar (according to characteristics from the Census 2000) to the group that received the intervention using propensity score matching.[3] The difference between what we observed in the intervention group and what we observed in the selected comparison group represents our impact estimator. We should keep in mind that the indicators are measuring the change in access to each service from 2000 to 2005; therefore, we are using a difference-in-differences impact estimator.

Given that propensity score matching, as is true for any quasi-experimental method, cannot guarantee that participants and the comparison group are similar on unobserved characteristics, we used two potential comparison groups to estimate the impacts for each intervention. The two comparison groups can have different unobservable characteristics; therefore, comparing the estimated impacts of each group allows us to have some robustness or sensibility check with respect to unobserved characteristics. An additional advantage of using two potential comparison groups is that the matching procedure has two opportunities to work, since ex ante we do not know if we would be able to find comparison groups that are similar to the intervention groups.

We first describe the potential comparison groups from which we will draw the matched comparisons. Then, we describe the methodology and present evidence that the intervention groups and the selected comparison groups are similar based on data from the Census 2000.

A. Potential Comparison Groups

The two potential comparison groups were defined as follows:

Comparison Group 1: This potential comparison group is the same for the three interventions. It includes all the polygons defined in 2004 that did not receive support from the program in 2003 or 2004 for any type of project. We identified 2,350 of such polygons.

Comparison Group 2: The second comparison group is not the same for all the interventions.

[3] Propensity score methods are discussed in Rosebaum and Rubin (1983, 1985), Dehejia and Wahba (1999, 2002), and Smith and Todd (2005).

- The potential comparison group for the **drinking water intervention** includes all the polygons that did receive Habitat's assistance in some modality but did not use the funds for projects related to access to drinking water. We identified 674 such polygons.

- The potential comparison group corresponding to the **sewage and drainage intervention** includes all the polygons that received Habitat's assistance in some modality but did not use the funds for sewage and drainage projects. We identified 585 such polygons.

- The potential comparison group corresponding to the **electricity intervention** includes all the polygons that received Habitat's assistance in some modality but did not use the funds for electricity projects. We identified 752 of such polygons.

The appendix presents Tables A1 to A3 that compare the characteristics of the intervention and potential comparison groups. We find that for the three interventions (drinking water, sewage, and electricity), the mean characteristics of the intervention group are significantly different from those of the two potential comparison groups. Therefore, our objective is to use the propensity score matching method for each of the intervention groups and potential comparison groups to find comparison groups that are similar to the corresponding intervention group.

B. Method for Selecting Comparison Groups

Propensity score matching uses the propensity score, which estimates the probability of participation in the intervention, to determine if two polygons are similar, but several algorithms are used to select the comparison group. Given that the impact estimations could differ depending on the selected algorithm, for this study, we used the following three algorithms to verify the consistency of the results:

- **Nearest neighbor with replacement.** This method assigns to each intervention polygon the comparison polygon whose propensity score is closest to the propensity score of the intervention polygon. In the estimations presented in this paper, we did not impose any restrictions of common support. However, we also produced the estimations restricting to common support, and they give very similar results to the ones presented here.[4] Thus, each intervention polygon was assigned a comparison polygon, but since we allowed for replacement, a comparison polygon could have been assigned to more than one intervention polygon. As part of the matching procedure, we assigned weights to the comparison polygons based on the number of times the polygon was matched. Each comparison polygon had a weight corresponding to the number of times it was assigned to an intervention polygon.

- **Three nearest neighbors with replacement.** This method assigns to each intervention polygon the three nearest comparison polygons based on the estimated propensity score. The advantage of this algorithm over the nearest neighbor is that

[4] Heckman, Ichimira, and Todd (1998) and Heckman, LaLonde, and Smith (1999) discuss common support issues in detail.

having a greater number of comparison polygons increases efficiency (or power). The trade-off is that selecting comparison polygons that are less similar to the intervention polygon may increase the bias. To address this issue, we restricted the selection of polygons to be within certain neighborhoods (caliper), and the difference in the propensity score index had to be within 0.10 of the standard deviation of the corresponding propensity score index. We also restricted the sample to have common support. Given these restrictions, not all the intervention polygons had comparison polygons assigned; in general, we were able to match 90 percent of the intervention polygons. With this algorithm each intervention polygon was matched to at most three comparison polygons or fewer if the restrictions were binding. Matched comparison polygons were given a weight corresponding to one divided by the number of comparison polygons matched to the corresponding intervention polygon (e.g., if two comparison polygons were matched to one intervention polygon, the weight for each comparison polygon was ½). Since we also did the matching with replacement, one comparison polygon was possibly matched to more than one intervention polygon. In those cases, we added the weights of each match (e.g., if polygon X was used as a match for two intervention polygons and the corresponding weights are ½ and 1/3, then the weight of X is ½+ 1/3 = 5/6).

- **Local linear regression.** This method uses all the comparison polygons within a certain bandwidth around an intervention polygon to calculate the impact by means of a weighted regression. The weights are a function of how near the comparison polygons are to the intervention polygon. This algorithm also improves the efficiency of the estimator at the cost of possible bias.[5]

Propensity Score Estimation

We analyzed each intervention separately. For each of the three interventions, we selected comparison groups within each of the two potential comparison groups (six models). The propensity score was estimated with a logit model in which the dependent variable was an indicator of whether the polygon received the intervention. The set of independent variables included in each specification differs for each of the six models estimated. We included variables that were correlated with the probability of participation and with the outcome variable corresponding to that intervention. We used a stepwise procedure to determine the variables of the Census 2000 that were correlated with the probability of participation and with the value of the outcome variable in 2000 (e.g., for the electricity intervention, we included the variables related to the probability of participation and the variables correlated to the level of electricity in 2000, such as having electric appliances). We also included variables at both the polygon and municipality levels to account for similarities in the surrounding areas.

Furthermore, we included some political variables in the logit models to account for possible political favoritism. As described earlier, part of the process for selecting the polygons that receive Habitat's support depends on negotiations among the municipality, the state, and the program operators. It can be said that political favoritism may play a role in this selection

[5] Smith and Todd (2005) and Caliendo and Kopeining (2005) discuss this method in more detail.

procedure. Therefore, to address this possibility, we used data from the results of the latest municipal and state elections previous to 2004 and created two political variables at the municipal level that we included in the estimations.[6] We created a variable that we called the *electoral competition index*, which corresponds to the percentage of votes that the second place finisher received divided by the percentage of votes that the winner received. We also created an indicator variable of whether the same party was holding office at the municipal level and at the state level. These two variables may capture political favoritism toward the municipalities that are governed by the same party as the corresponding state or when political competition is high so that the municipal president delivers some "pork" to the constituency. In some models, we also included interaction between these two variables.

Aside from the political variables, all other variables included in the estimations were taken from the Census 2000. The list of variables included in each model can be seen in the appendix tables that present the balancing tests for each model.

