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Pablo Ibarrarán, Miguel Sarzosa and Yuri Soares

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Pablo Ibarraran, Miguel Sarzosa and Yuri Soares *

The authors are from the Office of Evaluation and Oversight of the Inter-American Development Bank.

 Correspondence to: Yuri Soares, e-mail: yuris@iadb.org, Office of Evaluation and Oversight, Inter-American Development Bank, Stop B-750, 1300 New York Avenue, NW, Washington, D.C. 20577.

ABSTRACT

This paper assesses the welfare impacts of local investments projects in rural areas of Guatemala. Using census track data from two rounds of the Guatemalan population census, as well as administrative data on investment projects, we are able to estimate the impact of education, sanitation, productive, and total investment activities at the village level on measures of welfare. This is the first impact evaluation of social funds in Guatemala, and also the first paper that uses village level data, and both a multi-treatment effect approach and the generalized propensity score with continuous treatments to analyze this type of interventions. We find, as expected, that local investment in schools significantly boost enrollment, that investments in water and sewerage significantly improved measures of access to water. We also show that the amount of investment matters. We estimated dose-response functions based on the generalized propensity score and show that larger investments are associated with larger welfare improvements. Also, beyond the commonly used unsatisfied basic needs indicators we examined more meaningful welfare impacts in infant mortality and school progression. We found evidence of positive impacts of education on normal school progression, as measured by student overage. On the other hand, we found no impact of sanitation projects on measures of child mortality. In terms of productive projects, there was a significant and consistent impact on consumption. We did not find evidence to suggest complementarities of impacts: project impacts were in general independent of the presence of other types of projects.

INTRODUCTION

Since the early 1990s Latin American countries have relied on investment funds to finance local development projects. Initially as a response to the stabilization and reform policies of the early 1990s, the funds were set up as a measure to compensate for the negative distributive, employment, and welfare impacts that were hypothesized to emerge as a consequence of liberalization and the end of price supports and agricultural subsidies. Social funds expanded rapidly and they became an important instrument for social investments, well beyond the short-term initial conception.

In this paper we look at the impact of local investments by analyzing the effectiveness of one of the primary sources of this type of investments in Guatemala, the FIS (*Fondo de Inversión Social*). Although investment funds have been studied in other countries (see literature review below), there are no impact evaluations of the Guatemalan FIS. This is particularly relevant given the central role that the FIS, and its cousin fund, the FONAPAZ, were to have in addressing the grievances of the poor, rural—and mostly indigenous populations of the country, following 36 years of civil war.[1]

This paper also contributes to the literature in that it models the existence of dosage effects, that is whether and by how much the amount of investment determines the magnitude of the welfare impacts of the program. Although the techniques to analyze continuous treatments have been developed for a number of years, their application to evaluation of this type of programs is rare. The paper also looks at the specific type of investments financed by the program, comparing the impact of multiple treatments. In order to accomplish this, we utilize the richness of the Guatemalan administrative data to identify projects approved and executed at the village level (*lugar poblado*) in education, sanitation, and productive infrastructure. Given that there are sufficient villages with each of the different types of investments –and all the combinations of them—we are able to establish pair-wise comparisons for each of the investment groups.

The remainder of the paper is structured as follows. In the section below we review the literature on the effectiveness of investment funds on local outcomes. In section three we provide a general overview of social funds in Guatemala, and of the FIS in particular. In sections four and five we describe the methodology and the data. In section six we present results on the targeting of FIS, and in

[1] Peace accords were signed in 1996 marking the end a protracted and bloody civil war. The conflict had had as protagonists the elites in power (generally represented by the Guatemalan Republican Front) and the Guatemalan National Revolutionary Unity (URNG) force, which drew membership mostly from the rural poor, and indigenous segments of society.

section seven we analyze and discuss the impact of FIS investments on consumption and poverty. Section eight concludes the paper.

LITERATURE REVIEW: WHAT IS KNOWN OF SOCIAL FUNDS

Substantial work has been done on FIS over the past 10 years, but the question on the benefits and effectiveness of FISs is unresolved. Much of what is written regarding FISs is based either on methodologies that do not tackle the central problem of program placement,[2] or that are based on anecdotal evidence. This has been so because the focus of most of the evaluations has been at the institutional level, and thus the assessments did not lend themselves to treatment effect evaluation methodologies. It has also been the case due to the paucity of information on the public policy and investment environment in small municipalities. Indeed, longitudinal information regarding the role of public policy is required in order to draw appropriate conclusions from impact evaluation estimates. These deficiencies have left a gap in knowledge regarding the impact of social investment in marginalized and poor communities. Although much has been learned from opinion surveys and community perception tools, the hard data and rigorous technique required to document and track the welfare impact of these programs has been scarce.

One of the only main at consolidating findings of different social fund impact evaluations was done by the World Bank (Rawlings et al, 2004). The assessment uses the treatment effect methodology, making an effort to construct meaningful counterfactuals. It covers four Latin American countries: Bolivia, Honduras, Nicaragua and Peru. The evaluation compared social outcomes of communities that received treatment with comparison communities. In the case of Peru and Honduras the comparison was made between treated groups and "pipeline" groups. Being that "pipeline" is defined as communities with projects that were approved but not yet executed. None of the evaluations undertaken by World Bank contained baseline data. The consequence is that the possibility of capturing selection on unobservable is very high, making it fundamental to

[2] The problem of program placement is that, in order for the impact evaluation techniques to be valid, it is necessary to assume that the probability of assignment to the treatment does not depend on the potential outcomes. This condition holds with random assignment, and the way the literature deals with it is by assuming that it holds conditional on observed variables. So, absent random assignment, it is necessary to tackle the problem by making either the strong or weak unconfoundedness assumption (Rosenbaum and Rubin, 1983) and using techniques that control for the selection bias, such as the propensity score. Most of the FIS evaluation literature ignores this problem.

"observe" as much heterogeneity as possible through extensive and high quality surveys.

Nonetheless, the World Bank assessment aims to answer four broad questions: Do social funds reach poor areas and poor households? Do social funds deliver high-quality, sustainable investments? Do social funds affect living standards? How cost-efficient are social funds and the investments they finance, compared with other delivery mechanisms? The findings regarding targeting show that health projects tend to be pro-poor, education projects are essentially neutral, and sewerage projects are regressive. However, authors have argued that being pro-poor should not be the appropriate criteria with which to judge targeting. Rather, social funds should be judged versus the effectiveness of targeting of other public sector programs, such as ordinary health and education services. This point is made by Tendler (Tendler, 2000), who demonstrates that primary schooling and health services managed by existing government entities are actually more progressive than social funds.

The World Bank results point to the largest impact parameters on health, and more modest impacts on other sectors, although the finding is not across the board. In education there are no consistent findings other than an increase in enrollment due to better constructed and equipped schools. This is a result corroborated, for example, by Paxson and Schady (2002) for Peru, as well as by Newman (2002) for Bolivia. The results of Newman are particularly convincing, given that he was able to implement a randomized design between treated and not treated communities. The relevant result in Newman was a large impact on under-5 mortality. The result on health is also consistent with the findings of Marcus (2002) for social investment funds in Mali, Tajikistan and Mongolia.

Beyond the impact of specific investments, there has been a proliferation of papers on the political economy of local investment. For example, Schady (1999) found that the placement of FONCODES projects in Peru favored municipalities of the government party. More recently, Araujo et all (2005) found that local inequality adversely impacted the ability of communities to organize and obtain funding for local projects. Heinrich (2006) also looked at local organization, and she found that increased levels of participation did not produce better results, even if they produced better opinion regarding results among residents. The results of Rao in Jamaica (2005) also show that community-driven development in the case of the Jamaican social fund does not seem to be providing a better match between local projects and local needs. On the other hand, many assessments based on case studies find results to the contrary.

A second set of criticisms levied against social funds is that they compete with legitimate responsibilities of line ministries and sub-national governments. This

argument was made in the World Bank's Evaluation Department assessment of social funds (IEG, 2004), as well as in a number of other studies. The IEG evaluation is particularly critical of the lack of coordination between social funds and other government agencies, even if it does point out that user satisfaction with social funds is high.

SOCIAL FUNDS IN GUATEMALA

In Guatemala the social funds appeared not as a response to the adjustment costs but rather to address the issue of the *social debt* towards the poor, who had accumulated huge deficits in terms of access to basic public services. Since the late 1980s the concept of *social debt* has been present in the political debate in Guatemala, and one of the mechanisms envisioned to address the issue was the use of social funds. Later, after the peace agreements were reached between the government and the rebel groups, social funds were selected to implement them. Hence, the first social fund was the National Fund for Peace, FONAPAZ, created in 1991 by presidential decree with the specific task of coordinating public and private investments targeted to address the needs of the population affected by the armed conflict.

In May 1993 the Social Investment Fund (FIS) was created as a spin-off of FONAPAZ, with the purpose of improving the living conditions of those living in poverty in the rural areas. The FIS was created by a legislative decree, as an autonomous entity. This resulted, in principle, in greater independence from the political cycle and in a more professional management than in FONAPAZ, which was more subject to political interferences. Both FONAPAZ and FIS have received financial support from the international community (IDB, World Bank, GTZ, BCIE, OPEC), and they fund small projects in the areas of education, sanitation, health, basic infrastructure and productive projects. In 1993 another fund was created in the Development Ministry, the Regional Fund for Community Development (FRDC), which was later transformed in the Solidarity Fund for Community Development (FSDC) under the Executive Secretariat of the Presidency (SCEP). In 1994 a special fund for indigenous population was created, FODIGUA.

