Does Technical Assistance Matter? An Impact Evaluation Approach to Estimate its Value Added

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ABSTRACT

Many public programs and operations by multilateral organisations include technical assistance to the direct beneficiaries of the program in addition to pure financing. However, there is no substantial body of studies that calculates the additional impact; in the sense of exclusively attributable to, of technical assistance on the outcome of interest of the program. We propose the use of multi-treatment impact evaluation method -propensity score combined with exact matching for dosage and double difference- for estimating technical assistance's impact. We illustrate the technique for two potable water and sewerage programs where the direct beneficiaries are local governments, although the method is applicable for different types of programs and beneficiaries. The impact calculations reveal that technical assistance does matter as it has an impact over and above that of only financing. Given the small dollar value of technical assistance relative to the dollar value of transfers not only does technical assistance matter but it is a way of getting more for less. Thus technical assistance, in the examples studied, does matter.

INTRODUCTION

“*The provision of ongoing technical assistance is assumed to be an important mean of facilitating program fidelity. However, little quantitative research to date has examined whether technical assistance (TA) does in fact improve local prevention systems and programs, and the most effective method of delivering TA…. Without experimentally varying TA support, it is difficult to isolate the differential effects of varying amounts, types, and models of TA service delivery. Ideally, randomized or quasi-randomized controlled studies would assess implementation fidelity for different types and dosages of TA...*” *(Feinberg et. al., 2008)*

Many public programs and operations (grants or loans) by bilateral and multilateral organisations include technical assistance, TA, in addition to financing. Hence the impact of technical assistance over and above the impacts of pure financing is a policy relevant evaluative question. However, there appears to be little to no literature on estimating the impact, i.e. the outcome exclusively attributable to, of technical assistance when it is part of a package that includes monetary transfers. There is a knowledge lacuna.

Technical assistance can be viewed as an instrument to enhance technical efficiency of the recipient through transfer of relevant knowledge. A decision making unit (household, firm, public entity) can be said to be technically inefficient if it produces less than the maximum output(s) for given input(s) or does not use the minimum input(s) for the production of a given level of output(s). Thus technical assistance is to ensure the decision making unit has the ability to produce closer to the boundary of its production set.

TA framed as such leads to data envelope analysis (see Ray 2004), as it allows multiple inputs and multiple output analysis, hence could be used to estimate the role of TA. However, although this technique is useful in a diagnostic to determine which decision making units are inefficient hence require TA, it is not a useful method to determine the impact of TA. Data envelope analysis is inappropriate method to determine if the TA was responsible for any observed trend improvements in technical efficiency of the TA recipients in a dynamic data envelope analysis unless the hypothesis that non-controllable variables do not affect the outputs is satisfied (see Bosch et. al., 2001).

The problem of “non-controllable variables”, however, can be handled by an impact calculation. So can the problem of selection bias, i.e., program participants differ from non-participants, of particular relevance where TA is decided by the beneficiary rather than by a diagnostic made by a central authority where needs are judged against competence. The impact approach calculates the observed change in output due to the treatment (in our case technical assistance) as the difference in the average value of the output between the treated beneficiaries (Decision Making Units in DEA parlance) and a comparison group composed of similar non-treated DMUs. Specifically, to determine the impact of technical assistance we use propensity score-double difference technique. The methodological challenge is the extension of the common calculation of a single treatment with a given dosage to a multi-treatment (public works only and public works plus technical assistance) with different dosage (amount of transfers for public works). Our definition of treatment is a municipality that receives technical assistance plus public works and "non-treated" municipality that received public works only.

The two cases examined in this study correspond to the Neighbourhood Improvement Program (NIP) of Chile and the Social Investment Fund of Guatemala (SIF). NIP provides funds to municipalities for the construction of water and sewerage solutions. SIF provides funds that cover a spectrum of sectors that includes education, health, water, sewerage (drainage), local capacity, community services, social protection, and infrastructure in general. We only consider the water and sewerage projects. The TAs of the two programs differ, while for NIP the TA is for the specific works for SIF it is for general administrative capacity. However, both are demand determined rather then decided by the central authority.

The rest of the paper is divided into three sections. The following section provides a brief description of the methodology and data used in this study. The subsequent section provides a brief description of the two programs. The penultimate section contains the impact findings. We end the paper with the conclusions.

THE METHODOLOGY

The typical impact methodology is based on homogenous treatment. In contrast, in our case the treatment is heterogeneous both regarding dosage (i.e. amount of resources transferred) and is multi-treatment (transfers only and transfers plus technical assistance). Our interest is the multi-treatment aspect of the program but where we need to explicitly take into account the dosage effect. So, we match not only by propensity score but also by exact dosage. Then we calculate the impact of two treatments: transfer for public works plus technical assistance and separately the impact of transfers for public works only. The difference between the two calculated impacts –calculated through modified propensity score matching, double difference- is taken as the impact of technical assistance.

In greater detail we construct the counterfactual using the Propensity Score Matching (PSM) technique. In general terms, the PSM classifies the cases or units, beneficiaries and non-beneficiaries in two categories, unmatched and matched. The unmatched category corresponds to beneficiaries and non-beneficiaries units that do not have an equivalent case or unit in the counterpart group. Instead, the matched category corresponds to the group of beneficiaries and non-beneficiaries that share similar propensity score, thus high probability that share similar observed and unobserved characteristics. This last category is named the support group.

Thus, all calculations for the impact evaluation are performed on the support group that theoretically should be a balanced sample of beneficiaries and non-beneficiaries. This is different from the "naïve" evaluation in which the assessment is based on the simple observation of the evolution of the outcome indicator of the beneficiaries over time.