C. Selected Comparison Groups

We used propensity score matching methods to select comparison groups similar to each of the intervention groups studied. For each intervention group, we selected two comparison groups:

- ***Comparison Group 1.:*** This group includes the polygons that did not implement any project with Habitat's support in 2003 or 2004.
- ***Comparison Group 2.*** This group includes the polygons that implemented some project with Habitat's support in 2003 or 2004, but the project was not related to the corresponding intervention.

Balancing tests confirmed that the selected comparison groups were similar to the intervention groups according to the data from the Census 2000. Tables IV.1 to IV.3 show the means of some of the key variables in 2000 for the intervention and comparison groups selected by the algorithm of nearest neighbor. For example, Table IV.1 shows that for the drinking water intervention group, the percentage of households without drinking water in the house was 56.7 percent, which is similar to the percentages in the two selected comparison groups (57.1 percent and 57.3 percent). We can see that the differences between the intervention and comparison groups tend to be small and not statistically significant. Tables with the complete list of variables and balancing tests are presented in the appendix.

To assess the balance between the intervention and selected comparison groups, we performed t-tests of equality of means in the complete sample and in each of the quartiles generated by the corresponding propensity score. In general, we did not find consistent and systematic differences between intervention and comparison groups. Although some of the tests found significant differences especially at the fourth quartile, this could result from sampling

[6] The information used comes from the databases of local elections maintained by the Centro de Investigación para el Desarrollo, A.C.

error given that the tests were performed multiple times. Furthermore, none of these differences seems to be systematic. We will present a summary of those tests for the nearest neighbor algorithm that gave us the most differences of the three algorithms.[7]

Drinking Water Intervention. We do not find statistically significant differences at the 5 percent level between the intervention and the two comparison groups in any of the 40 variables included in the propensity score. Table IV.1 shows that in 2000, access to drinking water was similar in these groups: the percentage of households without drinking water in the house for the intervention group was 56.7 percent, 57.1 percent for comparison group 1, and 57.3 percent for comparison group 2. We do not find significant differences in the percentages of households that did not have access to drinking water on the property: 21.9 percent for the intervention group, 25 percent for selected comparison group 1, and 22.1 percent for selected comparison group 2.

TABLE IV.1

MEAN CHARACTERISTICS OF THE DRINKING WATER INTERVENTION AND THE TWO COMPARISON GROUPS SELECTED BY NEAREST NEIGHBOR MATCHING, DATE FROM CENSUS 2000

Characteristics	Drinking Water Intervention Group	Selected Comparison Group 1	Selected Comparison Group 2
Percentage of households without drinking water in the house	56.7	57.1	57.3
Percentage of households without drinking water on the property	21.9	25.0	22.1
Number of households without water in the bathroom	2,271.6	1,345.6	1,351.5
Number of households without drinking water in the house	2,097.1	1,125.1	1,169.6
Number of households without drinking water on the property	597.0	396.9	449.7
Percentage of households without bathrooms	9.6	9.9	12.5
Percentage of households without water in the bathroom	65.4	65.9	65.8
Number of households	4,030.1	2,348.5	2,197.5
Number of polygons	**217**	**149**	**153**

*Statistically significant difference at the 10 percent level.
**Statistically significant difference at the 5 percent level.
***Statistically significant difference at the 1 percent level.

[7] Because of the restrictions imposed on the other two algorithms, common support and bandwidth, the balance was better achieved in these cases at the cost of losing some observations of the intervention group.

Sewage Intervention. Out of the 35 variables included in the propensity score model, we find only one variable (houses with access to sewage in the municipality) with statistically significant differences at the 5 percent level between the intervention and the two comparison groups. Table IV.2, shows that in 2000, the percentage of houses without connection to sewage was 43.8 percent in the sewage intervention group, 45.9 percent in the selected comparison group 1, and 41.9 percent in the selected comparison group 2. The differences are not statistically significant at the 5 percent level.

TABLE IV.2

MEAN CHARACTERISTICS OF THE SEWAGE INTERVENTION AND THE TWO COMPARISON GROUPS SELECTED BY NEAREST NEIGHBOR MATCHING, DATE FROM CENSUS 2000

Characteristics	Sewage Intervention Group	Selected Comparison Group 1	Selected Comparison Group 2
Percentage of houses without sewage connection	43.8	45.9	41.9
Percentage of households without water in the bathroom	63.9	25.0	22.1
Number of households without water in the bathroom	1,967.3	1,298.4	1,306.8
Percentage of households without bathrooms	7.6	7.8	7.9
Number of households	3,422.2	2,164.1	2,235.8
Number of polygons	**306**	**219**	**191**

*Statistically significant difference at the 10 percent level.
**Statistically significant difference at the 5 percent level.
***Statistically significant difference at the 1 percent level.

Intervention on Electricity. Out of the 45 variables included in the propensity score model, we find only three variables[8] with statistically significant differences at the 5 percent level between the electricity intervention group and the two comparison groups. The differences in access to electricity are not statistically significant in 2000 and the percentage of households without electricity in the electricity intervention group is 6.4 percent, 8.2 percent in the selected comparison group 1, and 7.4 percent in the selected comparison group 2.

[8] The square of the number of households without electricity, the number of households with illiterate head of household, and the percentage of households without a blender.

TABLE IV.3

MEAN CHARACTERISTICS OF ELECTRICITY INTERVENTION AND THE TWO COMPARISON GROUPS SELECTED BY NEAREST NEIGHBOR MATCHING, DATA FROM CENSUS 2000

Characteristics	Electricity Intervention Group	Selected Comparison Group 1	Selected Comparison Group 2
Percentage of households without electricity	6.4	8.2	7.4
Number of households without blender	787.6	713.5	591.5
Number of households without electricity	126.4	91.9	143.9
Number of households without refrigerator	1,699.9	1,125.1	848.9*
Percentage of households without refrigerator	41.6	41.7	41.4
Number of households	5,317.4	2,592.7	2,668.1
Number of polygons	**139**	**92**	**101**

*Statistically significant difference at the 10 percent level.
**Statistically significant difference at the 5 percent level.
***Statistically significant difference at the 1 percent level.

D. Reliability of the Methodology

Given that this evaluation started in 2006, three years after Habitat was implemented for the first time, we are limited to quasi-experimental methods. Propensity score matching was an adequate method for this evaluation given that for the three interventions studied (drinking water, sewage, and electricity), we were able to select comparison groups that were similar to the intervention groups with both potential comparison groups. Therefore, we have confidence that the indictor differences between the intervention and comparison groups are not related to preexisting differences in observable characteristics. The selected comparison groups and the intervention groups are also similar in the political variables we included in the propensity score models in order to control for possible political favoritism in the selection of beneficiaries. In general, we do not obtain consistent results across the two comparison groups; therefore, we cannot rule out the possibility that part of the impacts we do find are due to difference in unobserved components across these two groups. However, as we explain later, we prefer to focus on the results obtained with comparison group 1, given that they are less likely to suffer from selection problems.