A summary of the key characteristic of the most important social funds is presented in Table 1. FIS was the only autonomous fund and the only one that targeted –in theory—exclusively on the rural poor. In terms of resources, however, the FSDC, which now operates through the transfer of resources to the municipalities, has been the largest one, followed by FONAPAZ and then by FIS. Also, while FIS had a well-defined project cycle and all the projects were

formally evaluated based on predefined criteria, FONAPAZ followed a similar mechanism but in a less rigorous fashion, and it is also intended to fulfill presidential commitments, and FSDC transferred funds directly to the departments, which later transfer them to the municipalities.

Table 1. Basic characteristics of the most important social funds in Guatemala

Fund name (Investment)*	*Year of creation*	*Legal base*	*Purpose*	*Main characteristics*	*Government office*
FONAPAZ (US$692 million)	1991	Governmental Agreement 408-91	To satisfy high priority needs of refugees, displaced and repatriated from the armed conflict. To provide favorable conditions to consolidate peace.	Flexible. Executes new projects, repairs, rehabilitations and enlargements.Responds to commitments of the President. Works in the ZONAPAZ region.	Office of the President
FIS (US$603 million)	1993	Legislative decrees 13-93 and 2-2000	To invest on activities that will 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.	Flexible. Works with the priority sectors according to its programs catalog. Only servs projects that benefit poor population of the rural area of the country.	Autonomous, descentralized, with its own law, legal status and patrimony.
FSDC (US$847 million)	1992	Legislative decree 84-92	To develop rural area organization	Supports project execution	Ministry of Development
	1994	Governmental Agreement 250-94	To channel resources to the development councils	Executes projects in the rural area	SCEP
	1996	Governmental Agreement 247-96	To transfer resources to the Municipalities based on the planning of the development councils	Executes projects in the rural area (this fund doesn´t have an established projects cycle)	SCEP
FODIGUA (US$25.4 million)	1994	Governmental Agreement 435-94	To develop the Mayan population, working on its culture, identity and customs	Executes projects in regions with high concentration of indigenous people. The projects are small and of small amounts	Office of the President

* The source of the investment figures is the Ministry of Finance, which does not agree with the FIS data. However, it is the only source with comparable information for all funds, and the purpose here is only to illustrate the relative size of the different funds.

Both FONAPAZ and FIS operate on demand and although they are supposed to allocate resources in a progressive way, there are no predefined formulas that they follow. FIS computed its own unsatisfied basic needs index that was used to decide which projects to fund, but this was not the main criteria and it was not always followed. In fact, one of the objectives of this paper is to empirically

assess the targeting of both FIS and FONAPAZ, and to compare their results in this aspect. In terms of the type of projects financed by each fund, FIS and FONAPAZ had significant overlap in terms of the type of projects financed by each fund (the top three were education, water and sanitation, and infrastructure/productive projects). In terms of the geographical overlap, both programs invested in virtually all the municipalities of the country.

This is the first impact evaluation of social funds in Guatemala. A preliminary evaluation of the Local Development Program financed by the World Bank through FONAPAZ attempted to use micro-data to determine whether beneficiary villages reduced their unsatisfied basic needs index –the most commonly used poverty proxy in the literature of social funds—more than non-beneficiary villages. The results suggest that the index fell equally for both groups of villages.[3]

Data from the 1994 Census shows the high levels of poverty in Guatemala and the poor status of the poor when FIS started to operate: 30% of boys and 40% of girls aged 5-15 did not attend school, 50% of households had dirt floor, 72% of household heads did not finish primary education, and 35% of household dumped their garbage in public spaces, while 30% of the population was illiterate. A simple and commonly used way to summarize the lack of basic services is through the use of the unsatisfied basic needs.[4] As shown in table 2.a, in 1994 15% of households had at least one school-aged child not attending school, 23% had a poor quality dwelling, while 40% lived in overcrowding conditions, 21% lacked access to water, 25% did not have proper drainage and in 15% of the households the dependency ration was too high. The situation improved by 2002 for the first four indicators, most notably in education and dwelling characteristics.

[3] There are several evaluations on FIS and FONAPAZ, but none use welfare indicators to assess the impact. Rather, they usually present beneficiary satisfaction survey information as proxy for impact.

[4] The index was introduced by ECLAC in the early 1980s and it measures how many of those needs a household lacks. Although rough, the index is useful because it is easily computable form census data and it may be comparable across countries. See Feres and Mancero (2001)

Table 2.a, % of Households with Unsatisfied Basic Needs, 1994 and 2002

Unsatisfied Basic Need	1994	2002
Education	14.89	7.73
Dwelling	23.21	12.74
Overcrowding	40.88	35.55
Water	20.75	16.52
Drainage	25.2	25.85
Dependency Ratio	14.79	15.32
Number of households	1,591,546	2,200,620

Another interesting figure is the number of UBNs that a household has. As shown, in 1994 only 32% of households had all of their basic needs met, and by 2002 there was a slight improvement as 38% of household satisfied all their basic needs. However, in 2002 there were still 32.4% of households with two or more unsatisfied basic needs (down from 41% in 1994).

Table 2.b, % of Households by number of Unsatisfied Basic Needs, 1994 and 2002

Number of UBN in Hhld	1994	2002
0	31.71	38.43
1	27.26	29.13
2	20.64	18.46
3	12.57	9.39
4	5.73	3.58
5	1.8	0.89
6	0.3	0.12

This dismal social reality was aggravated by the political tensions that were accumulated due to the internal armed conflict, and further complicated by the expectations of the peace agreements reached in the mid 1990s.

THE IDENTIFICATION STRATEGY

We define as impact of a social fund the change in either consumption or in specific development indicators that is attributable to the fund's investment in a particular place. Did villages that received funding from FIS see improved consumption and/or access to basic social or infrastructure services and/or other welfare indicators compared to what they would have had without the intervention? The basic problem involved in identification of the impact of social investment funds is how to deal with program placement. In this case programs were not placed randomly, although –as it will be shown in section 5— their targeting is among the worst targeted programs in LAC. In the lack of a randomized design, the strategy adopted here is to use pre-program information on village characteristics to match treated villages with comparable untreated villages, and to control by other relevant characteristics such as the investment from other funds and access to financing at the municipal level.

We start the analysis with the traditional impact effect evaluation assuming selection-on-observables which is controlled with the propensity score. Following the mainstream practices[5] we used both matching techniques and a regression framework controlling for the p-score. Here we model the treatment as a binary variable, i.e. whether the village received or not FIS investment between 1994 and 2002.

We extend the basic analysis in two ways that will be described in more detail in chapter 7. First, by accounting for the fact that the treatment, i.e. the accumulated investment per household at the village level, is a continuous variable. Here we follow Hirano and Imbens (2004) and estimate an entire dose-response function that relates the dosage of the per-household investment at the village level with response observed in the welfare and outcome indicators. The generalized propensity score was computed using maximum likelihood to estimate the parameters of interest assuming that the distribution of the treatment given the covariates followed a normal distribution, and then used a quadratic function (in the generalized p-score and in the treatment) to estimate the conditional expectation of the outcome based on the treatment and the generalized p-score. From this specification, the response for a particular dosage can be estimated.

The second extension of this paper consists in identifying the marginal treatment of different treatment types, as developed in Imbens (1999) and by Lechner (1999)[6]. The way to deal with multiple treatments is by estimating the ATE or

[5] For a recent survey on the use of the propensity score for evaluation of public policies, see Bia (2007)
[6] See Bia (2007) for a review of both methods.

ATT of treatment *t* relative to treatment *s*, i.e. by making pair-wise comparisons between the different treatments. The first stage estimates a multinomial logit model to determine the probability of having one of the different treatments, which are defined as mutually exclusive and jointly exhaustive. Then pair-wise comparisons are made by conventional matching techniques. Here we model as different treatments the following type of FIS investments at the village level: education (E), health (i.e. water and sanitation and health, H), or productive/infrastructure (P) exclusively; the combination of two or the three of them (EH, EP, HP, EPH), and finally the absence of any FIS investment. As shown in the next section, the distribution of treatments allows us to use these categories.

DATA

The data used are essentially from two sources. The first is the administrative data from the FIS program itself, which is available from all the projects approved during the life of the fund, i.e. from 1993 to 2006. FIS sponsored over 16,000 projects in the twenty-two departments of Guatemala, reaching 329 of the 331 municipalities. So, although the program was intended to reach poor rural population, it covered the entire country. Also, 20.25% of total FIS investment was not in rural villages.

FIS had a catalog of about fifty eligible types of investments, which we consolidated into seven broad categories. As shown in Table 3, during its lifespan FIS invested just over USD$470[7] million, largely in education, productive projects, and –to a lesser extent—in water and sanitation and health. Education projects (evenly divided between construction and equipment) were the most important projects during the first three or four years, after which productive projects (roads, bridges and community banks) gained relevance.

[7] This figure comes from the project database that we got from the FIS authorities. It does not match with the one in Table 2 for which data on total planned expenses from the Ministry of Finance was used.

