Information and Participation in a Social Program

David Coady, César Martinelli and Susan W. Parker*

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Abstract

Participation in a social program, like that in clubs and other social organizations, is the result of a process in which an agent first learns about the requirements, benefits, and the likelihood of acceptance, applies for membership, and finally is accepted or rejected. At each stage of the process, decisions made by the agent are responsive to expectations about the decisions and outcomes at the following stages. We propose a model of the participation process and estimate it using data from a social program in Mexico. We distinguish empirically between information costs and other application costs, and show that self-selection due to information costs in fact contributes to targeting the program to the poorest families. *JEL* I38, D83

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*Coady: International Monetary Fund, 700 19th Street NW, Washington, DC 20431 <dcoady@imf.org>. Martinelli: CIE-ITAM, Camino Santa Teresa 930, 10700 Mexico DF, Mexico <martinel@itam.mx>. Parker: CIDE, Carretera Mexico-Toluca No. 3655, 01210 Mexico DF, Mexico <susan.parker@cide.edu>. We acknowledge financing from the Instituto Nacional de Salud's (INSP) ongoing evaluation of *Oportunidades*. We thank Harold Alderman, Carola Alvarez, Jean-Yves Duclos, Paul Gertler, Mauricio Hernandez, John Maluccio, Ferdinando Regalia and participants at seminars in Cornell University, University of Minnesota, IFPRI, Warwick University and Georgia Tech for comments and discussion. We also thank Iliana Yaschine, Bernardo Hernandez and Citlalli Hernandez for helpful clarifications. The authors alone are responsible for any remaining errors.

1 Introduction

Social programs around the world often rely on the voluntary participation of those deemed deserving. Available evidence, however, shows an enormous variation in the "take-up" rate or rate of participation by eligible individuals in social programs. Currie (2006), for instance, reports take-up rates from below 10% to more than 90% in the US and from below 50% to close to 100% in the UK. Remler and Glied (2003) report take-up rates of US medical assistance programs varying from 43% to 99%. The issue of variation in participation in social programs has correspondingly attracted a good deal of attention from the economics literature. Most of this literature focuses on the impact on participation outcomes for eligible individuals of time costs and other inconveniences related to application, as well as stigma considerations which add psychological costs to other costs of participation.

In this paper, we propose and estimate a model of participation as a sequential decision process. The first stage of this process corresponds to the agent's decision to invest some time and effort in learning about how to apply to the program, given the agent's prior expectations about benefits from the program and the likelihood of being accepted. The second stage corresponds to the agent's decision to apply to the program, having learned in the previous stage the cost of application, and given the agent's expectations about benefits from the program and the likelihood of being accepted. The third stage corresponds to the decision by program officers about whether or not to enroll the agent into the program.

Our model captures two key features of participation. The first is the sequential nature of the decision process: an agent needs to obtain information before actually applying, and needs to apply before being assessed for eligibility. The second key feature is the interdependence between stages: at each stage, the agent's decision is responsive to the agent's expectations about the decisions and outcomes in the following stages. In the spirit of rational expectations, we assume that the agent has unbiased beliefs about the decisions and outcomes in the following stages. This assumption ties the estimation of each stage to that of the subsequent stages.

In our view, participation in a social program is not essentially different from participation in clubs or other nonexclusionary social organizations. As

in these other instances, positive benefits from membership are not enough for participation. Before even contemplating applying, an individual needs to be informed about the likely net benefits and requirements for participation. This information may be effectively costless for some potential applicants through membership in other organizations or social networks, via word-of-mouth or targeted advertising. For many potential applicants, however, acquiring information may entail some effort with inconvenience and psychological costs, such as embarrassment if there is a mismatch between the potential applicant socioeconomic status and that of organization members. Similarly, the application itself may entail some costs, related particularly to the opportunity cost of time.

We estimate the model using data from *Oportunidades,* a prominent social safety-net program in Mexico that combines means-testing with self-selection by households. The survey data we use provide detailed information on the different stages of the participation process as well as on the socioeconomic household characteristics used to determine eligibility and the level of transfers a household would receive if deemed eligible. Our data allow us to measure errors made by program officers at the enrollment stage, leading both to undercoverage of eligible households and to leakage to non-eligible households. Our data also allow us to distinguish neatly between the application stage and other stages of the participation process, and to determine the eligibility status and potential benefits for nonapplicants, both of which have been problematic for earlier empirical analysis.