Since we cannot rule out the possibility that part of the impact we find can be attributed to unobserved components, we used two potential comparison groups that may differ in some unobserved characteristics. Comparison group 1 (polygons that did not receive Habitat's support

in 2003 or 2004) could have fewer selection problems. Even if the polygons were not selected to receive Habitat's assistance, it is difficult to come up with scenarios in which the selection process was correlated to the outcomes measured. In contrast, comparison group 2 may suffer from some selection bias. One possible scenario is that the polygons in comparison group 2 (polygons that received Habitat's assistance but did not use it for projects in the corresponding intervention) decided not to implement projects on that intervention, for example electricity, because they had other sources funds for electricity and did not need Habitat's funds for that intervention. If this happened systematically for comparison group 2, we would be facing a selection problem in which the outcome measured is correlated with the probability of being in the comparison group. Therefore, we consider that the results from comparison group 1 are more robust than the results using comparison group 2.

V. RESULTS

No favorable or unfavorable impacts of the drinking water intervention were found on access to drinking water in the house or on the property. Favorable and statistically significant effects of the sewage intervention were found on access to sewage connection. No favorable or unfavorable impacts of the electricity intervention were found on access to electricity.

Tables V.1 to V.4 present the results for the two empirical specifications we used to estimate impacts. These two specifications are

- Difference on the impact indicators between the intervention and selected comparison groups. Since the indicators we used are changes between 2000 and 2005, this is a difference-in-differences estimator.

- Difference on the impact indicators between the intervention and selected comparison groups using a regression to control for differences in observables characteristics that may have remained after the matching procedure.

We present the results for the three algorithms used to select the two comparison groups for each intervention. As we discussed, there are some pros and cons of using each of these algorithms, but, in general, we consider that a result is robust when it is consistent across the three algorithms.

A. Impacts of the Drinking Water Intervention

We do not find statistically significant impacts of Habitat in *access to drinking water in the house*. Table V.1 presents the estimated impacts. We should note that impacts of negative magnitude, such as those obtained when using comparison group 1, mean that the intervention group reduced its lack of access to drinking water more than did the selected comparison group 1. Therefore, negative impacts are related to favorable results of the program; in contrast, positive impacts are related to unfavorable results for the program. The impacts on access to drinking water in the house range from -0.23 percent to -2.55 percent. To determine how large these impacts are, we calculated some effect sizes. An impact of -2.55 translates into 0.10 standard deviations of the indicator in the comparison group. We find that polygons that received Habitat's support to implement projects related to drinking water reduced the lack of drinking water by more than the comparison polygons that did not receive Habitat's support for any project, but these differences are not statistically significant. Hence, we interpret them as no evidence of favorable or unfavorable effects of Habitat on access to drinking water in the house.

When we compare the polygons that participated in the drinking water intervention with the polygons that did receive Habitat's support but did not use it for dinking water projects (comparison group 2), the impacts are not statistically significant and vary in magnitude and sign depending on the algorithm, from -1.59 percent to 0.17 percent. In summary, we do not find evidence of favorable or unfavorable effects of Habitat on access to drinking water in the house with the two comparison groups.

We do not find evidence of robust favorable or unfavorable impacts of Habitat in *access to dinking water on the property* with either of the two comparison groups (Table V.2). Only one

favorable and statistically significant impact was found in access to drinking water on the property (-3.14 percent) in comparison group 1. For all other specifications using comparison group 1, we found favorable impacts (negative magnitude) but no significance; the impacts range from -0.16 percent to -1.05 percent; the latter is equivalent to 0.06 standard deviations of the indicator in the comparison group.

When we compare the polygons that participated in the drinking water intervention with polygons in comparison group 2, the impacts are not statistically significant and vary in magnitude and sign depending on the algorithm (from -1.16 percent to 1.96 percent). Given that these variations are not significant, we interpret them as showing that the impact is very near zero.

TABLE V.1
IMPACT ESTIMATIONS IN THE PERCENTAGE OF HOUSEHOLDS WITHOUT DRINKING WATER IN THE HOUSE

Propensity Score Matching Method	Comparison Group1	Comparison Group 2
Nearest neighbor (dif-in-dif)	-2.55 (2.35)	-1.59 (2.41)
Nearest neighbor (dif-in-dif regression adjusted)	-1.82 (1.72)	-1.31 (1.81)
Three nearest neighbors (dif-in-dif)	-1.17 (2.15)	1.32 (1.88)
Three nearest neighbors (dif-in-dif regression adjusted)	-0.23 (1.57)	0.61 (1.55)
Local lineal regression	-0.44 (1.60)	0.17 (1.69)

Note: Standard errors in parenthesis.
*Statistically significant difference at the 10 percent level.
**Statistically significant difference at the 5 percent level.
***Statistically significant difference at the 1 percent level.

TABLE V.2
IMPACT ESTIMATIONS IN THE PERCENTAGE OF HOUSEHOLDS WITHOUT DRINKING WATER ON THE PROPERTY

Propensity Score Matching Method	Comparison Group 1	Comparison Group 2
Nearest neighbor (dif-in-dif)	-1.05 (2.18)	-1.16 (2.19)
Nearest neighbor (regression adjusted dif-in-dif)	-3.14** (1.56)	-0.81 (1.65)
Three nearest neighbors (dif-in-dif)	-0.59 (2.16)	1.96 (2.07)
Three nearest neighbors (regression adjusted dif-in-dif)	-1.46 (1.31)	0.55 (1.36)
Local lineal regression	-0.16 (1.58)	1.15 (1.55)

Note: Standard errors in parenthesis.

*Statistically significant difference at the 10 percent level.
**Statistically significant difference at the 5 percent level.
***Statistically significant difference at the 1 percent level.

B. Impacts of the Sewage Intervention

We find statistically significant and favorable impacts of Habitat on *access to sewage* (Table V.3). Using comparison group 1, we find favorable impacts of almost -3 percent (impacts range from -1.35 percent to -2.88 percent). An impact of -3 percent translates to 0.15 standard deviations of the sewage indicator in the comparison group. This means that the polygons that participated in the sewage intervention reduced the lack of access to sewage almost 3 percentage points more than did the polygons that did not receive Habitat support for any project.

When we compare the polygons that participated in the sewage intervention with the polygons that did receive some support from Habitat but did not use it for sewage projects (comparison group 2), we also find favorable but not statistically significant impacts ranging from -0.62 percent to -1.66 percent.

TABLE V.3
IMPACT ESTIMATIONS IN THE PERCENTAGE OF HOUSEHOLDS
WITHOUT SEWAGE CONNECTION

Propensity Score Matching Method	Comparison Group1	Comparison Group 2
Nearest neighbor (dif-in-dif)	-1.35 (2.03)	-1.66 (1.84)
Nearest neighbor (regression adjusted dif-in-dif)	-2.64* (1.43)	-0.62 (1.48)
Three nearest neighbors (dif-in-dif)	-2.88* (1.67)	-1.06 (1.78)
Three nearest neighbors (regression adjusted dif-in-dif)	-2.88** (1.31)	-0.84 (1.38)
Local lineal regression	-2.68** (1.35)	-0.93 (1.46)

Note: Standard errors in parenthesis.

*Statistically significant difference at the 10 percent level.
**Statistically significant difference at the 5 percent level.
***Statistically significant difference at the 1 percent level.