Table 3. Distribution of FIS funds by year and type of project

	Education	Health	Water and Sanitation	Local Capacities	Community Service	Social Protection	Productive	Total Investment ($000's)
1994	65%	9%	16%	1%	0%	4%	4%	$ 3,877
1995	75%	7%	6%	0%	0%	6%	5%	$ 25,656
1996	52%	16%	9%	0%	0%	18%	4%	$ 25,163
1997	49%	9%	13%	1%	2%	10%	16%	$ 54,986
1998	32%	7%	16%	2%	1%	3%	38%	$ 81,218
1999	31%	8%	21%	2%	2%	4%	32%	$ 100,283
2000	33%	7%	18%	2%	0%	5%	34%	$ 73,726
2001	13%	9%	16%	5%	0%	5%	52%	$ 44,812
2002	21%	11%	23%	1%	0%	6%	37%	$ 25,537
2003	41%	29%	3%	5%	0%	6%	16%	$ 8,284
2004	37%	10%	27%	0%	0%	4%	22%	$ 13,471
2005	21%	4%	31%	0%	0%	6%	38%	$ 12,723
2006	11%	12%	70%	0%	0%	4%	2%	$ 1,949
Total	35%	9%	17%	2%	1%	6%	30%	$ 471,685

The FIS data also allows identifying the program's investment, the community's counterpart and the total investment. Additionally it provides –in most of the cases (69% of projects and 68% of investment)—the exact location of the project, at the level of the village or *lugar poblado*[8], which is the smallest geographic area that is possible to identify in both of the population censuses that provide pre-program information (1994) and allow for a follow-up in 2002.

The basic data about FIS was generated from the fund's information and monitoring system; similar data was requested from FONAPAZ. However, it was not possible to obtain reliable data from FONAPAZ. FONAPAZ data at the project level was available but incomplete, so it was used only for ancillary analysis. With this information we were able to obtain an approximation to the overlap between the two funds. At the municipal level –the most disaggregated level we have for FONAPAZ—we find that the correlation of per-capita normalized investment of both funds is 0.19, however for the three largest areas of FIS investment the correlations are higher: 0.37 for education, 0.25 for productive/infrastructure projects and 0.21 for water and sanitation. In terms of geographical coverage, both funds covered the same 319 municipalities.

[8] Villages in 2002 had a mean population of 635 and a median population of 243.

For the implementation of the multiple treatments methodology, each village was classified according to the type of FIS investment it received. The information is summarized in Table 4.

Table 4. FIS investment by type (in matched villages).

	*Investment**							
category	*Education ($)*	*%*	*Health ($)*	*%*	*Productive ($)*	*%*	*Total ($)*	*HHlds*
No FIS	-		-		-		-	778,670
Only education	322,138	100%	-	0%	-	0%	322,138	231,158
Only Productive		0%	-	0%	281,482	100%	281,482	84,626
Only Health		0%	176,515	100%		0%	176,515	102,315
E&P	113,618	38%		0%	183,986	62%	297,604	73,604
H&P		0%	92,208	40%	135,834	60%	228,042	41,500
E&H	112,629	25%	155,381	34%	190,290	42%	458,300	102,980
E&H&P	98,802	40%	149,921	60%	-	0%	248,724	95,446

* Thousands of Quetzales

The second source of information consists of the 1994 and 2002 population censuses. These capture basic individual and household information, and allow us to compute similar indicators in both years; particularly the unsatisfied-basic-needs approach to measure poverty. These data is particularly useful because it provides a comprehensive baseline for the program: in 1994 investments by social funds in general were virtually nonexistent. Although in 2002 investments were still ongoing, in the case of FIS 87% of its total investments took place between 1994 and 2001. Besides, given the lack of an evaluation design of the FIS, this was the only viable option. It was possible to match most villages between both censuses: the 1994 census had 20115 villages, the 2002 had 17673 villages and 14464 were matched, which represent 94.83% of the population in 1994 and 91.29% in 2002. Of the projects for which the village was identifiable, 85% were located in a village that was matched across censuses.

An alternative to working at the village level is to use municipal data, for which there is a richer set of information available. While the only sources of village-level data are the censuses and the FIS administrative records, at the municipal level data from other sources can be used. For example investments from other funds (although even at this level the FONAPAZ registries are dubious), constitutionally-mandated transfers from the central government, local revenues, the political affiliation of the mayor, as well as other information on local

capabilities such as the existence of a municipal office of planning and the quality of its staff are available at the more aggregate level. Additionally, at this level the match between censuses is complete and all the project data may be used. However, municipal-level information would counfound the treatment effect, whose beneficiaries are typically members of the village where the productive, education, water or other project is being financed. Likewise, the methodologies of estimating dosage effects would best be tailored to contexts with large numbers of observations.

Lastly, the 2001 Living Standards Survey was also used in order to estimate household-level data on consumption, based on the procedures developed by Elbers, Lanjouw and Lanjouw (2002) for imputing consumption by using census and household data.

The table below shows the UBN index at the household level. A first look at the raw data shows that, between 1994 and 2002, the UBN fell from 68.29 to 61.57 (note that the index is computed at the household level, meaning that in 2002 61.57% of households in Guatemala had at least one unsatisfied basic demand). These figures were 60.15% and 51.27% in urban areas and 73.27 and 71.96 in rural areas. Limiting the analysis to those villages that are matched across censuses, we find that the overall drop was from 67.97% to 61.76%. The exercise was also done according to whether the household is located in a village that received or did not receive FIS.

Table 5. Differences between 1994 and 2002 UBNs

	HOUSEHOLD LEVEL				HOUSEHOLD LEVEL (Average number of UBN)				VILLAGE LEVEL*			
	1994	2002	Dif	%	1994	2002	Dif	%	1994	2002	Dif	%
overall	67.97	61.76	-6.21	-9.14	1.3854	1.1380	-0.2474	-17.86	1.7245	1.4682	-0.2563	-14.86
FIS	69.56	63.75	-5.81	-8.35	1.4215	1.1844	-0.2372	-16.68	1.7054	1.4474	-0.2579	-15.13
No FIS	66.47	59.78	-6.69	-10.06	1.3514	1.0921	-0.2593	-19.18	1.7324	1.4768	-0.2556	-14.75

* Village level mean of the household UBN

The raw data does not show strong differences between households living in FIS and non-FIS villages: at the household level non-FIS villages saw a greater

reduction in the number of UBN, although the difference was not statistically significant.[9]

TARGETING

The first question we want to address is whether the program reached the poorest inhabitants in the country's rural areas, as it was intended to do.[10] To do so, the 1994 census was used to construct welfare and needs measures, and then the distribution of the accumulated investment between 1994 and 2006 was analyzed.[11] The overall finding is that the FIS was poorly targeted, and when compared to FONAPAZ one finds that at first FONAPAZ had better targeting, but it deteriorated sharply in the most recent years. Comparisons of FIS with other social funds in Latin America show that by far the Guatemalan FIS was the worst in terms of targeting.

Chart 1 shows the municipal participation of total FIS investment by deciles of population based on the unsatisfied basic needs index –first column of each group. A useful albeit rough benchmark is the share of the population living in poverty and in extreme poverty, which are about 56% and 20% according to the 2003 UNDP National Human Development Report for Guatemala. Hence, most of the FIS investments should be in the lower two deciles, with little or no resources being dedicated to upper four. However, although the distribution of resources was slightly pro-poor, in that the lower deciles have a larger share than the higher ones, the allocation is not particularly progressive. The share for the bottom 20% is only 29%, for the mid 20% is 22% and for the top 40% it is high, at 28%.[12]

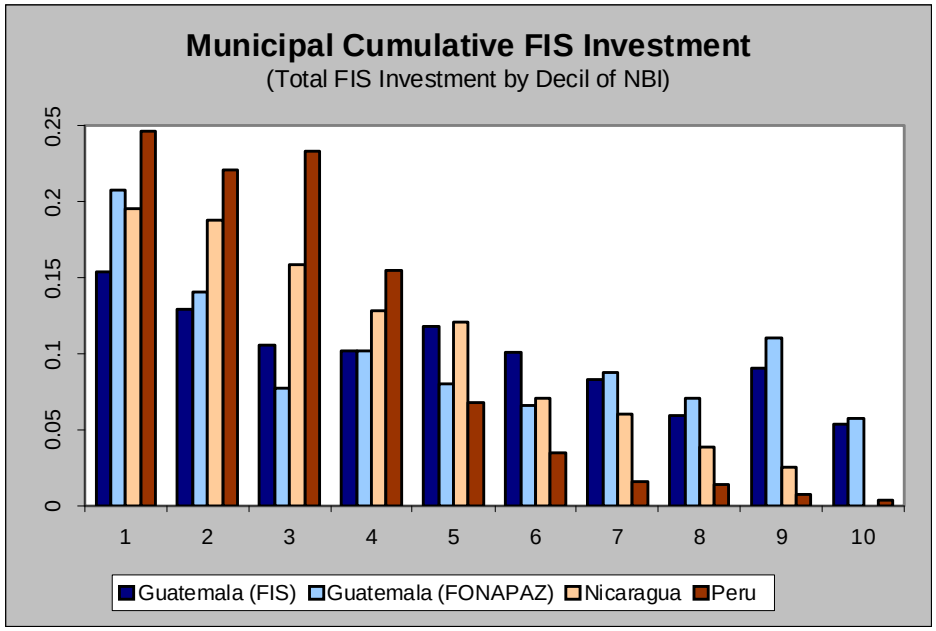
[9] A t-test for the significance of the differences between having or not FIS in the change of the UBN shows that the difference was of 0.0023453 with a standard error of 0.0131617.