Matching procedure

From Rosenbaum y Rubin (1983), given the outcome of untreated and treated units $\boldsymbol{Y_c}, \boldsymbol{Y_t}$, respectively, conditional to X, and that the participation into the program D, are independent $(\boldsymbol{Y_c}, \boldsymbol{Y_t}) \perp \boldsymbol{D} \mid \boldsymbol{X}$.

We have that, if $\boldsymbol{F}(\boldsymbol{y_c} \mid \boldsymbol{X}, \boldsymbol{D}=1) = \boldsymbol{F}(\boldsymbol{y_c} \mid \boldsymbol{X}, \boldsymbol{D}=0)$ then the expected outcome of the counter-factual can be constructed from non-participants in the program. Additionally, if the probability to participate into the program conditional on X is positive and less than the unit, $0 < \Pr(D=1 \mid X) < 1$ then, the expected impact of the program will be.

$$E(Y_t - Y_c \mid X, D=1) = E(\Delta \mid X, D=1)$$

A categorical dependant variable model estimates the participation into the program. A logistic regression is used to calculate the probability (propensity) of a particular unit to participate, the propensity score, is simply is the conditional probability of being a treated for given observed covariates $\boldsymbol{X}$. The propensity score is used in matching treated and untreated units.

Thus, the impact of the intervention is defined as $\boldsymbol{I} = \frac{1}{|\boldsymbol{N}|}\sum_{\boldsymbol{i}\in\boldsymbol{N}}\left(\boldsymbol{y_i} - \frac{1}{|\boldsymbol{J_i}|}\sum_{\boldsymbol{j}\in\boldsymbol{J_i}}\boldsymbol{y_j}\right)$ where N is the number of units in the treatment group, J_i is the set of comparison units matched to treatment units i, and | J_i | is the number of comparison units J_i .

The above procedure is valid when the treatment or intervention is received by some and others not, and where the treatment among the treated units is homogenous. If treatment is heterogeneous then there are not two disjoint groups but several disjoint groups that can potentially be matched to each other, thus the traditional bipartite matching is no longer valid. In the case of different dosages treatment the procedure needs to be adjusted. There are two approaches. The first one uses clusters to maximize the difference between dosages of treatment (see for an application Ruprah et. al., 2007). The second approach, used in this paper, is controlling by the amount of the intervention, i.e. by dosage. This approach modifies the traditional propensity score matching by adding an additional dimension that has a relative weight 1000 times greater than the weight of the initial propensity score matching (for a detailed description of this approach see Abadie et. al., 2004). Thus, the dosage is not used as a simple balancing variable but as a controlling variable, thus $(\boldsymbol{Y}_c, \boldsymbol{Y}_t) \perp \boldsymbol{D} \mid \boldsymbol{X}, \boldsymbol{k}$, where $\boldsymbol{k}$ is the dosage.

Matching procedure is performed minimizing distances. $\boldsymbol{d}(\boldsymbol{k}_c, \boldsymbol{k}_t) < \boldsymbol{\varepsilon}$, and $\boldsymbol{d}(\boldsymbol{X}_c, \boldsymbol{X}_t) < \boldsymbol{\delta}$ where $\boldsymbol{d}$ indicates the distance between control and treated units, $\boldsymbol{\varepsilon}$ is a very small number, and $\boldsymbol{\delta}$ indicate the thresholds used in the traditional matching method.

Balancing Techniques

The balancing of the samples in the support group is evaluated individually and jointly. The individual test of balance is performed by using the t-test which assesses whether the means of each characteristic of the two groups, treated and controls, are statistically different from each other. Regarding the jointly balance test, we use the Hotelling test or also named the T-Squared test. Its formula is $\boldsymbol{t}^2 = \frac{\boldsymbol{n}_1 \boldsymbol{n}_2 (\overline{\boldsymbol{X}}_1 - \overline{\boldsymbol{X}}_2)' \boldsymbol{S}^{-1} (\overline{\boldsymbol{X}}_1 - \overline{\boldsymbol{X}}_2)}{\boldsymbol{n}_1 + \boldsymbol{n}_2}$ where n_i is the number of observations of treated and controls. $\overline{X}_i$ are vectors that contains the means or averages of the matrices of characteristics of the samples, and $\boldsymbol{S}^{-1}$ is the inverse matrix of their variances and co-variances. T-squared statistics is distributed as $\boldsymbol{F}(\boldsymbol{p}, \boldsymbol{n}_1 + \boldsymbol{n}_2 - \boldsymbol{p} - 1)$, where P is the number of variables. If the T-squared is greater than the specified threshold then the jointly difference between means of the two samples is statically different from zero and the balancing between both samples is poor.

Although we do not use the distribution of the PSM we also test whether the unmatched and matched PS distribution are similar to obtain greater confidence that the treated and comparison groups are similar. To do so we use the Kolmogorov-Smirnov two-sample "D" test that assesses whether two independent samples have been drawn from the same population (or from populations with the same distribution). The statistical test uses the maximal difference between cumulative frequency distributions of the two samples. The test is complemented by Charts of the PS of matched and unmatched distributions.

Data

The two cases examined in this study correspond to the Neighbourhood Improvement Program (NIP) of Chile and the Social Investment Fund of Guatemala (SIF). The information utilized in this paper includes administrative data and socio-demographics characteristics of the localities or municipalities. The administrative data contains the information about the interventions of the programs, and the socio-demographic data corresponds to the characteristics of the municipalities and villages. The administrative data for the NIP comes from the Office of Regional Development (SUBDERE, for the Spanish acronyms) in Chile and for the Social Investment Fund the data was provided by the program's executing unit.