C. Impacts of the Electricity Intervention

We do not find robust evidence of favorable or unfavorable impacts of the electricity intervention in *access to electricity* with either of the comparison groups (Table V.4). We find only one unfavorable and statistically significant impact in access to electricity when we used local lineal regression in comparison group 1 (3.3 percent). In all other specifications of comparison group 1, we find unfavorable but insignificant impacts that range from 0.29 percent to 1.79 percent; is the latter is equivalent to 0.13 standard deviations of the sewage indicator in comparison group 1.

The impacts using comparison group 2 are unfavorable but again not statistically significant (from 0.03 percent to 0.11 percent). These results mean that the polygons that received Habitat's assistance in electricity projects reduced their lack of electricity by less than the comparison polygons, but these differences are not statistically significant.

TABLE V.4

IMPACT ESTIMATIONS IN THE PERCENTAGE OF HOUSEHOLDS WITHOUT ELECTRICITY

Propensity Score Matching Method	Comparison Group 1	Comparison Group 2
Nearest neighbor (dif-in-dif)	1.79 (1.92)	1.11 (1.63)
Nearest neighbor (regression adjusted dif-in-dif)	0.25 (0.31)	0.34 (0.29)
Three nearest neighbors (dif-in-dif)	1.40 (1.98)	0.80 (1.38)
Three nearest neighbors (regression adjusted dif-in-dif)	0.29 (0.27)	0.06 (0.25)
Local lineal regression	3.3** (1.67)	0.03 (0.85)

Note: Standard errors in parenthesis.

*Statistically significant difference at the 10 percent level.
**Statistically significant difference at the 5 percent level.
***Statistically significant difference at the 1 percent level.

VI. CONCLUSIONS

We find evidence that Habitat intervention increased access to sewage about 3 percentage points more in the intervention group than in similar comparison polygons, but it did not have a statistically significant effect in access to drinking water or electricity. In this section, we discuss some possible explanations of why we find these limited or nonexistent impacts.

A. Program Activities Did Not Translate into Sufficiently Large Impacts

Many social programs do not attain the improvement goals that they initially proposed. One possibility is that Habitat is one of those programs (at least in the infrastructure areas we evaluated). Other explanations are possible, such as insufficient funds to attend to the infrastructure needs of the polygons. We calculated that in 2004, Habitat's per capita spending was 295 pesos in sewage projects, 172 pesos in drinking water projects, and 265 pesos in electricity projects. It could be that these funds are not sufficient to deliver favorable impacts in infrastructure. Another possibility is that the nature of the program is too diverse and the funds available are in some sense diluted in too many areas.

B. Resource Redistribution Within the Municipality

The results show that the access to infrastructure was similar in the intervention groups and in the comparison groups. One possibility is that receiving Habitat funds allows the municipality to shift resources from one polygon that receives Habitat's funds to other polygons that do not. We do not have data that would allow us to verify that this type of redistribution occurs within the municipalities. However, we tested this hypothesis by reestimating impacts using the subsample of polygons that belong to different municipalities. The idea is that this subsample should not be affected by redistribution issues given that these polygons belong to different municipalities. So if the impacts we find in this subsample are larger than those obtained with the original sample, this would give some support to the hypothesis that redistribution of resources affected our original estimations. The results obtained with this subsample are similar to the results obtained with the original sample; therefore, we do not think that redistribution had an important effect on the original results.

C. Validity of the Impact Indicators in Relation to the Projects Implemented with Habitat's Assistance

The impact indicators used in this evaluation are based on access to infrastructure by the households in the eligible polygons. These are the only available indicators in the Census databases. However, as we explained before, the three interventions studied include projects to extend the access to infrastructure of the households as well as other type of projects. For example, the drinking water intervention includes programs in rehabilitation, extension, construction, and distribution. In this evaluation, we did not separate each of these subprograms but assumed a polygon was in the drinking water intervention if at least one project in any of these areas was implemented. Therefore, the indicators may be somewhat misaligned with the interventions. For example, it is possible that although we do not find an increase in access to drinking water, the quality of the service has improved. Nevertheless, 87 percent of the projects included in the drinking water intervention that were implemented correspond to subprograms of extension or construction that should have had an effect on access (they represent 91 percent of the funds invested in drinking water). Similarly, 89 percent of the projects included in the

sewage intervention belong to the extension or construction subprograms, and they also represent 91 percent of the total funds invested in sewage-related projects. There are no subprograms in the electricity intervention.

D. Analysis at the Polygon Level

Habitat identifies the polygons as the units to which the program assigns funds. However, it is possible that the projects implemented with Habitat's assistance do not benefit the entire polygon but are focused only in some sub-area within the polygon it and the impacts are diluted. But defining a unit of analysis differently from the unit of assignment of program funds is not possible for this evaluation.

E. Sample Sizes

This study is limited to using the sample sizes of the intervention groups. By using the three nearest neighbors or the local linear regression, however, we increased the statistical power. We made some approximate power calculations, and we concluded that for the sample sizes in this study, we could detect impacts of a minimum of three to five percentage points. It is possible that there were some favorable effects that were of smaller magnitude that we were not able to detect because of low statistical power. However, such effects would be so small that they might not be policy relevant.

VII. REFERENCES

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APPENDIX

1. Potential Comparison Groups

The following tables compare the characteristics of the intervention and potential comparison groups based on information from the Census 2000.[9]

TABLE A.1

MEANS OF THE CHARACTERISTICS OF THE DRINKING WATER INTERVENTION GROUP AND THE TWO POTENTIAL COMPARISON GROUPS BASED ON THE CENSUS 2000

	Drinking water Intervention Group	Potential Comparison Group 1		Potential Comparison Group 2	
Percentage of households without drinking water in the house	56.66	45.14	***	49.87	***
Percentage of households without drinking water in the property	21.91	13.06	***	17.68	**
Number of households	4,030.10	762.72	***	1,574.8	***
Number of households without water in the bathroom	2,271.60	417.34	***	944.07	***
Households without drinking water in the house	2,097.10	378.57	***	817.39	***
Households without drinking water in the property	596.97	110.28	***	231.75	***
Households without electricity	89.32	15.02	***	43.99	***
Households in alimentary poverty	443.65	86.465	***	172.58	***
Percentage of households without bathroom	9.62	5.05	***	5.70	***
Percentage of households without water in the bathroom	65.36	50.64	***	60.05	**
Percentage of households without electricity	4.88	1.94	***	3.95	
Number of polygons	**217**	**2,350**		**674**	

*Statistically significant difference at the 10 percent level.
**Statistically significant difference at the 5 percent level.
***Statistically significant difference at the 1 percent level.

[9] The tables present only the variables that we consider more importantly related to access to each service, but the results are similar for other infrastructure and poverty variables.