As suggested by the model, we estimate the stages of the participation process backwards. We first estimate the probability of being enrolled into the program for a household that applies to the program, taking into account not only the official eligibility criteria but also the possibility of mistakes by program officers. We then use the estimated probability of enrollment conditional on application and the monetary benefits from participation to calculate the expected gain from application. We use the expected gain from application and household characteristics possibly related to the cost of application, in particular through the cost of time, to estimate the probability of a household applying to the program, conditional on being informed. We then calculate the expected net benefit of application, considering uncertainty about the realization of the application costs for any given household.

We finally use the expected net benefit from application and household characteristics related to the cost of information acquisition, such as exposure to advertising and word-of-mouth communication by other potential applicants, to estimate the probability of a household acquiring information in the first place.

We find that the stages of the participation process are indeed interdependent: whether a household is informed and whether it applies conditional on being informed are very sensitive to the potential expected benefits. We also find that both application and information costs are progressive, with information costs in particular increasing sharply with household socioeconomic status, as measured by per capita expenditure. Since the official eligibility criteria are related to household socioeconomic status, this means that application and information costs contribute greatly to reduce application to the program (and thus, in view of enrollment mistakes, participation in the program) by ineligible households. Information costs, in particular, are on average larger than application costs, and especially so for ineligible households.

Research on the optimal design of poverty alleviation programs by Besley and Coate (1992) and others has put some emphasis on the use of work requirements to help in the selection of deserving beneficiaries. Our empirical results show that application and information costs play a similar role in deterring those potential applicants who are less in need. To the extent that the eligibility criteria set forth for a poverty alleviation program are only an imperfect measure of need, especially in the context of developing countries in which verifiable income data is lacking, self-selection due to progressive application and information costs may be very helpful in the targeting of social programs. Progressivity in information costs may be achieved, as seems to have been the case with *Oportunidades*, by targeting advertisement to poor neighborhoods.

There is an extensive literature on the endogenous determination of participation in social programs, including the seminal work by Ashenfelter (1983), Moffitt (1983) and Blundell, Fry and Walker (1988); see Currie (2006) for a recent review. Of particular relevance to our research is the work of Heckman and Smith (2004), who introduce in the literature the idea of analyzing participation in social programs as a sequential process. Heckman

and Smith study the determinants of participation of eligible individuals for the Job Training Partnership Act in the US. Our data has the advantage of allowing to distinguish between application and other stages, which is not possible for the JTPA due to data limitations. While Heckman and Smith's analysis is in their words deliberately descriptive, we conduct ours in the context of a decision model. This enables us to distinguish empirically between information and (other) application costs.

As mentioned earlier, the detailed nature of our data means that some of the measurement problems encountered in earlier papers are likely to be substantially reduced, even if not eliminated completely. Determining eligibility on the basis of survey evidence on household income and other characteristics opens up the possibility of measurement error, as studied by Duclos (1995) and Hernandez and Pudney (2007) in the context of the UK income-support program for pensioners. Eligibility status in *Oportunidades* is determined on the basis of observable characteristics of the household dwelling, family size, and geographic dummies, on which we expect measurement error to be less of a problem than with respect to income.

Our empirical finding about the importance of information for participation is consistent with previous literature. Available evidence from Heckman and Smith (2004) and other studies suggests that providing information about programs can increase take up. Daponte et al. (1999), for instance, find that informing households about their eligibility and benefits increases participation in the Food Stamp program in the US. Aizer (2003, 2007) finds that outreach efforts in the form of community based application assistance and advertising campaigns improve take up of Medicaid among groups facing language barriers and immigration concerns. Our finding that information and other application costs actually help in targeting *Oportunidades* to those most in need is more of a departure from previous literature. This is perhaps due to the fact that previous literature has focused on social programs in the US and the UK. The challenge of targeting a poverty alleviation program may be different in a developing country than in the US or the UK, given that income cannot be independently verified (for example through tax institutions).[1]

[1] To our knowledge, the only previous analysis of the participation process in a developing country is by Micklewright et al. (2004). These authors investigate the determinants

The remainder of the paper is organized as follows. In section 2 we provide some background on our dataset. In section 3 we present our model of the participation process. In section 4 we describe our empirical results. In section 5 we gather some concluding remarks.