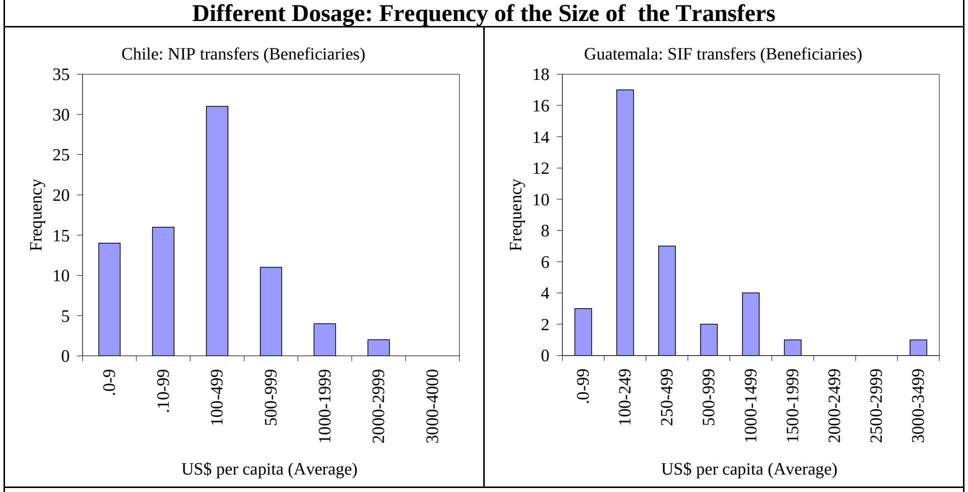
The socio-demographic characteristics of the villages in Guatemala come from the special processing of the Censuses of 1994 and 2004 produced by the National Statistics Institute (INE) of Guatemala. In the case of Chile the information at municipality level comes from the special processing of the Socio-Economic Characterization Surveys (CASEN) produced by the Ministry of Planning (MIDEPLAN), aggregated data from the National Statistic Institute (INE) of Chile, and from the National System of Municipality Indicators (SINIM) produced by the Office of Regional Development of Chile.

DESCRIPTION OF THE PROGRAMS

Neighbourhood Improvement Program, NIP, provides funds for the construction of water and sewerage solutions to low-income population by transferring capital directly to other public entities, and by other provisions through the Regional Development Fund (FNDR) managed by the central government. Its main objective is to improve the quality of life of the low- income population living in poor sanitary conditions.

The interventions evaluated in this paper correspond to a sub-sample of 496 interventions of NIP carried out from 1996 to 2003. The total expenditure on these projects was US$129 million, of which 95% was classified as works and 4% as Technical assistance (TA). The rest 1% was classified as other interventions. In terms of number of interventions, 263 were classified as technical assistance, 215 works only, and 18 as titling and land. The amount of transfers for works varies considerably by project (see Figure 1, Chile), hence is important to take transfers into account in an analysis of TAs.

Figure 1
Different Dosage: Frequency of the Size of the Transfers



Source: Own calculations based on administrative data

Social Investment Fund, SIF, of Guatemala provides works and institutional support to poor communities nationwide. The interventions of the SIF cover a spectrum of sectors that includes education, health, water, sewerage (drainage), local capacity, community services, social protection, and infrastructure in general. The priority sectors are established according to its own programs catalogue and are intended to improve the standard of living and the economic and social conditions exclusively of the poor and extremely poor sectors of the rural area of the country (Ibarraran et. al., 2008).

The pool of interventions from the SIF to be evaluated in this paper corresponds to a sub-sample of 15,119 interventions of the SIF carried out between 1994 and 2002. These correspond to water and sewerage projects. The total amount in these projects is US$434 millions of which 98% was classified as works and 0.8% as Local Capacity (LC). The rest 1.2% was classified as other interventions. In term of number of interventions, 248 were classified as Local Capacity, 14557 works, and 314 as other. Again the amount of transfers per project varied considerably (see Figure 1, Guatemala) hence dosage effects have to be taken into consideration.

The characteristics of the interventions classified as TA in Chile and LC in Guatemala are shown in Table 1. TA in Chile was redefined as the interventions in legal assistance, technical assistance, design, studies and inspections. In the case of Guatemala the LC was redefined as institutional development for the efficiency of transfers, organizational development of groups, and the development, training and actualisation of directors.

Some interventions as titling, land acquisitions, nutritional education, revolving funds, rural female promotion, and special projects were excluded as TA and LC. This decision was carried out because of the two following reasons. First, the evaluation of the TA and LC component requires minimising the heterogeneity of interventions. TA and LC interventions are characterized by their heterogeneity and it is difficult to establish a standardized classification. Second, even though interventions such as, titling, land acquisitions, revolving funds, etc., can facilitate the implementation and might improve the efficiency of other programs, we are trying to identify interventions that only co-exist with the implementation of infrastructure interventions, as in the case of TA, or that may affect the entire institutional production and delivery of good and services, as in the case of the LC. However, the remaining heterogeneity of TA in each program may pose a problem in the impact calculation as the method requires homogeneity in "treatment".

Table 1
Technical Assistance and Local Capacity Interventions

	Technical Assistance (Chile)	**Local Capacity (Guatemala)**
Treatment	• Legal • Technical • Design • Studies • Inspection	• Institutional development for the efficiency of Transfers • Organizational development of Groups involved • Development, training in general and of Directors.
Other	• Titling • Land	• Nutritional education • Revolving funds • Rural female promotion • Special projects

RESULTS

The calculations for the evaluation of the programs are shown in the Table 2 sample average treatment effect, SATE. There are two estimations for each program. The first calculation corresponds to the impact evaluation of the programs without controlling by the amount of investment, the second calculation corresponds to the impact evaluation of the programs controlling by the amount of investment. The outcome is the increased access to potable water and sewerage

The impact of TA and LC is positive in reducing the percentage of houses without water and sewerage connections (only sewerage in the case of Guatemala). The localities that received works plus a TA obtained an additional improvement in access about 4% in Chile. In the case of Guatemala the additional impact of Local Capacity component was almost 20%. For both cases the size of the impact was larger when the dosage effect was controlled for, confirming the need to control for dosage in estimating the impact of TA.