TABLE A.2

MEANS OF THE CHARACTERISTICS OF THE SEWAGE INTERVENTION GROUP
AND THE TWO POTENTIAL COMPARISON GROUPS
BASED ON THE CENSUS 2000

	Sewage Intervention Group	Potential Comparison Group 1		Potential Comparison Group 2	
Percentage of houses without sewage connection	43.82	28.72	***	39.20	**
Percentage of households without water in the bathroom	63.89	65.48	***	60.01	***
Number of households	3,422.2	762.72	***	1,519.3	***
Households without water in the bathroom	1,967.3	417.34	***	901.25	***
Households without drinking water in the house	1,815.2	378.57	***	770.15	***
Households without drinking water in the property	596.97	110.28	***	231.75	***
Households in alimentary poverty	351.18	86.465	***	179.71	***
Percentage of households without bathroom	7.57	5.05	***	6.17	***
Percentage of households without electricity	4.6	1.94	***	3.95	
Number of polygons	**306**	**2,350**		**585**	

*Statistically significant difference at the 10 percent level.
**Statistically significant difference at the 5 percent level.
***Statistically significant difference at the 1 percent level.

TABLE A.3

MEANS OF THE CHARACTERISTICS OF THE ELECTRICITY INTERVENTION GROUP
AND THE TWO POTENTIAL COMPARISON GROUPS
BASED ON THE CENSUS 2000

	Electricity Intervention Group	Potential Comparison Group 1		Potential Comparison Group 2	
Percentage of households without electricity	6.38	1.93	***	3.65	***
Number of households	5,317.4	762.72	***	1,591.5	***
Households without blender	787.62	116.62	***	272.34	***
Households without drinking water in the house	2,883.6	378.57	***	804.76	***
Households without drinking water in the property	808.07	110.28	***	230.61	***
Households without electricity	126.4	15.02	***	41.84	***
Households without refrigerator	1,699.9	262.7	***	520.61	***
Percentage of households without bathroom	10.18	5.05	***	6.0	***
Percentage of households without drinking water in the property	23.37	13.06	***	18.03	**
Percentage of households without water in the bathroom	67.70	50.64	***	60.17	**
Number of polygons	**139**	**2,350**		**752**	

*Statistically significant difference at the 10 percent level.
**Statistically significant difference at the 5 percent level.
***Statistically significant difference at the 1 percent level.

From these tables we can see that for the three interventions (drinking water, sewage, and electricity) the mean characteristics of the intervention group are significantly different from the two potential comparison groups. Therefore, our objective is to use the propensity score matching method for each of the interventions and potential comparisons to find comparison groups that are similar to the corresponding intervention group.

2. Balancing Tests After Selecting Comparison Groups by Propensity Score Matching

In this section we present the tables that compare mean characteristics of the intervention groups to the mean characteristics of the comparison groups selected by the three algorithms used for matching. We can see that with the three algorithms and for the two potential comparison groups we were able to find comparison groups that were similar to the intervention groups according to the means characteristics of the Census 2000.

TABLE A.4

MEAN CHARACTERISTICS OF THE DRINKING WATER INTERVENTION GROUP AND THE COMPARISON GROUP 1, BY THE ALGORITHM USED FOR MATCHING

	Nearest Neighbor		Tree Nearest Neighbors		Local Linear Regression	
Variable	Intervention Group	Comparison Group1	Intervention Group	Comparison Group1	Intervention Group	Comparison Group1
Variables at the Polygon Level						
Percentage of households without water in the house	56.7	57.1	57.3	57.4	57.2	57.1
Percentage of households without water in the property	21.9	25.0	22.3	23.7	22.2	25.0
Number of households	4,030.1	2,348.5	1,723.8	1,784.3	2,001.3	2,089.2
Younger than 12	5,027.9	3,202.7	2,280.7	2,379.9	2,656.5	2,812.7
Older than 65	855.1	436.1*	368.8	380.2	410.3	419.8
Households without water in the bathroom	2,271.6	1,345.6	1,076.0	1,078.9	1,253.2	1,214.4
Households without water in the house	2,097.1	1,125.1	961.2	883.3	1,107.9	990.8
Households without water in the property	597.0	396.9	348.3	312.3	392.4	357.8
Households without electricity	89.3	62.9	67.5	52.9	77.5	55.4
Crowding	2.5	2.5	2.5	2.5	2.5	2.5
Crowding^2	6.4	6.5	6.4	6.6	6.4	6.5
Households without blender	615.2	551.4	381.9	376.8	451.5	459.8
Households without laundry	2,047.5	1,383.6	980.7	1,041.4	1,160.8	1,229.4
Households without water in the house ^2[a]	74.0	3.2	2.8	2.3	3.7	2.5
Households without water in the house ^3[a]	570.0	1.2	1.4	1.0	2.0	0.9
Head of household illiterate	386.1	250.8	207.0	212.7	240.4	244.4
Head of household sin schooling	494.3	318.6	255.7	268.7	294.3	304.6
Households in alimentary poverty	443.7	339.1	260.9	271.6	303.5	320.5
Head of household older than 65^2	320,000.0	25,375.0	20,887.0	23,109.0	24,012.0	24,268.0
Percentage of households without bathroom	9.6	9.9	9.9	10.1	9.9	10.1
Percentage of households without water in the bathroom	65.4	65.9	65.9	67.2	65.8	66.4
Percentage of households without electricity	4.9	4.6	5.1	5.2	5.0	4.6
Percentage of households without gas stove	10.3	12.5	10.6	12.4	10.6	12.9
Percentage of households with dirt floor	16.7	18.4	16.8	18.2	16.9	17.8
Variables at the Municipal Level						
Percentage of households with water	87.0	86.9	87.0	87.2	87.0	86.6
Percentage of houses with water in the house	64.0	62.8	63.9	62.9	63.9	62.1
Percentage of houses with water in the house^2	44.7	43.7	44.8	43.6	44.7	42.9
Percentage of houses with water, electricity, y sewage^3	50.4	48.5	50.4	49.4	50.3	48.0
Houses with tube water	67,260.0	63,383.0	64,987.0	60,088.0	64,781.0	60,558.0
Houses with water in the house	54,568.0	51,931.0	53,046.0	48,768.0	52,847.0	49,408.0
Houses with water in the property	12,760.0	11,521.0	12,006.0	11,378.0	12,001.0	11,207.0
Houses with water carried from other place	2,492.4	2,341.4	2,350.6	2,187.6	2,408.3	2,233.5
Political Variables at the Municipal Level						
Same party	64.1	57.1	64.3	61.5	64.1	59.3
Political Competence	75.3	76.5	75.9	75.6	75.8	76.5
Interaction	46.8	43.6	47.5	45.9	47.4	45.3
Interaction^2	36.2	35.2	37.0	36.2	36.9	36.6
Number of polygons	**217**	**149**	**196**	**354**	**209**	**149**

[a] Units in millions or larger.

*Statistically significant difference at the 10 percent level.
**Statistically significant difference at the 5 percent level.
***Statistically significant difference at the 1 percent level.