2 Evidence on Information and Participation

Oportunidades was introduced in the poorest urban localities in Mexico in 2002.[2] An advertising campaign was carried out to inform potential applicants that registration centers for the program would open during certain dates. The advertising campaign used TV and radio advertisements, flyers, posters in churches, schools, health clinics and market places, and loudspeaker announcements. Applicants who turned up at the registration centers were asked to provide information on their address and on their dwelling characteristics, such as whether the dwelling had access to running water, whether it had a dirt floor, the number of rooms in the dwelling, and household appliances and other durable goods available to the household. Eligibility into the program was determined using those characteristics and demographic information to compute a household poverty index. The weights attached to each characteristic in the household poverty index were previously determined using a poverty regression similar to those described by Ravallion (1996). The methodology was public (Reglas de Operación 2002) but not the specific weights.

Applicants initially found to be eligible received a household visit during the following weeks to verify the information given, after which a final classification on eligibility was made. Due to budget and capacity constraints at the level of program offices, not every household initially found eligible was considered for a household visit, leading in all likelihood to errors of exclu-

of participation of households in a social assistance program in Uzbekistan. This program lacks explicit rules for determining benefit levels, an essential ingredient in our analysis of participation.

[2] *Oportunidades* is a scaled-up version of the rural *Progresa* program. This program has become widely known in the economic literature because of the substantial resources devoted to its evaluation, and has been seen as a prototype for social safety-net reforms in other developing countries, especially in Latin America (see e.g. Parker, Rubalcava and Teruel 2007).

sion. Moreover, some households who were classified initially as eligible at the registration center and found to be ineligible after the verification did in fact enroll in the program,[3] leading to errors of inclusion.

Our dataset is the *ENCELURB* (Encuesta de Evaluación de los Hogares Urbanos 2002), the survey used to assess the targeting performance of *Oportunidades* in urban areas. Shortly after enrollment, a sample of 20,859 households in participating localities were visited and asked a series of questions aimed at calculating their household poverty index. From these, 4,639 households reported being beneficiaries of the program; for these households we have compared their answers to the survey with the answers to the program verification visit and found them consistent.[4] Of the 16,220 households in the sample that reported not being beneficiaries of the program, a subsample of 5,776 were reinterviewed and asked if they knew about the program, if they knew where the program office was located, and if they went to the office to apply for the program.

Table 1 below presents information on participation level by eligible and ineligible households, using the 10,515 households for which this information is available, because they either declared being beneficiaries or were reinterviewed. To calculate the numbers in Table 1, we have reweighed the households to take into account that only a fraction of non beneficiaries were reinterviewed.[5] Table 1 illustrates that enrollment mistakes are common: roughly one in six eligible applicants is rejected, and one in three ineligible applicants is accepted into the program. Table 1 also illustrates that lack of knowledge about the program is a major barrier to participation, especially for ineligible applicants. From Table 1, leakage (that is, participation by ineligibles as a fraction of total participation) is 28.2%, and undercoverage (that is participation by eligibles as a fraction of the eligible population) is 49.6%.

[3] See Martinelli and Parker (2007).

[4] On the other hand, comparing the program verification visit with the answers provided in the registration center uncovered a good deal of both under and overreporting of household characteristics, which is attributed in related work to strategic deception and to stigma considerations (Martinelli and Parker 2007).

[5] The households that were reinterviewed included 90% of eligible, 55% of not eligible but nearly so and 20% from the remainder. These percentages were determined beforehand but within each group the households were chosen randomly.

TABLE 1
PARTICIPATION IN OPORTUNIDADES BY ELIGIBILITY STATUS[a]

Level of participation (in %)	Eligible households	Ineligible households
Did not know about the program	27.8	49.1
Knew about program but not where to apply	5.8	9.8
Knew where to apply but did not apply	5.9	9.8
Applied but not enrolled	10.0	11.5
Enrolled	50.4	19.8

[a]Observations: 10,515. Source: *ENCELURB*.