Table 2
Impact Calculations

	Impact	Std. Err	Z	P>|z|	[95% Con	f. Interval]
NIC: Chile	**Works+TA versus Works only**					
Not controlled by amount of investment, bias corrected						
SATE	-2.4%	1.8%	-1.31	0.191	-6.0%	1.2%
Controlled by amount of investment, bias corrected						
SATE	-3.8%	1.8%	-2.11	0.035	-7.3%	-0.3%
SIF Guatemala	**Works+LC versus Works only**					
Not controlled by amount of investment, bias corrected						
SATE	-7.2%	7.5%	-0.97	0.334	-21.8%	7.4%
Controlled by amount of investment, bias corrected						
SATE	-19.6%	10.1%	-1.94	0.052	-39.5%	0.2%

Note: negative numbers of impact imply a reduction in lack of access. Standard errors and intervals of confidence are bias corrected through bootstrapping.

Why such a large difference in value added between TA in NIP and SIF? One possible answer is that while TA in the NIP program is only for the specific works financed in SIF the TA is for the purpose of general municipality administrative improvement plus coordination with other actors, not just for the works that are to be financed. However, although a plausible hypothesis our analysis cannot determine its validity.

CONCLUSIONS

Technical assistance is often provided to beneficiaries of public programs in addition to pure transfers. However, there is no substantial body of studies that calculates the additional impact, in the sense of exclusively attributable to, of technical assistance on the outcome of interest of the program.

In this paper we applied impact techniques to calculate the value added of technical assistance when it is a part of a transfers to municipalities that finance potable water and sewerage works. Controlling for dosage (amount of transfers for the public works) and considering two treatments (public works and technical assistance and public works only) we find that technical assistance has a positive and statistically significant impact of a reduction of lack of access of potable water and sewerage over and above the impact of financing of public works. This result holds for Chile's Neighbourhood program and Guatemala's Social investment Fund where TA contributed to increased outcomes of 4% and 20% respectively. Thus, given the small dollar value of TA relative to the dollar value of transfers for the works financed not only does technical assistance matter but it is a way of getting more for less.

We applied the method to two water projects. However, the method is applicable to any situation where TA is part of a program's benefits. However, the applicability of the method is limited to situations where some beneficiaries receive only transfers while other receive both transfers and a TA plus where there is a sufficient sample size to find enough similar beneficiaries for both treatments.

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DETAILS OF THE MATCHING PROCEDURES

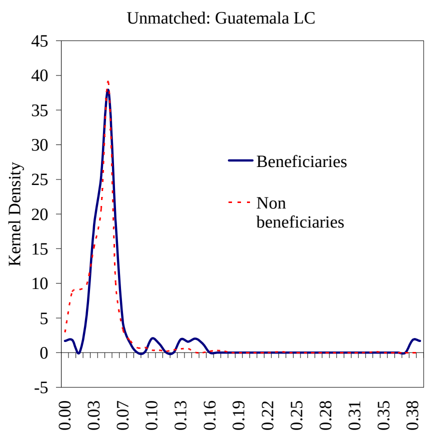
Table A1
Guatemala: Participation Equation and Individual Covariates Bias Reduction and T-Statistics.