TABLE A.5

MEAN CHARACTERISTICS OF THE DRINKING WATER INTERVENTION GROUP AND THE COMPARISON GROUP 2 BY THE ALGORITHM USED FOR MATCHING

	Nearest Neighbor		Tree Nearest Neighbors		Local Linear Regression	
Variable	Intervention Group	Comparison Group2	Intervention Group	Comparison Group2	Intervention Group	Comparison Group2
Variables at the Polygon Level						
Percentage of households without water in the house	56.6	57.3	55.9	56.7	56.0	55.6
Percentage of households without water in the property	21.9	22.1	21.4	23.8	22.0	22.8
Number of households	4,030.1	2,197.5	1,833.1	1,988.4	1,975.0	2,313.2
Younger than 12	5,027.9	2,961.4	2,496.2	2,704.0	2,617.0	3,096.0
Older than 65	855.0	438.2*	366.2	406.1	434.0	461.5
Head of household older than 65	154.1	88.2*	74.0	78.2	85.0	92.0
Households without water in the bathroom	2,271.6	1,351.5	1,124.2	1,198.3	1,126.4	1,411.5
Households without water in the house	2,097.1	1,169.6	959.7	1,003.9	971.1	1,221.3
Households without water in the property	596.9	449.7	356.7	386.2	358.5	476.7
Households without electricity	89.3	66.5	65.7	68.1	66.3	69.4
Crowding	2.5	2.5	2.5	2.5	2.5	2.5
Households without bathroom	208.41	142.2	94.6	97.3	102.6	124.0
Households without blender	615.1	473.2	367.8	387.9	388.6	494.4
Households without laundry	2,047.5	1,300.1	1,010.0	1,085.4	1,034.3	1,356.3
Households without laundry ^2[a]	60.0	5.7	2.8	3.8	2.9	6.1
Households without water in the house ^2[a]	74.0	4.3	2.6	3.2	2.6	4.6
Households without water in the house ^3[a]	570.0	2.8	1.2	1.7	1.1	2.9
Head of household illiterate	386.1	238.4*	196.7	205.9	206.1	245.9
Head of household with elementary education	915.3	500.1	425.0	465.1	448.0	527.66
Households in alimentary poverty	443.6	312.7	244.3	257.9	252.4	318.7
Percentage of Households without bathroom	9.6	12.5	8.6	8.4	9.4	7.9
Percentage of Households without water in the bathroom	65.4	65.8	65.1	65.9	65.4	64.0
Percentage of Households without electricity	4.9	4.7	5.0	5.2	5.0	4.8
Percentage of Households without gas stove	10.3	10.0	9.0	8.5	9.9	8.7
Percentage of households with dirt floor	16.7	17.3	16.9	18.3	17.0	18.2
Percentage of Households without laundry	56.7	60.5	56.4	57.5	56.7	58.2
Variables at the Municipal Level						
Percentage of houses with water	87.0	86.8	87.2	87.9	87.3	86.5
Percentage of houses with water in the house	64.0	61.2	64.8	65.8	64.8	63.1
Percentage of houses with water in the house^2	44.7	41.5	45.7	46.7	45.8	43.6
Percentage of houses with water, electricity, and sewage^3	50.4	48.0	51.3	53.0	51.3	49.5
Percentage of houses with water, electricity, and sewage	76.8	75.5	77.3	78.6	77.4	76.2
Houses with bathroom^3[a]	1.6	1.2	1.4	1.4	1.4	1.3
Houses with water in the house	54,568.0	50,185.0	53,111.0	56,142.0	54,434.0	53,349.0
Houses with water in the property	12,760.0	11,397.0	11,746.0	12,354.0	11,994.0	11,661.0
Houses with water from other place	2,492.4	2,272.4	2,382.8	2,381.9	2,423.1	2,395.20
Percentage of persons fro 6 to 24 in school	64.3	63.4	64.3	64.2	64.33	64.0
Political Variables at the Municipal Level						
Same party	64.1	66.8	62.8	63.8	63.1	64.5
Political Competence	75.3	74.7	75.5	74.7	75.6	74.3

Table A.5 *(continued)*

Table A-5 *(continued)*

Variable	Nearest Neighbor		Tree Nearest Neighbors		Local Linear Regression	
	Intervention Group	Comparison Group2	Intervention Group	Comparison Group2	Intervention Group	Comparison Group2
Number of polygons	**217**	**153**	**196**	**325**	**203**	**152**

[a] Units in millions or larger.

*Statistically significant difference at the 10 percent level.
**Statistically significant difference at the 5 percent level.
***Statistically significant difference at the 1 percent level.

TABLE A.6

MEAN CHARACTERISTICS OF THE SEWAGE INTERVENTION GROUP AND THE COMPARISON GROUP 1, BY THE ALGORITHM USED FOR MATCHING

	Nearest Neighbor		Tree Nearest Neighbors		Local Linear Regression	
Variable	Intervention Group	Comparison Group1	Intervention Group	Comparison Group1	Intervention Group	Comparison Group1
Variables at the Polygon Level						
Percentage of Households without sewage	43.8	45.9	43.5	42.8	43.8	45.8
Number of households	3,422.2	2,164.1	1,613.6	1,513.1	2,178.2	2,072.0
Number of households^2 [a]	23	1.8	11.0	8.4	2.3	1.7
Number of households^3 [a]	430	3.2	2.0	1.3	6.5	3.2
Households in alimentary poverty	351.2	257.0	208.7	212.8	258.9	249.5
Households in capacities poverty	622.9	453.0	350.9	356.8	445.2	438.4
Schooling of head of household	6.1	6.0	6.0	6.0	6.1	6.0
Households without water in the bathroom	1,967.3	1,298.4	937.8	919.3	1,298.3	1,252.3
Households without water in the house	1,815.2	1,197.4	829.5	794.4	1,144.5	1,151.8
Households without gas stove	182.7	127.1	125.8	125.1	145.2	124.3
Crowding^2	6.3	6.5	6.3	6.3	6.3	6.5
Crowding^3	16.4	17.1	16.3	16.5	16.5	17.1
Households without blender	514.8	441.0	313.0	292.2	407.9	407.9
Percentage of Households without bathroom	7.6	7.8	7.6	7.5	7.5	7.9
Percentage of Households without water in el bathroom	63.9	65.5	63.6	64.1	63.9	65.7
Percentage of Households without water in the house	55.4	57.2	55.0	54.4	55.3	57.3
Percentage of Households without water in the property	21.5	21.9	21.0	20.9	21.5	22.0
Percentage of Households without electricity	4.6	6.8	4.4	5.0	4.6	6.9
Percentage of households with dirt floor	16.6	20.0	16.3	17.2	16.7	19.8
Percentage of Households without water in the bathroom^2	45.1	46.9	44.9	45.3	45.1	47.1
Percentage of Households without water in the bathroom^3	33.9	35.7	33.8	34.0	33.9	36.0
Percentage of Households without gas stove	7.8	8.2	8.0	8.4	7.8	8.3
Percentage of Households without radio	14.7	15.3	14.7	14.6	14.7	15.2
Percentage of Households without TV	10.4	11.3	10.4	10.7	10.5	11.3
Percentage of Households without car	77.2	77.4	77.2	78.1	77.1	77.5
Variables at the Municipal Level						
Percentage of houses without bathroom	89.5	89.5	89.4	88.9	89.5	89.4
Percentage of houses without electricity	96.8	96.9	96.7	96.6	96.7	96.9
Percentage of illiterates older than 15	92.9	92.7	92.0	92.9	92.9	92.1
Percentage of people from 6 to 24 in school	64.8	64.4	64.0	63.6	89.5	89.4
Houses with sewage connected	54,348.0	48,203.0	51,446.0	45,153.0	53,234.0	47,245.0
Houses with sewage available	64,479.0	55,738.0	60,974.0	52,826.0	62,859.0	54,783.0
Houses without sewage	7,215.8	6,624.7	6,963.7	5,996.5	7,019.6	6,479.6
Political Variables at the Municipal Level						
Percentage of Same party	55.6	54.9	55.0	53.3	55.3	55.6
Electoral Competition	76.3	77.8	76.2	76.9	76.7	77.9
Interaction	40.4	41.1	39.9	38.8	40.4	41.6
Number of polygons	**306**	**219**	**271**	**485**	**302**	**219**

[a] Units in millions or larger.