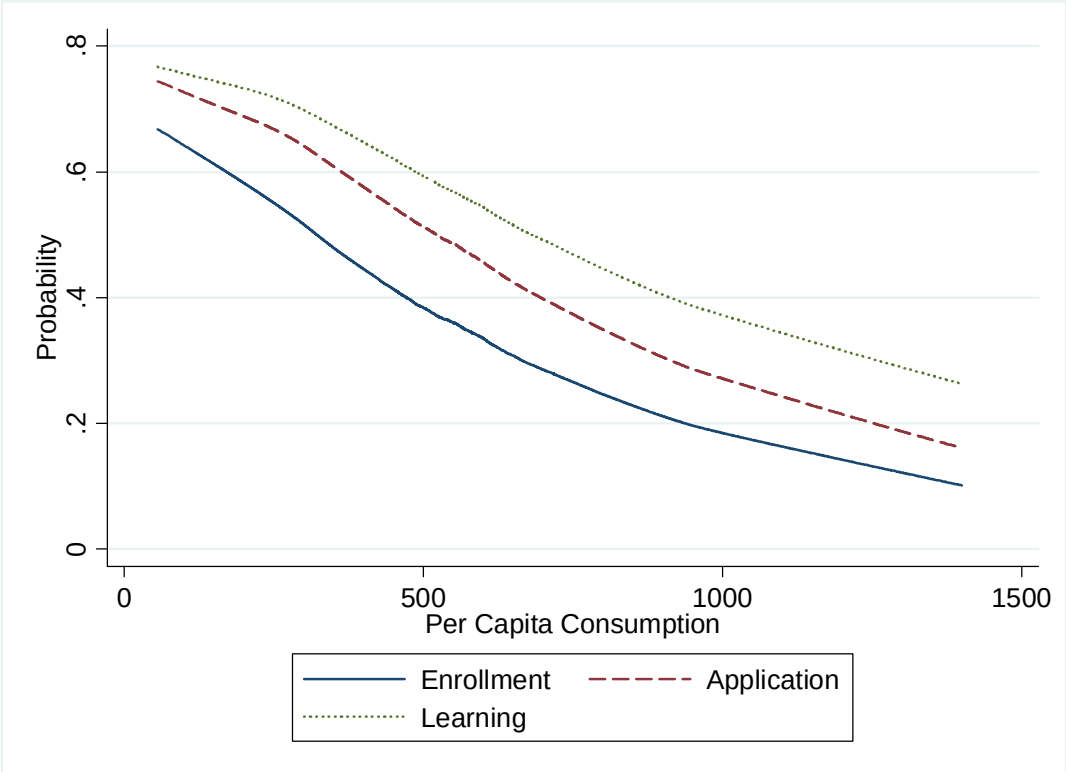

FIGURE 1.–Learning, application and enrollment by expenditure levels.

Figure 1 presents information on participation level, this time disaggregated by socioeconomic status, as measured by household per capita expenditure.[6] The fraction of households in the sample who knew where to apply to the program, or unconditional probability of learning, is declining in the household's socioeconomic status. The unconditional probability of applying and the unconditional probability of enrollment track closely the unconditional probability of learning. The distances between the three unconditional probabilities are roughly uncorrelated with socioeconomic status. The fraction of informed households who enroll in the program is decreasing with socioeconomic status, but most of the decline in the unconditional probability of enrollment for better off households seems to be due to the decline in the probability of learning. Since eligibility is related to socioeconomic status, it is tempting to conclude that higher information costs explain the different level of enrollment for eligible and ineligible applicants. This conclusion, however, is not necessarily correct; it is perfectly possible that the lack of knowledge is due to the anticipation by relatively better off households that they are less likely of being enrolled into the program, conditional on application. Estimating a model of participation is necessary in order to distinguish empirically between the impact of different information costs and the impact of different expectations about the likelihood of acceptance.

We provide now some background on the benefits of participation and the characteristics of households in the sample. Cash benefits for participants in *Oportunidades* include a purely unconditional grant (termed "nutrition grant"), plus some grants conditional on the school attendance of the children in the household, as described in Table 2. The program also includes free medical consultations and nutrition supplements. Since we can calculate the potential cash benefits a household can receive under the program, we have an idea about the incentive to participate for each potential applicant.