[10] In a sense, this is the minimum one could expect as it (largely) depends on the program operators.

[11] The results do not change if we limit the analysis to investment up to 2003, when the new census was available. An analysis could be done using the 2002 data to create the needs-indicators and test the targeting from 2004 onwards. However, these investments are very small so we did not investigate further this issue.

[12] The results are similar if based on deciles of population by estimated per capita consumption, and if the analysis is done at the village level instead than at the municipal level. In the case of consumption, the poorest 20% obtain 29% of the resources, however the mid 20% also obtain a significant share –25%, and the 40% of the population living in the better-off municipalities get about 15% of the resources.

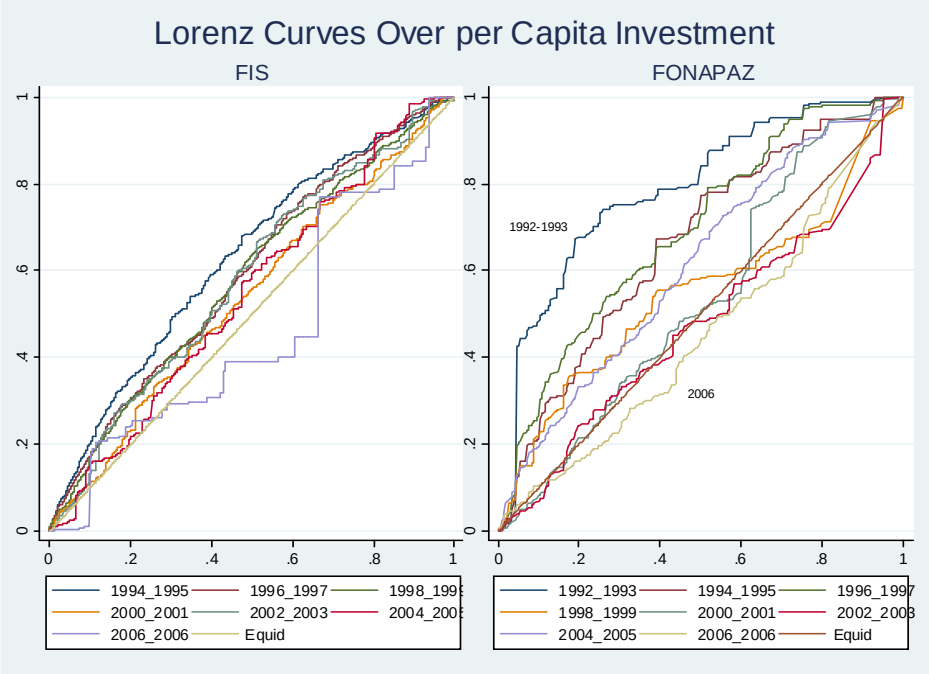
Chart 1. Municipal Investments of Social Funds by Deciles of Unsatisfied Basic Needs.



Two additional comparisons are useful: with FONAPAZ in Guatemala, and with the average of other social funds. On the former, the Chart 1 shows that FONAPAZ invested more in the first two deciles, but it also invested more on the top three deciles, so the comparison shows that both FIS and FONAPAZ are poorly targeted. This is evident when comparing to the social funds in Nicaragua and, particularly, in Peru, countries that were able to concentrate a significant share of its investments in the first three deciles.

In terms of changes over time, Chart two shows Lorenz curves for FIS and FONAPAZ. As can be seen, although the allocation of FONAPAZ deteriorated markedly over the different years, the same is not true of the FIS.

Chart 2. Targeting of FIS and FONAPAZ over time.



The allocation of FIS resources across income groups is not particularly progressive or pro-poor, as shown above. One possible explanation is that the FIS allocation rule was based on a measure of unsatisfied basic needs, as calculated by the FIS using census data. That is, if the basic needs do not reflect consumption of income, it is possible that the allocation based on basic needs would be more progressive. This is not the case. As seen below the allocation with respect to average unmet basic needs shows the same behavior as the allocation based on income. The bottom decile receive a little bit more than 10% (12%), but so does the 7th thru 9th deciles. In short, the FIS was not able to concentrate its investments in the areas with greater needs.

Chart 3. Distribution of FIS resources according to FIS targeting criteria.

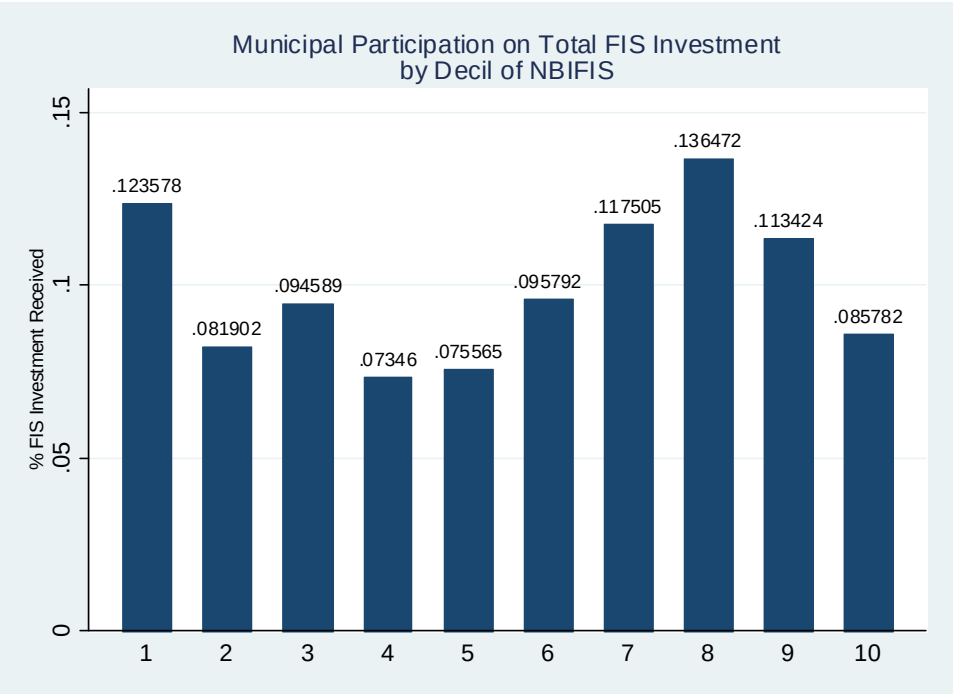
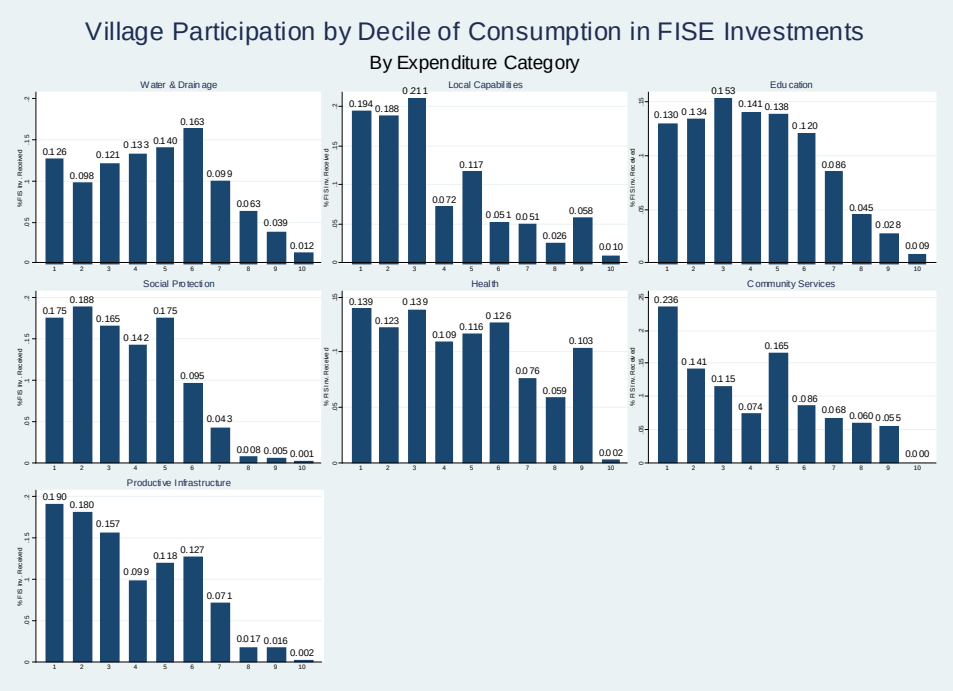


Chart 4 shows targeting results for the different types of FIS projects, by deciles of consumption. Of the three largest categories, infrastructure achieved better targeting, with 37% of investment in the lower two deciles and 12% in the top 40%. However, in education and in water and sanitation the results are disappointing, particularly in that the poorest deciles receive less than those in the middle of the distribution. The best-targeted component is also the smallest one: for local capabilities 60% of investment goes to the poorest 30%. The conclusions do not change if we analyze different types of investment according to the needs related to that particular investment (see Chart A2 in Annex)

Chart 4. Targeting of FIS: Specific investments according to deciles of specific needs



IMPACTS

The overall identification strategy was based on determining if the villages were FIS invested had larger improvements in welfare than those without FIS. Extensions to the analysis were the amount of resources invested, and the composition of the investments (i.e. whether it makes a difference to have investments only in education versus having investments in education, health and infrastructure, holding the total investment amount constant). Of course, the mere correlation between FIS and change in indicators may be spurious, both due to selection issues and because many other things changed between 1994 and 2002. To control for these problems, the analysis was done matching villages with the same probability of receiving FIS, which was computed based on the 1994 village characteristics available from the census. The computation of this probability guarantees the villages with the same probability of treatment also have similar level of poverty. Second, the analysis was done controlling for

municipal fixed effects.[13] Hence, the assumption is that conditional on the likelihood of receiving FIS investment and within the same municipality, the differences between beneficiary and non/beneficiary villages were time invariant.