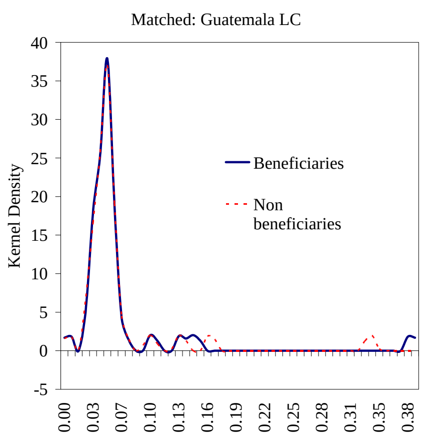
				Mean			% Reduction of	T-Test	
Variable (By Village)		**Coeff.**	**Sample**	**Treated**	**Control**	**% Bias**	**the Bias**	**t**	**|P|>t**
Households with Bathrooms with Drainage	Coeff.	2.381**	Unmatched	0.06	0.04	15.50		1.04	0.30
		[1.117]	Matched	0.06	0.04	16.90	(9.30)	(0.20)	0.84
Private Wage Earner	Coeff.	-2.766**	Unmatched	0.09	0.16	(39.40)		(2.01)	0.05
		[1.361]	Matched	0.09	0.08	9.20	76.60	2.32	0.02
Family Employment	Coeff.	2.701*	Unmatched	0.04	0.02	20.70		2.36	0.02
		[1.495]	Matched	0.04	0.05	(2.70)	87.10	(3.17)	0.00
Constant	Coeff.	-2.932***							
		[0.221]							
Percentage of Households in multi familiy units			Unmatched	0.00	0.00	(7.30)		(0.32)	0.75
			Matched	0.00	0.00	(2.50)	66.60	(4.76)	0.00
Percentage of Households in Shanty Houses			Unmatched	0.26	0.27	(2.30)		(0.13)	0.89
			Matched	0.26	0.31	(14.10)	(514.00)	(0.55)	0.58
Percentage of Households in Dwellings Wall made of Bricks			Unmatched	0.02	0.01	9.80		0.53	0.59
			Matched	0.02	0.00	31.60	(221.90)	1.82	0.07
Percentage of Households in Dwellings Wall made of adobe			Unmatched	0.42	0.40	5.30		0.32	0.75
			Matched	0.42	0.32	25.20	(372.40)	(0.37)	0.71
Percentage of Households in Dwellings Walls made of timber			Unmatched	0.21	0.14	28.40		1.91	0.06
			Matched	0.21	0.18	12.90	54.80	2.49	0.01
Percentage of Households in Dwellings Walls made of Bajarete			Unmatched	0.06	0.13	(35.40)		(1.70)	0.09
			Matched	0.06	0.14	(42.70)	(20.70)	(3.59)	0.00
Percentage of Households in Dwellings Walls made of timber			Unmatched	0.17	0.19	(5.50)		(0.32)	0.75
			Matched	0.17	0.24	(24.80)	(347.50)	(0.52)	0.61
Percentage of Households in Dwellings Floor made of Concrete			Unmatched	0.00	0.01	(8.80)		(0.40)	0.69
			Matched	0.00	0.00	7.60	13.50	1.29	0.20
Percentage of Households in Dwellings Ceilings made of Metal			Unmatched	0.51	0.45	17.60		1.06	0.29
			Matched	0.51	0.39	35.40	(100.50)	2.95	0.00
Percentage of Households in Dwellings Ceilings made of Asbesto			Unmatched	0.01	0.01	16.30		0.94	0.35
			Matched	0.01	0.01	18.70	(14.40)	0.02	0.98
Percentage of Households in Dwellings Ceilings made of Teja (wood)			Unmatched	0.21	0.26	(14.20)		(0.85)	0.40
			Matched	0.21	0.26	(14.10)	0.50	(2.24)	0.03
Percentage of Households in Dwellings Ceilings made of Paja			Unmatched	0.26	0.27	(1.80)		(0.11)	0.92
			Matched	0.26	0.31	(14.30)	(673.70)	(0.56)	0.58
Percentage of Households in Dwellings Floor made of Bricks			Unmatched	0.04	0.05	(5.10)		(0.29)	0.77
			Matched	0.04	0.06	(13.70)	(170.40)	(2.02)	0.04
Percentage of Households in Dwellings Floor made of Torta			Unmatched	0.16	0.21	(25.90)		(1.39)	0.16
			Matched	0.16	0.14	9.80	62.10	0.35	0.72
Percentage of Households in Dwellings Floor made of Sand			Unmatched	0.79	0.74	22.80		1.26	0.21
			Matched	0.79	0.80	(2.20)	90.50	0.38	0.71
Households with access to potable water (Piped)			Unmatched	0.14	0.14	(1.80)		(0.10)	0.92
			Matched	0.14	0.12	8.40	(364.40)	0.75	0.46
Households with access to potable water (Truck)			Unmatched	0.00	0.00	4.70		0.21	0.83
			Matched	0.00	0.01	(7.30)	(56.50)	0.02	0.98
Households with Bathrooms (inside home)			Unmatched	0.66	0.68	(9.40)		(0.55)	0.58
			Matched	0.66	0.73	(25.50)	(172.30)	(1.29)	0.20
Households with Bathrooms with Septic			Unmatched	0.02	0.02	(4.70)		(0.28)	0.78
			Matched	0.02	0.01	5.30	(13.40)	(1.38)	0.17
Households with Bathrooms with Drainage or Septic			Unmatched	0.02	0.02	(0.20)		(0.01)	0.99
			Matched	0.02	0.03	(16.50)	(6,969.10)	(0.63)	0.53
Access to Public Sanitation			Unmatched	0.01	0.00	5.10		0.29	0.77
			Matched	0.01	0.00	9.30	(81.60)	(0.43)	0.67
Access to private Sanitation			Unmatched	0.00	0.00	(1.20)		(0.06)	0.95
			Matched	0.00	0.00	0.70	40.80	(1.42)	0.16
No Access to Public or private Sanitation (Burn the trash)			Unmatched	0.25	0.29	(13.60)		(0.81)	0.42
			Matched	0.25	0.30	(17.80)	(31.40)	(0.53)	0.59
No Access to Public or private Sanitation (Dispose the trash)			Unmatched	0.52	0.48	11.60		0.70	0.48
			Matched	0.52	0.50	5.80	49.70	1.11	0.27
Percentage of Households by tenency (Own)			Unmatched	0.89	0.87	9.90		0.59	0.56
			Matched	0.89	0.87	7.20	26.70	1.03	0.31

Continuation of Table A1
Guatemala: Participation Equation and Individual Covariates Bias Reduction and T-Statistics.