Table 3 describes average household characteristics for eligible and ineligible households. Ineligible households are better off than eligible households both in terms of total expenditure and in terms of per capita expenditure. They have smaller families, so in addition to be less likely of being enrolled into the program they have smaller benefits of participation. Benefits of

[6] Figure 1 is produced using lowess (locally weighted regressions), as originally proposed by Cleveland (1979).

TABLE 2
MONTHLY CASH BENEFITS OF OPORTUNIDADES[a]

Grants	Nutrition grant		150	
	Education grants:	Grade	Boys	Girls
	Primary	3	100	100
		4	115	115
		5	150	150
		6	200	200
	Middle School	7	290	310
		8	310	340
		9	325	375
	High School	10	490	565
		11	525	600
		12	555	635
Maximum Transfer to Household	With High-School children		1550	
	Other households		915	
Average Transfer[b]			350	

[a]In Mexican pesos (2002); 11 pesos is approx. US$1. [b]Urban households (2003).

TABLE 3
CHARACTERISTICS OF POTENTIAL PARTICIPANTS[a]

	Eligible		Ineligible	
Household characteristics	Mean	Std. Dev.	Mean	Std. Dev.
Total monthly expenditure (pesos)	2314	2404	2899	3923
Per capita expenditure (pesos)	492	492	777	1317
Family size	5.19	2.20	4.23	1.79
Children from 0 to 5	0.97	0.98	0.51	0.71
Children from 6 to 11	1.27	1.13	0.68	0.84
Children from 12 to 17	0.73	0.97	0.63	0.88
Head of Household Characteristics	Mean	Std. Dev.	Mean	Std. Dev.
Sex (Male=1)	0.78	0.41	0.80	0.40
Age	40.46	14.43	41.72	14.33
Education (years)	4.43	4.46	5.94	3.85
Speaks indigenous language	0.13	0.34	0.06	0.24

[a]Observations: 9,944 eligible and 5,755 ineligible households. Source: *ENCELURB*.

participation, nonetheless, are substantial both for eligible and for ineligible households; the average monthly transfer is approximately 15% of the average monthly expenditure for eligible households and 12% for ineligible households.

3 A Model of the Participation Process

Whether or not a potential participant receives benefits from a targeted program depends on whether the participant decides to seek knowledge, apply and is accepted. Thus, the participation outcome is the result of a "participation process" with three stages. The first two stages involve decisions by the potential participant. In each of these two stages, expectations about the next stages are crucial. Beliefs about the probability of being enrolled are important for the decision to apply, and beliefs about the likelihood of applying and getting enrolled into the program are important for the decision to seek information about the program. For this reason, we describe the participation process backwards, starting with the probability of being enrolled for a potential participant who is already informed about the program and contemplating whether to apply.

3.1 Enrollment decisions and gains from participation

Eligibility for means-tested poverty-alleviation programs is usually determined on the basis of a score and a cutoff. In *Oportunidades*, the score is calculated using demographic information and other observable characteristics of the applicant's household, including the number of household members, the number of children below eleven in the household, an index of household overcrowding, the age and years of education of the household head, a set of dummies indicating whether the dwelling lacks a number of desirable characteristics (like a connection to running water, a paved floor, a refrigerator, etc.) and a set of regional dummies. Household h is eligible if $\gamma_e X_{eh} \geq \rho$, where X_{eh} is the vector for household h of the characteristics used in the score, γ_e is the vector of weights attached to these characteristics, and the cutoff ρ represents the "poverty line." In practice, enrollment is determined not only by eligibility according to program rules but also by rationing

due to budget limitations at different program offices, discrimination at the program offices, and other considerations that can lead to undercoverage or leakage.