The first specification is the following[14]

$$\Delta Outcome_{v,m} = \alpha_0 + \beta * FIS_{v,m} + \sum_{m=1}^{M} \delta_m * M_m + \varepsilon_{v,m} \quad (1)$$

where *v* represents the village, *m* the municipality (there are *M* of them), FIS is a binary variable equal to one if there was any FIS investment in village *v* in municipality *m* during the period. The summation in the right hand side is the municipal fixed effect. In order to control for selection on observables, the probability of receiving treatment was calculated based on 1994 data, and included as a control in the regression:

(2)

$$\Delta Outcome_{v,m} = \alpha_0 + \beta * FIS_{v,m} + \varphi * \hat{p}(X_{v,m}) + \sum_{m=1}^{M} \delta_m * M_m + \varepsilon_{v,m}$$

where $\hat{p}(X_{v,m})$ is the estimated probability of receiving FIS investment.

Table 6 shows the first set of results. For each outcome, the first column reports the $\hat{\beta}$ according to a version of (1) that excludes the fixed effects (i.e. the simple correlation between the outcome and a FIS indicator), while the second one reports the results from estimating equation (1). The third and fourth columns show the results of the specification that includes the probability of receiving treatment (equation 2).[15] While the third column lacks the municipal fixed effects, the fourth column shows the estimation with the complete specification of equation (2). The differences between the second and the fourth columns show

[13] The only other variable available in the 1994 census that might be relevant to explain changes in the outcome variable and that was not used to model the probability of selection is whether the household had relatives living abroad, a good proxy for remittances. A village level variable with the share of households with a relative abroad was computed and included in the regressions, however the results did not change the coefficients, as can be seen in Table A.2 in the Annex

[14] The regression framework is presented to show intuitively how we dealt with the placement problem. Non-parametric matching techniques were also used and are reported below.

[15] See table A.3a in the annex for the full regression results. Note that the p-score is significant for all outcomes except the water and overcrowding indexes.

the importance, even within municipalities, of controlling by pre-program characteristics. Finally the fifth column reports the results using a non-parametric matching technique based on the nearest three-neighbour method[16].

The impacts are positive, in that villages with FIS investment increased their per-capita consumption more than those that did not receive FIS, and they reduced their overall unsatisfied basic demand index more than non-FIS villages. For specific components of the overall index, we find positive impacts (i.e. larger reductions in the index) in education, drainage and overcrowding, with a negative impact in the quality of the dwelling index.

The results are economically meaningful. The impact on overall consumption represents between 10% and 20% of the average change in consumption during the period. Also, while the overall UBN fell on average 6.2 points, once we control for municipal fixed effects and the baseline characteristics, the adjusted drop was 3.4 points larger in villages that benefited from FIS. Similarly, in education the UBN fell on average 7.0 points, but for FIS communities the adjusted drop was 1.2 points larger.

Table 6. Impact of having FIS investment on the change in outcome indicators

	(i)	(ii)	(iii)	(iv)	PS Matching	(vi)
Consumption	-0.027***	0.013*	0.0109	0.020***	0.016**	0.026*
Total UBN	-0.002	-0.017	-0.0179	-0.034**	-0.037**	0.035
Education UBN	-0.006*	0.002	-0.0077**	-0.012***	-0.008**	-0.014***
Water UBN	-0.009	-0.007	-0.0104*	-0.009	-0.011	-0.024*
Drainage UBN	0.012**	0.002	-0.0093	-0.016**	-0.019***	-0.011
Dwelling UBN	-0.01**	0.002	0.0186***	0.018***	0.019***	
Depend. UBN	0.005	-0.004	0.0012	-0.002	-0.004	
Overcrow. UBN	0.005	-0.012***	-0.0096**	-0.013***	-0.015***	
Overage	-0.011***	-0.019***	-0.0039	-0.005**	-0.007	-0.006***
Infant Mortality	0.004	-0.004	0.0002	0.000		0.005
Number Obs.	14,464	14,464	14,464	14,464	13,880	

Legend: * p<.1; ** p<.05; *** p<.01

Additionally, these analyses were replicated by substituting the overall FIS indicator for specific type of FIS investments, the one most related to the

[16] For robustness check, we estimated the matching technique using five-neighbour method. Results did not varied.

particular basic need. [17] As shown in the last column, the estimates for consumption and education do not change (although the significance of the first one is diminished), while the effect on drainage is reduced to non/significant and there is a significant effect for water that was not identified in the first three columns.

The existence of dosage effects, i.e. whether the amount of accumulated investment matters, was also examined by estimating the dose-response function on the UBN index, defined here as the number of unsatisfied basic needs –thus ranging from zero to six. The specific education UBN was also analyzed (for which we modelled the dosage of education investment) as well as the estimated consumption.[18] Tables A.6 in the appendix show the details of the estimation that follows the two-stage procedure purposed by Hirano and Imbens (2004).

Since this is a propensity score technique for continuous treatments, we assume that the propensity scores follow a normal distribution and estimate them using maximum likelihood. Table A.6a shows the complete maximum likelihood estimation. Once the propensity scores are estimated, the second stage estimation is done by modeling the change in the UBN index given the propensity scores *Pi* and the amount invested *Di*. This is estimated by OLS using quadratic combinations of the two variables.

$$E\left[\Delta UBN_i \mid D_i, P_i\right] = \alpha_0 + \alpha_1 D_i + \alpha_2 D_i^2 + \alpha_3 P_i + \alpha_4 P_i^2 + \alpha_5 D_i P_i$$

Tables A.6b and A.6c show the second stage estimation coefficients. Then, a new vector of propensity scores $\hat{p}(d, X_i)$ is estimated for each level of investment *d*, where X_i are the variables used in the maximum likelihood estimation.

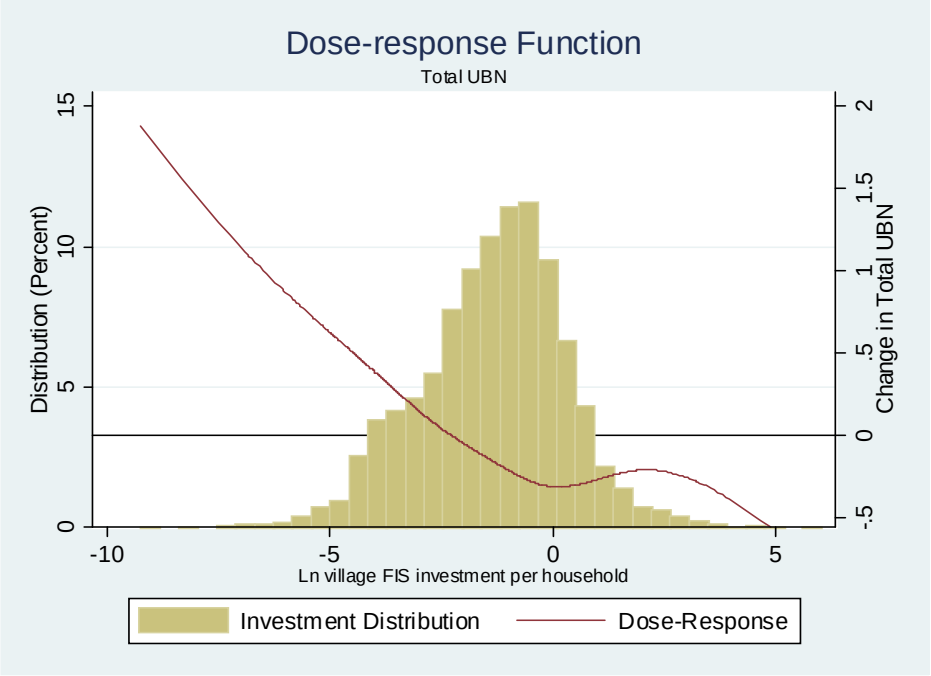
Using the coefficients estimated in the second stage, the mean of the potential change in the UBN is estimated from each vector of propensity scores.