*Statistically significant difference at the 10 percent level.
**Statistically significant difference at the 5 percent level.
***Statistically significant difference at the 1 percent level.

TABLE A.7

MEAN CHARACTERISTICS OF THE SEWAGE INTERVENTION GROUP AND THE COMPARISON GROUP 2, BY THE ALGORITHM USED FOR MATCHING

	Nearest Neighbor		Tree Nearest Neighbors		Local Linear Regression	
Variable	Intervention Group	Comparison Group2	Intervention Group	Comparison Group2	Intervention Group	Comparison Group2
Variables at the Polygon Level						
Percentage of houses without sewage connected	43.8	41.9	44.0	42.7	44.0	42.1
Number of households	3,422.2	2,235.8	1,957.3	1,714.5	2,804.7	2,058.9
Households in alimentary poverty	351.2	280.1	239.7	201.5	285.8	245.1
Demographic dependence	89.0	89.0	89.2	89.2	89.0	89.0
Head of household schooling	6.1	6.1	6.0	6.0	6.1	6.1
Percentage of households without gas stove	7.8	8.0	7.9	7.4	7.8	8.0
Households without water in the bathroom	1,967.3	1,306.8	1,211.6	968.7	1,581.7	1,165.0
Households without telephone	2,382.3	1,715.5	1,485.0	1,271.2	1,958.0	1,556.2
Households without water in the house	1,815.2	1,207.8	1,051.7	861.6	1,444.8	1,094.7
Households with dirt floor	393.2	306.1	279.6	222.7	315.8	261.3
Hectares	113.7	88.6	78.7	71.0	97.1	83.9
Hectares ^2	91,474.0	28,138.0	19,106.0	17,647.0	63,289.0	25,913.0
Households without car	2,630.1	1,689.1	1,521.6	1,282.4	2,153.8	1,525.5
Crowding	2.5	2.5	2.5	2.5	2.5	2.5
Households without water in the property	534.3	392.7	361.7	293.9	424.1	327.5
Households without water in the house ^2 [a]	5.7	1.4	6.8	5.9	3.8	1.3
Percentage of households without radio	14.7	14.5	14.7	14.7	14.7	14.4
Percentage of households without TV	10.4	9.8	10.4	10.4	10.5	9.8
Percentage of households without car	77.2	74.4	77.2	75.7	77.3	74.2
Percentage of households without bathroom	7.6	7.9	7.5	7.8	7.6	8.0
Percentage of households without water in the bathroom	63.9	60.8	63.8	63.5	64.0	60.6
Percentage of households without water in the property	21.5	19.5	21.0	21.1	21.5	19.3
Percentage of households without water in the house	55.4	52.6	55.0	54.6	55.4	52.5
Percentage of Households without electricity	4.6	4.1	4.6	5.0	4.6	4.1
Variables at the Municipal Level						
Percentage of houses without bathroom	89.5	89.6	89.5	89.7	89.6	89.5
Houses with sewage	64,479.0	56,175.0	63,208.0	55,907.0	64,058.0	55,665.0
Houses with sewage^2 [a]	9.0	6.3**	8.6	6.7	9.0	6.3**
Houses with connection to sewage	54,348.0	45,193.0	53,486.0	47,070.0	54,045.0	44,649.0
Houses sin sewage	7,215.8	6,640.3	6,930.6	6,222.9	6,991.3	6,658.3
Percentage of people from 6 to 24 in school	64.5	64.3	64.4	64.1	64.5	64.3
GDP per capita	71.5	71.9	71.5	71.6	71.5	71.9
Political Variables at the Municipal Level						
Political Competence	76.3	76.4	76.6	76.1	76.4	76.2
Same party	55.6	64.1	55.1	56.6	55.3	63.6
Number of polygons	**306**	**191**	**294**	**367**	**302**	**191**

[u] Units in millions or larger.

*Statistically significant difference at the 10 percent level.
**Statistically significant difference at the 5 percent level.
***Statistically significant difference at the 1 percent level.

TABLE A.8

MEAN CHARACTERISTICS OF THE ELECTRICITY INTERVENTION GROUP AND THE COMPARISON GROUP 1, BY THE ALGORITHM USED FOR MATCHING