We introduce the possibility of enrollment errors by assuming that the actual weights determining enrollment may be different from those set for eligibility, and that the actual cutoff for enrollment may be different from the one used for eligibility and may vary for different applicants. Here we have in mind the fact that the thresholds for different individuals reflect varying (regional specific) budget constraints and rationing. Formally, we assume that the actual cutoff for enrollment is distributed according to a logistic distribution with location parameter μ and scale parameter σ. Thus, the probability that h is eligible is

$$F\left(\alpha_e + \beta_e X_{eh}\right), \tag{1}$$

where F is the standard logistic distribution function, $\beta_e = \gamma_e/\sigma$ is the vector of (normalized) weights of household characteristics in the poverty score, and $\alpha_e = -\mu/\sigma$ is a constant term. We can estimate equation (1) using the actual enrollment decisions by program officers.

The utility gain from participating depends on the pre-program household income Y_h and the (monetary) benefit of participation B_h, both in per capita terms. Assuming for simplicity that the household has a constant risk aversion utility function with risk parameter ρ, we get that the gain from participating is

$$G_{eh} = \begin{cases} (Y_h + B_h)^{1-\rho} - Y_h^{1-\rho} & \text{if } \rho \neq 1 \\ \ln(1 + B_h/Y_h) & \text{if } \rho = 1 \end{cases}.$$

Note that we can calculate the potential benefits of participation using the program rules (see Table 2).[7]

[7] We are sidestepping for simplicity the issue of the different horizon of benefits for different applicants, according to the age and school grade of their children. If household h has a horizon of benefits T_h and discount factor β_h, then its expected benefit of participating should be multiplied by $(1 - \beta_h^{T_h+1})/(1 - \beta_h)$. If this term is similar for all applicants (e.g. they all discount the future heavily) ignoring it is just a normalization of the utility function.

3.2 The application problem

We assume that households have beliefs about the expected utility gain from application given by

$$G_{ah} = F\left(\alpha_e + \beta_e X_{eh}\right) G_{eh}.$$

We also assume that the cost of application is a linear function of a vector of observable characteristics of the household X_{ah} and a random term η_{ah}. That is,

$$C_{ah} = \max(\gamma_a X_{ah} + \eta_{ah}, 0).$$

For tractability, we assume that the terms η_{ah} are independently distributed across households according to a logistic distribution with location parameter 0 and scale parameter σ_a.[8] Though we use a linear expression for the cost of application, we take care in bounding the application cost from below by zero, i.e. we interpret a negative realization of $\gamma_a X_{ah} + \eta_{ah}$ as meaning a zero cost of application or no disincentive to apply.

Using the preceding expressions, we have that the household will apply to the program if it is informed and gains from application exceed costs; that is,

$$\beta_{ag} G_{ah} + \beta_{ax} X_{ah} \geq \varepsilon_{ah}, \tag{2}$$

where $\beta_{ag} = 1/\sigma_a$, $\beta_{ax} = -\gamma_a/\sigma_a$, and $\varepsilon_{ah} = \max(\eta_{ah}/\sigma_a, -\beta_{ax} X_{ah})$. Note that ε_{ah} is a random term with a density identical to the standard logistic density for $\varepsilon_{ah} \geq -\beta_{ax} X_{ah}$.

We can estimate equation (2) using a previous estimation of equation (1) and the decisions to apply or not by informed households. It is simple to check that the likelihood function associated with equation (2) above is the same whether we assume that ε_{ah} has a standard logistic distribution or that ε_{ah} has a density identical to the standard logistic density for $\varepsilon_{ah} \geq -\beta_{ax} X_{ah}$ and a point mass at $\varepsilon_{ah} = -\beta_{ax} X_{ah}$, as long as $\beta_{ag} > 0$.

[8] The assumption of logistic distribution is in line with common practice in discrete choice analysis. The variance of a logistic distribution is equal to $\pi^2/3$ times the square of the scale parameter. Usually logistic and normal errors are indistinguishable empirically (see e.g. Train 2004).

From the previous expressions, the net expected utility gain from application is

$$G_{ah} \text{ if } \varepsilon_{ah} \leq \beta_{ax} X_{ah}, \text{ and}$$

$$G_{ah} + (\beta_{ax}/\beta_{ag}) X_{ah} - \varepsilon_{ah}/\beta_{ag} \text{ if } \beta_{ax} X_{ah} \leq \varepsilon_{ah} \leq \beta_{ag} G_{ah} + \beta_{ax} X_{ah},$$

with the household declining to apply otherwise.