[17] This was done with the education UBN index and the investment in education, the UBN for water and for drainage with the water and sanitation investment, and for the overall UBN and the log consumption with the investment in productive and infrastructure projects. In all cases, the analysis controlled for the probability of receiving that type of investment, and the controls were those that did not receive that type of FIS investment (in order to maintain comparability with the overall results). See Table A.3b for complete regression results

[18] The analysis for consumption is not reported here. The overall pattern is the same, but the coefficients in the second stage of the dose-response approach were not significant.

$$E\left[\Delta UBN_i \mid d\right] = \frac{1}{N}\sum_{i=1}^{N}\left[\alpha_0 + \alpha_1 d + \alpha_2 d^2 + \alpha_3 \hat{p}(d, X_i) + \alpha_4 \hat{p}(d, X_i)^2 + \alpha_5 d\hat{p}(d, X_i)\right]$$

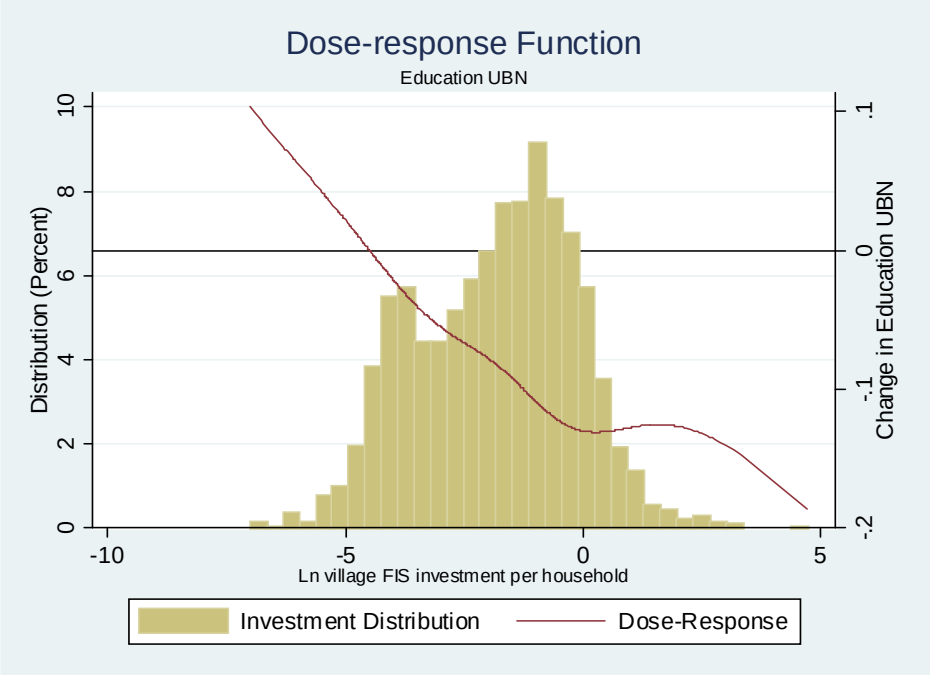
Consequently, to get a continuous dose-response function we estimated the average potential change in the UBN index at every level of investment (i.e. the level of investment each village received). In order to observe the portion of the villages that received enough investments to have positive effects, we report the graphs for the entire dose-response functions along with the distribution of the dosage across villages. The distribution shown contains the logarithmic transformation of village investment per household



The function for total UBN shows that, after controlling for the probability of receiving a particular amount of treatment, there is a positive relationship between investment and a reduction in the UBN, hence showing that larger investments did result in larger increases in welfare as measured by the UBN index.

The results show the existence of a per-household investment threshold over which there is a positive impact, and that the reduction in the UBN drops further if the per-household investment increases –up to a second threshold after which an additional quetzal does not have an additional impact. Also, of the beneficiary villages, 73.74% received enough investments as to see exhibit a positive impact.[19]

To show the dosage-response function for specific investments, the same analysis was replicated but focusing only on the investments in education as the treatment, with similar, although more positive, results[20]. Most of the villages that received the treatment had a positive impact (94.55%), and a clear pattern emerges by which higher dosage leads to higher response, up to a given threshold were there are few observations and the marginal effect fades away.



[19] For reference, the lower first threshold was of approximately one hundred quetzals per-household, and the second one 1300 quetzales per household.

[20] The main reason for showing the analysis made for the specific education UBN instead of other specific type of investment is that the amount of projects in education was significantly large, allowing us to report a continuous dose-response function.

Finally, the existence of multi-treatment effects, i.e. whether there existed complementarities of the different type of investments was examined following the methodology set purposed by Lechner (1999). The multi-treatment estimates of impact allowed for the identification of different states of nature: no project (0), and the education (E), health (H) and productive investment (P) projects as well as their combinations. In particular there we were able to identify eight types of treatment, i.e. 0, E, H, P, EH, EP, HP and the multiple treatment EPH.

This multi-treatment analysis methodology maintains the simplicity of the two-treatment procedure using pair-wise comparisons based on propensity scores estimation. So if the are *M* mutually exclusive treatments, there will be $\frac{M!}{M!-2}$ treatment comparisons using $\frac{M!}{2(M!-2)}$ propensity scores vectors $\hat{P}_m(X)$, where *m* is any of the *M* mutually exclusive treatments.

We estimated the propensity scores vectors using a multinomial logit on a set of socio-economical variables *X*. The scores allowed us to calculate the probability of receiving treatment *l* conditional on receiving treatment *m* or *l*.

$$\hat{P}_{l|ml}(X) = \frac{\hat{P}_l(X)}{\hat{P}_m(X) + \hat{P}_l(X)}$$

With this conditional probability, we performed a matching procedure to control for pre-program conditions for every combination of treatments. We used the five nearest neighbors matching technique and bootstrapped the average effect with 1000 repetitions in order to get standard deviations.

As illustrated in Table 7 we found evidence that suggests that focalized investment (i.e. treatment with only one type of investment) had greater impact over most of the outcomes evaluated (i.e. drainage, housing, dependency and total UBNs). For instance total UBN dropped 0.1156 more in the villages that received only health and sanitation investments than those villages that received the combined treatment (i.e. simultaneous investments in education, productive projects and health and sanitation). Likewise villages that only received productive investment had a grater positive impact in 0.0547 on its housing UBN than the villages that received the combined treatment.

On the other hand, combined investment had a greater impact over access to water and overcrowding UBNs –over which the global FIS effect was negligible.

Access to water UBN dropped 0.0418 more in those villages with combined investment than in those with productive and health and sanitation investments. Similarly, overcrowding UBN dropped 0.0205 more in villages that received the combined investment than in villages with productive projects only.

For education UBN and consumption there is no strong evidence whether focalized investment or combined investment had greater impacts. Nevertheless, this framework allowed us to infer that productive investments had larger impacts on consumption than any other type of investments like education or even combined investments. It also allowed us to see a significant greater impact on the education UBN of simultaneous investments in education and health and sanitation than simultaneous investments in education and productive projects.

Table 7. Multi-treatment impact estimations on the change in outcome indicators[21]

	Treatment	Control	ATT
Access to water UBN	H	HP	-.0232193*
	HP	EPH	-.041852***
Drainage UBN	H	EPH	-.0794698***
	HP	EPH	-.0659877***
	EH	EPH	-.0567261***
Housing UBN	P	EP	-.0256318***
	P	EPH	-.0547266***
	HP	EPH	-.0471832**
Dependency UBN	P	EPH	-.0135402**
	HP	EP	.0171951**
	EPH	HP	.0151398*
Overcrowding UBN	EPH	P	-.0204804**
	EP	EPH	.0204624**
Total UBN	E	EP	-.0402772**
	E	EPH	-.1305355***
	P	EPH	-.0811192***
	H	EP	-.0775603***
	H	EPH	-.1156401***
	EH	EPH	-.1082982***
Consumption	E	P	.0231275***
	P	EPH	-.0283347**
	P	HP	-.0209458*
Education UBN	EH	EP	.0185768***

Legend: * p<.1; ** p<.05; *** p<.01

CONCLUSIONS

In the absence of predefined indicators or a basic evaluation design, this paper was able to use the latest two population censuses from Guatemala to determine whether changes in some basic welfare indicators were attributable to the existence, amount and composition of investments of the *Fondo de Inversión*

[21] For the complete list of multi-treatment ATTs see Table A.5 in the appendix

Social. We began by documenting that the FIS was poorly targeted, thus suggesting that its legal autonomy did not result in greater technical development. Under the basic unconfoundedness assumption at the municipal level, we were able to identify impacts on the following indicators: consumption (10%), total UBN (50%) and education UBN (20%). We also show that, as expected, the amount of investment matters: higher levels of investment are associated with larger levels of welfare improvement. Finally, we documented that, with the available techniques, it was not possible to detect synergy effects: it is not the case that a balanced portfolio of investments is better than concentrating the FIS investment in a village on one type of projects.

The policy recommendations that follow from this analysis are limited due to the lack of data of other projects that would have allowed comparing the efficiency across social funds: who achieved the greatest reduction in unsatisfied basic needs per dollar spent, FIS, FONAPAZ or FSDC? We do not know. And this is terribly important as FIS has disappeared and it seems than now FONAPAZ is taking over, decisions that were not informed by the results of these or other social funds in Guatemala.