		Mean			% Reduction of	T-Test	
Variable (By Village)	Sample	Treated	Control	% Bias	the Bias	t	|P|>t
Percentage of Households by Tenency (rented)	Unmatched	0.02	0.02	(6.90)		(0.35)	0.73
	Matched	0.02	0.04	(43.40)	(524.80)	(3.88)	0.00
Percentage of Households with Male Head of Households	Unmatched	0.85	0.85	(9.00)		(0.48)	0.63
	Matched	0.85	0.85	(9.90)	(11.00)	(1.40)	0.16
Percentage of Indiginous Population	Unmatched	0.70	0.70	0.00		0.00	1.00
	Matched	0.70	0.65	11.20	(30,733.40)	1.45	0.15
Average Age of the Head of the Household	Unmatched	43.09	43.34	(7.20)		(0.39)	0.69
	Matched	43.09	43.53	(12.40)	(73.10)	(1.54)	0.12
Percentage of Household that only Speak Spanish	Unmatched	0.45	0.41	10.40		0.62	0.54
	Matched	0.45	0.40	12.20	(17.40)	0.65	0.52
Percentage of Head that NOT Read and Write	Unmatched	1.50	1.50	(4.00)		(0.22)	0.83
	Matched	1.50	1.53	(15.20)	(278.80)	0.39	0.70
Percentage of Female Population that NOT Read and Write	Unmatched	1.53	1.50	11.90		0.65	0.52
	Matched	1.53	1.51	7.40	37.80	1.49	0.14
Percentage of Population with Basic Education	Unmatched	0.53	0.56	(14.80)		(0.80)	0.42
	Matched	0.53	0.58	(26.60)	(80.30)	(0.47)	0.64
Percentage of Population with Secondary Education	Unmatched	0.03	0.03	(1.70)		(0.09)	0.93
	Matched	0.03	0.03	(6.70)	(287.80)	(0.76)	0.45
Percentage of Population with Tertiary Education	Unmatched	0.00	0.00	(0.80)		(0.04)	0.97
	Matched	0.00	0.00	(8.80)	(997.40)	(1.26)	0.21
Self Employment with Location, Stablishment, etc	Unmatched	0.00	0.00	(14.80)		(0.70)	0.49
	Matched	0.00	0.00	(29.30)	(97.70)	(2.33)	0.02
Self Employment without Location, Stablishment, etc	Unmatched	0.68	0.63	20.50		1.17	0.24
	Matched	0.68	0.70	(5.70)	72.10	(1.21)	0.23
Public Employment	Unmatched	0.01	0.02	(14.10)		(0.78)	0.44
	Matched	0.01	0.02	(26.50)	(88.00)	(2.87)	0.00
Percentaje of Head (Married)	Unmatched	0.01	0.01	6.40		0.40	0.69
	Matched	0.01	0.02	(20.20)	(217.90)	(2.80)	0.01
Percentaje of Head (Widow (er))	Unmatched	0.01	0.01	(3.70)		(0.20)	0.84
	Matched	0.01	0.02	(17.40)	(375.30)	0.72	0.47
Percentaje of Children Attending to School	Unmatched	0.68	0.66	7.80		0.46	0.65
	Matched	0.68	0.64	16.30	(108.40)	0.68	0.50
Unemployment	Unmatched	1.54	1.54	(1.30)		(0.07)	0.94
	Matched	1.54	1.50	11.90	(805.20)	1.17	0.24
Primary Age (Average)	Unmatched	1.03	1.02	3.60		0.21	0.83
	Matched	1.03	0.98	19.70	(448.30)	1.44	0.15
Total Consumption per Household	Unmatched	1,219.80	1,189.00	4.10		0.29	0.77
	Matched	1,219.80	1,340.40	(16.30)	(292.60)	(2.48)	0.01
Per Capita Consumption per Household	Unmatched	6.57	6.58	(2.50)		(0.16)	0.88
	Matched	6.57	6.63	(15.40)	(524.50)	(1.57)	0.12
Unmet Basic Need Index (Education)	Unmatched	0.20	0.20	(0.70)		(0.04)	0.97
	Matched	0.20	0.20	1.90	(168.60)	0.63	0.53
Unmet Basic Need Index (Hosuing Quality)	Unmatched	0.26	0.32	(19.90)		(1.09)	0.28
	Matched	0.26	0.38	(38.00)	(90.80)	(1.51)	0.13
Unmet Basic Need Index (Overcorwding)	Unmatched	0.53	0.53	(0.50)		(0.03)	0.98
	Matched	0.53	0.56	(14.90)	(3,115.90)	(1.59)	0.11
Unmet Basic Need Index (Water access)	Unmatched	0.18	0.16	7.50		0.44	0.66
	Matched	0.18	0.19	(4.40)	41.70	(1.35)	0.18
Unmet Basic Need Index (Sewerage)	Unmatched	0.24	0.24	0.90		0.05	0.96
	Matched	0.24	0.22	8.60	(872.70)	(0.25)	0.81
Unmet Basic Need Index (Dendency ratio)	Unmatched	0.21	0.21	(7.00)		(0.37)	0.72
	Matched	0.21	0.22	(13.20)	(88.30)	(0.52)	0.60
Unmet Basic Need Index (Total)	Unmatched	1.62	1.67	(6.60)		(0.35)	0.73
	Matched	1.62	1.76	(19.60)	(197.40)	(1.68)	0.09
Total Population	Unmatched	1,097.10	914.84	8.00		0.49	0.62
	Matched	1,097.10	510.05	25.70	(222.10)	1.52	0.13
Observations	842						
chi2	10.53						
Adjusted R-squared	0.0347						

Figure A1
Guatemala: Matching Indicators





Hotelling Test
Equality of means between groups
Unmatched
2-group Hotelling's T-squared = 52.332562
F test statistic: ((853-56-1)/(853-2)(56)) x 52.332562 = 0.874

H0: Vectors of means are equal for the two groups
F(56,796) = 0.8741
Prob > F(56,796) = 0.7315
Matched
2-group Hotelling's T-squared = 52.332562
F test statistic: ((853-56-1)/(853-2)(56)) x 52.332562 = 0.874

H0: Vectors of means are equal for the two groups
F(56,796) = 0.8741
Prob > F(56,796) = 0.7315

Kolmogorov-Smirnov Two-sample Test
Equality of distribution between groups

	D	P-Value	Corrected
Unmatched			
Untreated:	0.201	0.057	
Treated:	-0.004	0.999	
Combined K-S:	0.201	0.113	0.080
Matched			
Untreated:	0.254	0.011	
Treated:	-0.023	0.963	
Combined K-S:	0.254	0.021	0.013

Table A2
Chile: Participation Equation and Individual Covariates Bias and T-statistics.