3.3 The information acquisition problem

We view information acquisition as mostly about how and where to apply to the social program, which affect a household's idiosyncratic cost of application. That is, we assume that households know about the existence of a program but need to learn about its details, rules and how to apply. We should note that *Oportunidades* was the object of political debate and wide media coverage.

Since acquiring information allows a household to apply, and households ignore the realization ε_{ah} before acquiring information, the value of information is

$$G_{kh} = G_{ah} F(\beta_{ax} X_{ah}) + (1/\beta_{ag}) \int_{\beta_{ax} X_{ah}}^{\beta_{ag} G_{ah} + \beta_{ax} X_{ah}} (\beta_{ag} G_{ah} + \beta_{ax} X_{ah} - y) f(y)\, dy,$$

where F is the standard logistic distribution function and f is the standard logistic density function. Gathering terms and integrating by parts, we obtain

$$\begin{aligned} G_{kh} \;=\; & G_{ah} F(\beta_{ag} G_{ah} + \beta_{ax} X_{ah}) \\ & + (\beta_{ax}/\beta_{ag}) X_{ah} \left(F(\beta_{ag} G_{ah} + \beta_{ax} X_{ah}) - F(\beta_{ax} X_{ah}) \right) \\ & - (B_h + (\beta_{ax}/\beta_{ag}) X_{ah}) F(\beta_{ag} G_{ah} + \beta_{ax} X_{ah}) \\ & + (\beta_{ax}/\beta_{ag}) X_{ah} F(\beta_{ax} X_{ah}) \\ & + (1/\beta_{ag}) \ln(1 + \exp(\beta_{ag} G_{ah} + \beta_{ax} X_{ah})) \\ & - (1/\beta_{ag}) \ln(1 + \exp(\beta_{ax} X_{ah})). \end{aligned}$$

Cancelling terms in the expression above we get

$$G_{kh} = (1/\beta_{ag}) \ln \left(\frac{1 + \exp(\beta_{ag} G_{ah} + \beta_{ax} X_{ah})}{1 + \exp(\beta_{ax} X_{ah})} \right).$$

We assume that the cost of information is a linear function of a vector of observable characteristics of the household; that is,

$$C_{kh} = \max(\gamma_k X_{kh} + \eta_{kh}, 0),$$

where the terms η_{kh} are independently distributed across households according to a logistic distribution with location parameter 0 and scale parameter σ_k, and are also independent of the terms η_{ah}. As in the case of the application cost, we take care in bounding the information cost from below by zero. Note that we allow for households receiving information about the program costlessly.

From the previous expressions, a household will look for information about the program if

$$\beta_{kg} G_{kh} + \beta_{kx} X_{kh} \geq \varepsilon_{kh}, \tag{3}$$

where $\beta_{kg} = 1/\sigma_k$, $\beta_{kx} = -\gamma_k/\sigma_k$, and $\varepsilon_{kh} = \max(\eta_{kh}/\sigma_k, -\beta_{kx} X_{kh})$. Note that ε_{kh} is a random term with a density identical to the standard logistic density for $\varepsilon_{kh} \geq -\beta_{kx} X_{kh}$. We can estimate equation (3) using a previous estimation of equation (2) and the household reports about being informed or not about the program.

4 Empirical Analysis

4.1 Determinants of enrollment

We have estimated equation (1) using the sample of households in our dataset that reported applying into the program. We include as explanatory variables all the household characteristics that are used by the official eligibility criteria. We exclude the regional dummies contemplated by the official criteria, which are not public. We include instead dummies for the 170 neighborhoods in the sample, attempting to capture fixed effects at the neighborhood level due to rationing and other correlated shocks. We also include as explanatory variable whether the mother in the household speaks an indigenous language, which is not an official criterion. We consider the mother rather than the household head as we are interested in detecting discrimination at the program office level, and in 95% of the cases the applicant is in fact the mother

TABLE 4
DETERMINANTS OF ENROLLMENT[a]