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APPENDIX

Chart A1. Differences in distribution of UBN between FIS and No FIS Villages

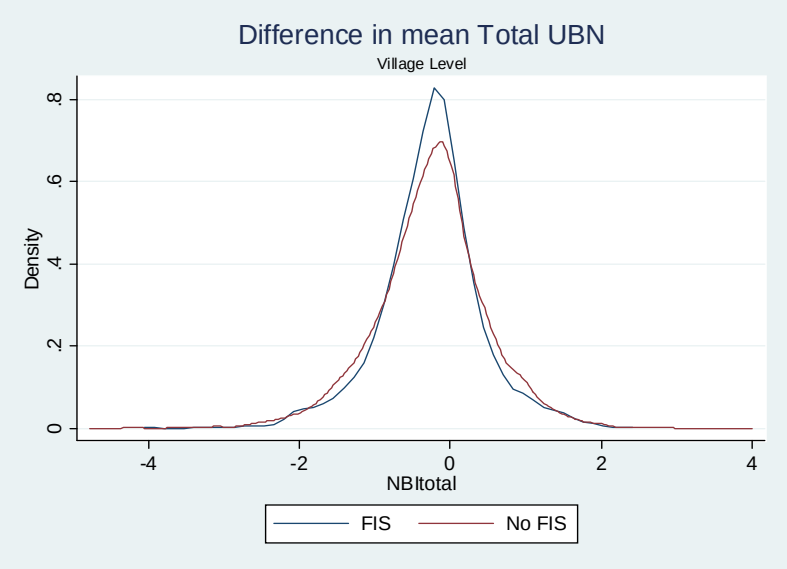
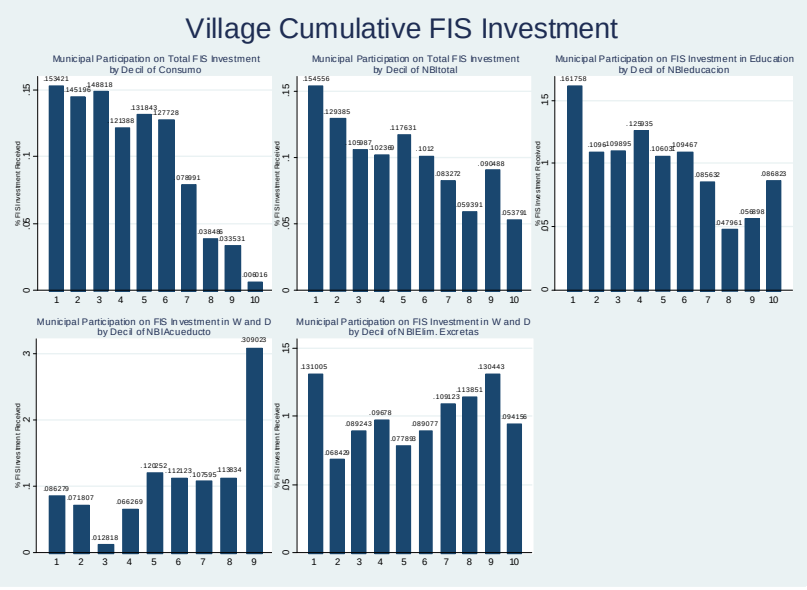


Chart A2. Targeting of FIS: Distribution of investment by type according to the needs related measure



ANNEX TABLES

	HousingUBN				OvercrowdingUBN				WaterUBN			
	1994	*2002*	*Diff*	*%*	*1994*	*2002*	*Diff*	*%*	*1994*	*2002*	*Diff*	*%*
Overall	22.78	12.68	-10.1	-44.34	40.53	35.42	-5.11	-12.61	20.61	16.31	-4.3	-20.86
FIS	25.06	15.24	-9.82	-39.19	41.32	35.77	-5.55	-13.43	19.59	15.8	-3.79	-19.35
No FIS	20.64	10.14	-10.5	-50.87	39.79	35.07	-4.72	-11.86	21.57	16.81	-4.76	-22.07
	DrainageUBN				**DependenUBN**				**EducationUBN**			
	1994	*2002*	*Diff*	*%*	*1994*	*2002*	*Diff*	*%*	*1994*	*2002*	*Diff*	*%*
Overall	25.31	26.25	0.94	3.71	14.64	15.47	0.83	5.67	14.67	7.68	-6.99	-47.65
FIS	26.3	28.32	2.02	7.68	15.16	15.79	0.63	4.16	14.71	7.51	-7.2	-48.95
No FIS	24.37	24.2	-0.17	-0.70	14.15	15.16	1.01	7.14	14.63	7.84	-6.79	-46.41

Table A.1 Changes in specific UBNs

Table A.2 Estimation results controlling by living abroad relatives

	Without Municipal Fixed Effects			With Municipal Fixed Effects		
	FIS dummy	*tmigra94*	*pscore*	*FIS dummy*	*tmigra94*	*pscore*
Consumption	.012989*	1.13318***	-.374469***	.019877***	.331229***	-.134256***
EducationUBN	-.007052**	.357421***	.01885026*	-.01116***	.255797***	.137464***
WaterUBN	-0.010395	0.036931	0.012851	-0.009813	0.029362	0.01564
Drainage UBN	-0.009847	-.250729***	.2029901***	-.014012**	-.146868*	.225870***
TotalUBN	-0.0159	.709252***	.140355***	-.031086**	.674585***	.201965***
HousingUBN	.020209***	.83738***	-.27468***	.018218***	.433730***	-.218835***
DependencyUBN	0.001259	-0.011936	.038612***	-0.001534	0.030369	-0.014737
Overcrowd.UBN	-.01011**	-.25972***	.141783***	-.01292***	0.037540	.044764***
Overage	-0.00497**	-0.51955***	-.06463***	-.00475*	-.31433***	-.17629***
Infant Mortality	.00025	.01049	.03741 ***	.0002537	.01049	.03741***

legend: * p<.1; ** p<.05; *** p<.01

Table A.3a Full Regression Results

	Without Municipal Fixed Effects			**With Municipal Fixed Effects**			
	Only Dummy	*With Pscore*		*Only Dummy*	*With Pscore*		
	FIS dummy	**FIS dummy**	**_pscore**	**FIS dummy**	**FIS dummy**	**_pscore**	*ATT PSMatch*
Consumption	-.02716864***	0.01096592	-.37132122***	.01288138*	.01967822***	-.09394166***	0.0119195*
EducationUBN	-.00559995*	-.00773582**	.02048506**	0.00189642	-.01186902***	.1868059***	-0.0070212**
WaterUBN	-0.00910821	-.01046583*	0.01302086	-0.00702698	-0.00912231	0.02843507	-0.0113608
Drainage UBN	.01167652**	-0.00936859	.20184337***	0.00204456	-.01552006**	.23836313***	-0.0088487
TotalUBN	-0.00234529	-0.01731762	.14359944***	-0.01683632	-.03369011**	.22871679***	-0.0157359
HousingUBN	-.00963217**	.01860871***	-.27085788***	0.0024065	.01784256***	-.20947736***	0.0209186***
DependencyUBN	0.00530249	0.00128228	.03855777***	-0.00394064	-0.00181951	-.02878502**	0.0018318*
OvercrowdingUBN	0.00503641	-.00962269**	.14059526***	-.01219578***	-.01318454***	0.01341814	-0.0112513***
Overage	-.01095913***	-0.0039948	-0.06694***	-.01929581***	-.00493482*	-.18386557***	-0.0051374*
Infant Mortality	0.00398236	0.00023825	.03743802***	0.00398236	0.00023825	.03743802***	

legend: *p<.1; ** p<.05; *** p<.01

Table A.3b Specific UBN Regression Results

Variable	Education FIS dummy	Education pscore	Watering and Drainage FIS dummy	Watering and Drainage FIS pscore	Productive FIS dummy	Productive projects pscore
Education UBN	-.0125779***	.0438186***				
Water UBN			-.0257283*	0.071787		
Drainage UBN			0.0208561	.2741249***		
Consumption					.0242806*	-.34015353***
Total UBN					0.039265	.30715587***

legend: *p<.1;** p<.05; *** p<.01

Table A.5 Multi-Treatment ATTs

		Consumpt	TotalUBN	EduUBN	toverage	WaterUBN	DrainUBN	HouseUBN	DependUBN	OvercroUBN
Education	P	.0231275***	-.0230015	-.0018251	-.0019802***					
	H	.011605	-.0272335	-.0188984***	-.0079076***					
	EP	.0021849	-.0402772**	.0119597***	-.0029395					
	HP	-.0167279**	-.0260458	-.0079778**	-.0115647***					
	EHP	.0339725***	-.130535***	.0107568***	-.0041865					
	EH	.0020881	-.0098699	-.0064495*	-.0014139					
	None	.0197385**	-.058666***	-.0124298***	-.0069529**					
Productive	E	-.0057159	.0498217**					.0057443	..0017628	.0131889*
	H	.0082313	.0096087					-.0116962	-.0136123**	.0086823
	EP	-.0066633	-.010487					-.0256318***	-.0026636	.0122809*
	HP	-.0209458*	-.0440802*					-.0330678***	.0072322	.0072362
	EHP	-.0283347**	-.081119***					-.0547266***	-.0135402**	.0348154***
	EH	-.0117587	.0470705**					-.0076459	.0031657	.0336697***
	None	-.0011604	.0278217					.0032471	.0054662	.0157238**
Health	E	-.0026789	.0059271			-.0184018	.0078159			
	P	.022223	-.0404084			-.0189202	-.0169775			
	EP	-.0033171	-.07756***			-.0141049	-.0475405***			
	HP	-.019751	-.0072881			-.0232193*	.0044506			
	EHP	.0090777	-.11564***			.0118125	-.0794698***			
	EH	-.0096187	-.0029317			-.0096499	-.004835			
	None	.011396	-.014584			-.0197639	-.0104366			
Education and Prod	E	.0140891	.0408888	-.0040169	-.000954			.031275**	.0030181	-.0088327
	P	.0137538	.0229378	-.0165597 **	-.0023784			.0205164*	-.0052529	-.0099836