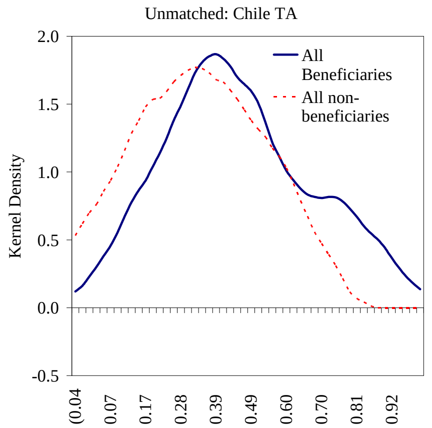
Variable (By Village)	Coef	Sample	Mean Treated	Mean Control	% Bias	% Reduction of the Bias	T-Test t	T-Test |P|>t
Total Population (Logs)	1.384***	Unmatched	10.30	10.55	(21.70)		(0.95)	0.35
	[0.40]	Matched	10.55	10.62	(6.00)	72.50	(0.89)	0.38
Population Density - P/Km2 (Logs)	-0.438**	Unmatched	3.71	3.62	5.20		0.22	0.83
	[0.20]	Matched	4.07	3.80	15.40	(196.40)	(0.13)	0.90
Agriculture Employment (% of total employment)	3.563*	Unmatched	0.30	0.31	(4.90)		(0.21)	0.83
	[1.96]	Matched	0.31	0.29	6.50	(33.10)	0.47	0.64
School Attendance (6-14)	33.43*	Unmatched	0.98	0.98	(16.20)		(0.64)	0.52
	[19.7]	Matched	0.98	0.99	(49.10)	(204.00)	(1.69)	0.10
Extreme Poverty Incidence	-13.81*	Unmatched	0.07	0.06	28.70		1.09	0.28
	[7.53]	Matched	0.07	0.06	44.70	(55.80)	2.62	0.01
Extreme Poverty Incidence in Urban Areas	7.612*	Unmatched	0.17	0.17	(4.90)		(0.22)	0.83
	[4.07]	Matched	0.16	0.19	(26.90)	(447.00)	(0.70)	0.49
Birth Rate per 1000	0.175*	Unmatched	16.72	17.50	(21.40)		(1.08)	0.28
	[0.095]	Matched	16.95	18.26	(36.00)	(67.70)	(1.15)	0.25
Number of Water Subsidies per 100	0.12	Unmatched	4.46	3.96	19.30		0.76	0.45
	[0.16]	Matched	4.12	4.09	1.00	94.90	0.79	0.43
Efficiency of Water Subsidies (%)	-1.271	Unmatched	0.81	0.83	(4.40)		(0.19)	0.85
	[1.20]	Matched	0.85	0.81	14.70	(234.60)	0.66	0.51
Total Investment as Percentage of Total Expenditure (%)	4.248**	Unmatched	0.28	0.27	10.60		0.42	0.68
	[2.12]	Matched	0.25	0.25	(1.90)	82.20	(0.07)	0.94
Real Investment PMB Per Capita 1992-2004 (Logs)	0.0572	Unmatched	9.18	8.33	24.80		1.14	0.26
	[0.077]	Matched	8.73	8.95	(6.60)	73.30	(0.37)	0.72
Constant	-52.55**							
	[20.8]							
Distance to the Capital of the Region - km (logs)		Unmatched	3.70	3.80	(5.80)		(0.25)	0.80
		Matched	3.46	3.83	(21.30)	(267.00)	0.08	0.94
Distance to the Metropolitan Region - km (logs)		Unmatched	5.62	5.61	0.40		0.02	0.99
		Matched	5.27	6.03	(42.80)	(11,703.40)	(1.15)	0.25
Accesibility. Dummy Var. (1 = Comuna con acceso directo por tierra sin dificultades aparente)		Unmatched	0.97	0.96	6.30		0.28	0.78
		Matched	0.97	1.00	(16.60)	(164.50)	(1.16)	0.25
Accesibility. Dummy Var . (1 = Comuna con transporte regular, acceso por tierra, pero con dificultades funcionales (distancia, transporte, relieve) y temporales (condiciones climáticas)		Unmatched	0.01	0.04	(15.90)		(0.76)	0.45
		Matched	0.03	0.00	18.60	(16.90)	1.16	0.25
Accesibility. Dummy Var . (1 = Comuna con transporte irregular, con acceso que combina medios de transporte (carretera, navegación, avión)		Unmatched	0.01	0.00	17.30		0.60	0.55
		Matched	0.00	0.00	0.00	100.00	.	.

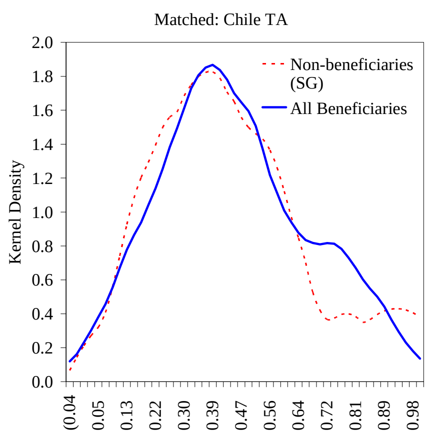
Continuation of Table A2
Chile: Participation Equation and Individual Covariates Bias and T-statistics,