	Nearest Neighbor		Tree Nearest Neighbors		Local Linear Regression	
Variable	Intervention Group	Comparison Group1	Intervention Group	Comparison Group1	Intervention Group	Comparison Group1
Variables a Polygon Level						
Percentage of Households without electricity	6.4	8.2	6.6	7.8	6.4	8.3
Number of households	5,317.4	2,592.7	1,741.8	1,899.6	2,862.0	2,246.4
Crowding	2.5	2.6	2.5	2.5	2.5	2.6
Crowding^2	6.5	6.7	6.6	6.5	6.5	6.7
Crowding^3	17.0	17.8	17.4	17.0	17.1	17.7
Mean age of head of household	40.6	40.3	40.5	40.6	40.6	40.5
Younger than 15	6,685.8	3,603.5	2,444.9	2,560.4	3,771.4	3,084.4
Older than 65	1,045.3	456.5*	347.5	398.9	587.4	434.9
Households without radio	626.7	443.4	244.8	282.8	424.3	372.6
Households without gas stove	318.4	210.7	160.3	161.8	283.5	203.9
Households without TV	442.2	301.0	196.6	209.9	322.8	271.2
Households without blender	787.6	713.5	352.5	416.9	569.6	595.3
Households without refrigerator	1,699.9	781.5*	640.8	658.5	993.7	735.6
Households without laundry	2,728.4	1,541.6	996.9	1,118.8	1,706.3	1,336.3
Households without car	4,206.5	1,913.5	1,397.0	1,473.2	2,321.2	1,695.8
Households without water in the bathroom	3,117.1	1,522.6	1,120.5	1,159.1	1,854.5	1,350.1
Households without water in the property	808.1	440.8	394.3	346.1	638.9	389.1
Households without water in the house	2,883.6	1,403.1	961.7	1,037.6	1,580.4	1,231.8
Households without electricity	126.4	91.9	67.7	65.6	90.7	83.0
Households without luz^2	64,341.0	17,995.0**	15,465.0	12,136.0	25,595.0	15,392.0
Households without luz^3[a]	56.0	4.7*	5.8	3.5	11.0	4.0
Head of household illiterate	500.7	233.5**	214.1	208.1	359.2	223.8
Head of household sin schooling	633.6	303.7*	262.1	257.7	443.3	283.5
Head of household older than 65	183.3	100.3	66.9	79.5	113.8	93.3
Households in alimentary poverty	584.0	346.4	269.5	268.7	429.2	321.0
Percentage of households without bathroom	10.2	9.3	10.7	10.3	10.2	9.5
Percentage of households without water in the bathroom	67.7	66.6	68.1	67.5	68.1	67.4
Percentage of households without water in the property	23.4	21.4	23.7	22.7	24.0	21.7
Percentage of households without water in the house	59.7	61.2	60.3	60.4	59.7	61.7
Percentage of households without electricity	6.4	7.9	6.6	7.6	6.5	8.2
Percentage of households without gas stove	11.6	12.0	11.8	11.6	11.8	12.5
Percentage of households with dirt floor	16.9	21.6	17.5	18.9	17.3	21.0
Dirt floor*Crowding	3,668.2	4,238.2	1,858.1	2,314.3	2,979.9	3,255.1
Households without blender^2 [a]	3.4	1.4	0.3	0.6	1.8	1.0
Percentage of Households without blender	24.9	29.4**	24.9	26.0	24.9	29.3*
Percentage of Households without refrigerator	41.6	41.7	42.4	43.2	41.6	42.9
Percentage of Households without TV	12.8	14.4	13.0	13.4	12.8	14.7
Total population	23,462.0	11,121.0	7,877.6	8,338.4	12,708.0	9,727.6
Variables at the Municipal Level						
Percentage of houses without bathroom	87.1	87.6	86.7	86.9	87.1	88.8
Percentage of houses without water, sewage & electricity	46.1	44.9	45.4	45.7	45.6	44.1
Total population [a]	0.3	0.3	0.3	0.3	0.3	0.3
Houses with water and electricity [a]	1.6	1.4	1.1	1.3	1.1	1.3
Political Variables at the Municipal Level						
Same party	66.9	56.8	68.2	60.2	66.7	60.0
Political Competence	73.1	74.9	73.2	73.5	73.4	74.8
Interaction	46.9	41.9	48.2	42.1	47.2	44.2
Interaction^2	35.1	33.0	36.1	31.4	35.3	34.7
Number of polygons	**139**	**92**	**110**	**210**	**132**	**92**

Table A-8 *(continued)*

Table A-8 *(continued)*

[a] Units in millions or larger.

*Statistically significant difference at the 10 percent level.
**Statistically significant difference at the 5 percent level.
***Statistically significant difference at the 1 percent level.

TABLE A.9

MEAN CHARACTERISTICS OF THE ELECTRICITY INTERVENTION GROUP AND THE COMPARISON GROUP 2, BY THE ALGORITHM USED FOR MATCHING

	Nearest Neighbor		Tree Nearest Neighbors		Local Linear Regression	
Variable	Intervention Group	Comparison Group2	Intervention Group	Comparison Group2	Intervention Group	Comparison Group2
Variables a Polygon Level						
Percentage of Households without electricity	6.4	7.4	6.0	6.7	6.5	7.4
Percentage of Households without bathroom	10.2	10.2	10.2	9.0	10.2	10.5
Percentage of Households without water in the bathroom	67.7	67.2	67.7	67.0	67.8	66.6
Percentage of households without water in the property	23.4	21.9	23.2	23.2	23.4	22.6
Percentage of households without water in the house	59.7	59.2	59.3	57.9	59.8	58.4
Percentage of Households without electricity	6.4	7.3	6.0	6.7	6.6	7.4
Percentage of Households without gas stove	11.6	11.8	11.3	10.9	11.6	11.7
Percentage of households with dirt floor	16.9	17.8	16.7	18.1	10.2	10.5
Demographic dependence	0.9	0.9	90.6	90.3	0.9	0.9
Households without water in the property	808.1	548.8	418.4	484.8	544.1	560.4
Households without water in the house	2,883.6	1,431.6	1,141.5	1,167.0	1,748.8	1,336.2
Households without water in la vivnda^2 [a]	5.2	1.1	5.3	9.3	1.6	1.1
Households without electricity	126.4	143.9	94.8	123.6	109.7	139.7
Households without luz^2	64,341.0	100,000.0	44,472.0	83,463.0	53,335.0	100,000.0
Households without luz^3 [a]	5.6	1.2	4.4	9.7	4.9	1.2
Percentage of Households without refrigerator	41.6	41.4	41.8	40.1	41.9	41.5
Percentage of Households without car	80.0	77.7	79.7	78.6	79.8	77.3
Percentage of Households without laundry	57.9	57.2	57.7	56.8	57.7	58.0
Older than 65	1,045.3	489.6	427.4	440.4	607.5	485.0
Households without radio	626.7	379.0	310.4	321.6	389.3	359.8
Households without TV	442.2	272.3*	241.2	239.7	300.9	260.1
Households without blender	787.6	591.5	468.0	499.3	553.9	550.2
Households without refrigerator	1,699.9	848.9*	788.4	765.7	1,111.2	808.8
Schooling of head of household	6.0	6.1	6.0	6.1	6.0	6.0
Percentage of households without radio	15.6	16.3	15.8	15.7	15.7	16.2
Percentage of households without TV	12.8	13.3	12.6	12.7	12.9	13.3
Percentage of households without VHS	74.8	75.0	75.0	74.5	74.9	74.5
Percentage of households without blender	24.9	25.9	24.7	24.6	25.0	25.6
Number of households	5,317.4	2,668.1	2,133.6	2,277.6	2,930.1	2,582.6
Variables at the Municipal Level						
Percentage of houses with water	59.9	61.0	60.2	61.0	59.8	61.8
Percentage of illiterates older than 15	91.9	92.2	91.7	92.1	91.9	92.3
Pooulation^2 [a]	2.2	1.6	1.9	1.7	1.9	1.7
Percentage of houses with water^2	73.8	73.5	73.8	73.7	73.9	73.1
Houses without sewage connection	16,230.0	12,281.0	14,721.0	12,560.0	15,386.0	11,596.0
Houses with water, sewage & electricity	60,020.0	51,143.0	55,591.0	53,007.0	56,749.0	51,771.0
Percentage of people from 6 to 24 in school	64.2	64.0	64.0	63.7	64.1	63.9
Index of infant survival	85.4	85.5	85.4	85.3	85.4	85.5
Percentage of houses sin bathroom	87.1	87.9	87.0	87.4	87.1	87.8
Political Variables at the Municipal Level						
Political Competence	73.1	73.1	73.6	72.2	73.5	74.0
Same party	66.9	59.0	66.0	62.7.3	66.4	57.5
Number of polygons	**139**	**101**	**126**	**214**	**134**	**100**

[a] Units in millions or larger.

*Statistically significant difference at the 10 percent level.
**Statistically significant difference at the 5 percent level.
***Statistically significant difference at the 1 percent level.