	H	.0259044*	.0097078	-.0311406***	-.0063328			.0291212**	-.0104662	-.0068803
	HP	-.0244034*	-.010542	-.0265739***	.0069203			-.0021113	.0171951**	.0084636
	EHP	-.0097475	-.0385206	.0011502	.004543			-.0216339	-.0073099	.0204624**
	EH	.0182884	.0495244	-.0130285*	-.0012534			.0269764**	.0011565	.0123115
	None	.0213797	.0280048	-.0084718	-.0084355			.0340067**	-.0016064	-.0051364
Health and Prod	E	.0101754	.0269448			-.0008143	.0038525	.0179002	-.00497464	-.004019
	P	.037662	-.1200642*			-.0119018	.0287769	-.0724841**	.0052109	.0316513*
	H	.024788	.0097782			.0193199	-.0076397	.0141421	-.0106616	-.0015412
	EP	.0268736	-.0103019			.0305737	-.0410143**	-.0104627	-.0156561	-.0051433
	EHP	-.0018327	-.0359593			.0548418***	-.0659877***	-.0471832**	-.0154846	.0194296
	EH	.025603	.0365316			.0197293	-.0021863	.0084924	-.0119121	.0153373
	None	.0313704	-.0171443			.0024907	-.0169143	.0212728	-.0107458	-.0025993
Education, Health and Prod	E	-.0124948	.0653969	-.0015187	.0012816	-.0272529*	.0620156***	.042433**	.0071519	-.0174072 *
	P	.0222851	.0424803	-.0071305	-.008387	-.0278954*	.0521889***	.0479333***	-.0021152	-.0204804**
	H	-.009594	.0886882**	-.0229568***	-.0073327	-.0085302	.0813751***	.0418248***	-.0015167	-.0014794
	EP	-.0109323	.0253732	-.0011692	-.0027891	-.0155379	.0359081*	.0146669	.0035215	-.0119921
	HP	-.0399576	.0833349*	-.015675*	.0033069	-.041852***	.0745408***	.0456486***	.0151398*	.0055566
	EH	-.0221232	.086594**	-.0091544	.0035411	-.0111379	.0563984***	.0261455	.0072531	.0171159*
	None	.0201304	.0732562*	-.0159228*	-.007239	-.0145678	.0712489***	.0580181***	-.0011181	-.0243519**
Education and Health	E	-.0036326	.020442	.008546	-.0000965	-.0152302	.0215057			
	P	.0149846	-.0398224	.0043231	-.0104238**	-.0038049	-.0015098			
	H	.0079498	.0193534	-.0132389**	-.0020521	.0284468*	.015225			
	EP	.0274111*	-.0416635	.0185768***	-.0077847*	.0147322	-.0121796			
	HP	-.0127017	-.0271649	-.0166113***	-.0022919	-.0153238	.0206278			
	EHP	.0144125	-.108298***	.0086436	-.0085067 *	.0155671	-.0567261***			

	None	.0214189	-.0295119	-.0053637	-.001815	-.0063738	-.0097816			

Table A.6a Maximum Likelihood estimation for Generalized Propensity Score for dosage function estimation[22]

Ln(Investement per Household)				Ln(Investment per Household in Education)			
mu				mu			
hhsize	0.09904**	dexcusa	-1.0396***	hhsize	0.0333	dexcusa	-0.85528*
pobtot	-0.00009***	dbmunic	-0.28342	pobtot	-0.0001***	dbmunic	-0.26003
area	-1.249***	dbpriva	-0.78914	area	-1.0873***	dbpriva	-0.25998
dapartmt	44.894***	dbquema	0.13620	dapartmt	50.698***	dbquema	-0.05310
drancho	-0.82431	dbtira	0.07025	drancho	-1.25	dbtira	-0.02839
dladrillo	3.4249***	dpropia	-0.3621***	dladril~	3.7376***	dpropia	-0.7456***
dadobe	0.14422	dalquil	-0.18160	dadobe	0.2278	dalquil	-1.7114***
dmadera	0.58715***	hombreJH	1.1974	dmadera	0.6794***	hombreJH	1.2039***
dbajare	0.5531***	edadJH	-0.00414	dbajare	0.3718	edadJH	-0.01306
dpalo	0.56025***	indigen	-0.1078	dpalo	0.57087***	indigen	-0.30883***
dtconcr	0.18062	idioma	-0.17169	dtconcr	1.2387	idioma	-0.0106
dtlamina	-0.17116	alfabJH	-0.09616	dtlamina	-1.043	alfabJH	-0.24781
dabbesto	1.8590	alfabmu	-0.06288	dabbesto	-0.076	alfabmu	-0.25238
dtejaba	0.07097	nivele~2	48.714	dtejaba	-1.039	nivele~2	83.618**
dtpaja	0.67122	nivele~3	50.824	dtpaja	0.3341	nivele~3	79.738*
dpladri	-0.72751	nivele~4	48.872	dpladri	-0.995	nivele~4	83.241**
dptorta	-0.1535	nivele~5	49.344	dptorta	-0.497	nivele~5	82.849**
dptierra	-0.1017	nivele~6	50.752	dptierra	-0.651	nivele~6	83.095**
dchorro	-0.15976	posici~3	0.33881	dchorro	-0.214	posici~3	0.24879
dcamion	0.24503	posici~4	-2.0907**	dcamion	1.1426*	posici~4	-0.81368
sanitar	-0.14930	posici~5	-0.25521	sanitar	-0.069	posici~5	-0.076141
tcuartos	0.02438	dcasado	-0.50689	tcuartos	0.0392	dcasado	-0.2523
dcondre	0.22751	Estudia	-0.21576**	dcondre	-0.06	Estudia	-0.14969
dconfosa	0.36879	trabaja	-0.15320*	dconfosa	0.3055	trabaja	-0.20683
		_cons	-50.512			_cons	-82.55**

[22] This is the fist stage of the two-stage procedure purposed by Hirano and Imbens (2004). We estimate $\hat{\beta}$ and $\hat{\sigma}^2$ by maximum likelihood in order to estimate the Generalized Propensity Score of the form:

$$\hat{P}_i = \frac{1}{\sqrt{2\pi\hat{\sigma}^2}} e^{\left(-\frac{1}{2\hat{\sigma}^2}\left(D_i - \hat{\beta}' X_i\right)^2\right)}$$

Where D_i is the investment received by the village *i*.

sigma		sigma	
_cons	1.48905	_cons	1.505491

Table A.6b Quadratic regressions for Dosage function estimates for overall investment over Total UBN

```
      Source |       SS       df       MS              Number of obs =    4219
-------------+------------------------------           F(  5,  4213) =    9.15
       Model |  19.9439623     5  3.98879247           Prob > F      =  0.0000
    Residual |  1836.77717  4213   .43597844           R-squared     =  0.0107
-------------+------------------------------           Adj R-squared =  0.0096
       Total |  1856.72113  4218  .440189931           Root MSE      =  .66029

------------------------------------------------------------------------------
    NBItotal |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
lntotalmpi~h |  -.0297155   .0140405    -2.12   0.034    -.0572423   -.0021888
    lnRscore |  -2.949864    .780355    -3.78   0.000    -4.479772   -1.419957
          T2 |  -.0185396   .0037932    -4.89   0.000    -.0259762    -.011103
          R2 |   5.608264   2.149804     2.61   0.009     1.393514    9.823014
          TR |   -.357325   .0772714    -4.62   0.000    -.5088178   -.2058322
       _cons |   .0248877   .0691445     0.36   0.719     -.110672    .1604474
```

Table A.6c Quadratic regressions for Dosage function estimates for education investment over education UBN

```
      Source |       SS       df       MS              Number of obs =    2847
-------------+------------------------------           F(  5,  2841) =   11.66
       Model |  1.11295292     5  .222590583           Prob > F      =  0.0000
    Residual |   54.236072  2841  .019090486           R-squared     =  0.0201
-------------+------------------------------           Adj R-squared =  0.0184
       Total |   55.349025  2846  .019448006           Root MSE      =  .13817

------------------------------------------------------------------------------
NBIeducacion |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
lntotalmpi~e |  -.0121495   .0041368    -2.94   0.003     -.020261   -.0040381
   lnRscoree |  -.5817712   .1772748    -3.28   0.001    -.9293716   -.2341709
         T2e |  -.0020606   .0009691    -2.13   0.034    -.0039607   -.0001604
         R2e |   1.529131    .534182     2.86   0.004     .4817078    2.576555
         TRe |  -.0444274   .0209491    -2.12   0.034    -.0855044   -.0033503
       _cons |  -.0829805    .013855    -5.99   0.000    -.1101475   -.0558136
------------------------------------------------------------------------------
```