Variable (By Village)	Sample	Mean Treated	Mean Control	% Bias	% Reduction of the Bias	T-Test t	T-Test |P|>t
Accesibility. Dummy Var . (1 = Comuna con transporte irregular, con acceso muy lim	Unmatched	0.00	0.00	.		.	.
	Matched	0.00	0.00	.	.	.	.
Population Dispersion. Dummy Var. (1 = Población comunal altamente concentrada)	Unmatched	0.22	0.25	(6.10)		(0.26)	0.80
	Matched	0.25	0.25	0.00	100.00	(0.74)	0.46
Population Dispersion. Dummy Var. (1 = Población comunal concentrada)	Unmatched	0.06	0.13	(22.30)		(1.02)	0.31
	Matched	0.09	0.18	(30.90)	(38.50)	(0.46)	0.65
Population Dispersion. Dummy Var. (1 = Población comunal dispersa)	Unmatched	0.13	0.21	(19.40)		(0.86)	0.39
	Matched	0.16	0.21	(14.90)	23.50	(0.55)	0.59
Population Dispersion. Dummy Var. (1 = Población comunal muy dispersa)	Unmatched	0.58	0.42	33.10		1.39	0.17
	Matched	0.50	0.35	29.40	11.10	1.43	0.16
Years from Implementation of "Plan Regulador Comunal" (Logs)	Unmatched	1.77	1.67	7.10		0.29	0.77
	Matched	1.78	2.12	(25.90)	(263.70)	(0.05)	0.96
Rural Areas	Unmatched	0.31	0.31	(0.30)		(0.01)	0.99
	Matched	0.31	0.29	7.70	(2,104.40)	0.60	0.55
Lack of Water or Sewerag	Unmatched	0.11	0.09	23.50		0.98	0.33
	Matched	0.09	0.07	19.90	15.30	0.59	0.56
Access to Electricity	Unmatched	0.95	0.96	(12.60)		(0.46)	0.65
	Matched	0.95	0.96	(6.70)	46.70	(0.29)	0.77
Housing Déficit	Unmatched	0.42	0.39	16.50		0.69	0.49
	Matched	0.38	0.36	11.20	31.80	0.90	0.37
Dependency Ratio	Unmatched	0.36	0.37	(4.30)		(0.19)	0.85
	Matched	0.36	0.36	0.60	86.90	0.93	0.36
Net Participation Rate	Unmatched	0.56	0.57	(13.00)		(0.56)	0.58
	Matched	0.57	0.58	(23.50)	(81.10)	(1.17)	0.25
Female Net Participation Rate	Unmatched	0.35	0.36	(15.10)		(0.66)	0.51
	Matched	0.36	0.38	(18.60)	(23.00)	(0.92)	0.36
Unempplyment Rate	Unmatched	0.11	0.11	18.20		0.71	0.48
	Matched	0.11	0.11	1.10	94.20	0.58	0.57
Male Household Head	Unmatched	0.72	0.72	(8.40)		(0.33)	0.74
	Matched	0.72	0.73	(9.80)	(16.60)	(1.26)	0.21
Net Participation Rate Male Household Head	Unmatched	0.78	0.78	(5.50)		(0.22)	0.83
	Matched	0.78	0.79	(23.10)	(322.50)	(0.81)	0.43
Age of the Household Head	Unmatched	47.00	46.49	21.90		0.98	0.33
	Matched	47.28	46.36	39.30	(79.10)	1.58	0.12
Undernourishment Rate (0-5)	Unmatched	0.03	0.03	7.40		0.30	0.77
	Matched	0.03	0.03	25.90	(251.50)	0.15	0.88
Per Capita Household Income (Real $)	Unmatched	11.59	11.60	(3.00)		(0.13)	0.90
	Matched	11.61	11.66	(15.80)	(428.30)	(0.55)	0.58
Gini of Per Capita Household Income (Real $)	Unmatched	0.50	0.49	12.60		0.52	0.60
	Matched	0.50	0.51	(13.50)	(6.50)	0.47	0.64
Poverty Incidence	Unmatched	0.25	0.25	10.70		0.44	0.66
	Matched	0.25	0.24	4.40	58.40	0.86	0.39
Ocupation Ratio	Unmatched	0.33	0.34	(13.50)		(0.56)	0.58
	Matched	0.34	0.35	(16.20)	(20.00)	(1.42)	0.16
Labor Income	Unmatched	12.10	12.14	(14.00)		(0.63)	0.53
	Matched	12.12	12.17	(14.80)	(5.30)	(0.87)	0.39
Infant Mortality Rate per 1000	Unmatched	8.53	8.32	3.80		0.14	0.89
	Matched	7.90	7.29	11.20	(197.20)	1.15	0.26
Community Organization Rate (%)	Unmatched	12.73	12.38	4.50		0.19	0.85
	Matched	12.48	11.76	9.30	(104.60)	1.21	0.23
Per Capita Total Budget of Municipality (Real $)	Unmatched	67.57	66.96	2.00		0.08	0.93
	Matched	57.87	64.86	(22.40)	(1,048.30)	(0.94)	0.35
Percentaje of Professional (employees) in the Municipality (Administration) %	Unmatched	0.20	0.19	5.70		0.23	0.82
	Matched	0.19	0.19	9.50	(66.50)	0.67	0.51
Own Income as Percentage of Total Income less Transfers (%)	Unmatched	0.36	0.39	(12.20)		(0.53)	0.60
	Matched	0.39	0.49	(53.00)	(333.30)	(2.37)	0.02

Observations	255
Chi2	77.38
Adjusted R Square	0.175

Figure A2
Chile: Matching Indicators





Hotelling Test
Equality of means between groups
Unmatched

2-group Hotelling's T-squared = 47.539181
F test statistic: ((67-40-1)/(67-2)(40)) x 47.539181 = 0.475

H0: Vectors of means are equal for the two groups
F(40,26) = 0.4754
Prob > F(40,26) = 0.9833

Matched

2-group Hotelling's T-squared = 42.86594
F test statistic: ((57-40-1)/(57-2)(40)) x 42.86594 = 0.312

H0: Vectors of means are equal for the two groups
F(40,16) = 0.3118
Prob > F(40,16) = 0.9986

Kolmogorov-Smirnov Two-sample Test
Equality of distribution between groups

	D	P-Value	Corrected
Unmatched			
Untreated:	0.312	0.032	
Treated:	0.000	1.000	
Combined K-S:	0.312	0.065	0.039
Matched			
Untreated:	0.059	0.943	
Treated:	-0.471	0.023	
Combined K-S:	0.471	0.046	0.025

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