Household characteristic	Estimated weight	Administrative weight
(Minors + elderly)/adults	0.213***	0.165
	(0.077)	
Family size/rooms in the house	0.078***	0.130
	(0.028)	
Female head of household	-0.079	-0.018
	(0.102)	
Access to medical services	0.044	0.447
	(0.103)	
Number of children below 11	0.239***	0.240
	(0.146)	
Household head without formal education	0.239	0.357
	(0.146)	
Household head with some primary education	0.132	0.189
	(0.102)	
Age of household head	-0.002	0.004
	(0.004)	
Mother speaks indigenous language	0.245*	0.000
	(0.144)	
House does not have toilet	0.809***	0.391
	(0.182)	
Toilet unconnected to running water	0.375***	0.207
	(0.127)	
Unpaved floor	0.390***	0.447
	(0.092)	
No gas heating	0.083	0.716
	(0.111)	
No refrigerator	0.481***	0.477
	(0.093)	
No washing machine	0.044	0.119
	(0.133)	
No vehicle (no car nor truck)	0.731*	0.150
	(0.282)	

[a]Observations: 4159. Source: *ENCELURB.*

Regression includes neighborhood fixed effects. Standard errors are shown in parenthesis.
*Significant at 10%; **Significant at 5%; ***Significant at 1%.

(Martinelli and Parker 2007). This is not surprising since cash benefits under *Oportunidades* are paid directly to the mother.

The results are reported in Table 4. Note that the estimated coefficients from equation (1), in the second column of Table 4, can be interpreted directly as weights of the respective household characteristics in the poverty score. For comparison purposes, we report in the third column of Table 4 the weights officially used in the year 2002 for eligibility purposes, renormalized so that the sum is the same in both columns.

Most of the important official criteria are also important and significant in practice, according to the estimation. Lacking a refrigerator, paved floor, a toilet or a toilet connected to running water are important according to both official criteria and in practice. Two exceptions are access to health services and lack of gas heating. Both characteristics are affected by location, which may explain their lack of significance since we include neighborhood dummies. On the other hand, lacking a vehicle (which has low weight officially) and speaking an indigenous language (which has no official weight) appear as important and marginally significant in practice. The latter means that we cannot reject the possibility that there is discrimination at the program office level in favor of indigenous applicants.

4.2 Determinants of application

We have estimated equation (2) using the sample of households in our dataset that reported knowing where to go in order to apply to the program.[9] We include as explanatory variables the expected benefit of application and a set of variables reflecting the cost of application. We have assumed a risk parameter of one for the estimation of the expected benefit of application, but the results are not very sensitive to the choice of the risk parameter around one. Since we use the results from equation (1) to estimate the expected benefit of application, we have bootstrapped the standard errors.

The variables related to the cost of application include the distance to the registration center and characteristics of the likely applicant, that is the

[9] The exact question in the survey was *¿Supo usted o alguna persona que vive aquí, en este hogar, a dónde ir para solicitar su incorporación al Programa Oportunidades?* (Did you, or anyone else living here, in this house, know where to go to apply to the Oportunidades program?)

TABLE 5
DETERMINANTS OF APPLICATION[a]

Household characteristic	Estimated coefficient	Marginal effect
Expected benefit of application	4.164***	0.421***
	(0.671)	(0.067)
Distance to registration (kilometers)	0.074	0.008
	(0.052)	(0.005)
Age of mother	-0.081***	-0.008***
	(0.022)	(0.002)
Square age of mother	7.6E-4***	7.7E-5***
	(1.0E-5)	(1.0E-6)
Years of education of mother	-0.083***	-0.008***
	(0.015)	(0.001)
Available babysitter	0.142	0.014
	(0.218)	(0.021)
Family size	0.040	0.004
	(0.030)	(0.003)

[a]Observations: 4761. Source: *ENCELURB.*
Regression includes neighborhood fixed effects and control for missing information about distance. Bootstrapped standard errors are shown in parenthesis. *Significant at 10%; **Significant at 5%; ***Significant at 1%.

mother, which are correlated with the opportunity cost of her time. We include in particular age and square of age, as age is commonly believed to have a quadratic relationship with market earnings. We also include years of education, which we can expect to have a positive effect on market earnings. Finally, we include a dummy for available babysitter, that is another adult female for households with children below 2, and we control for family size and neighborhood effects.

The results are reported in Table 5. Consistent with the model, the expected benefit of application has an important and statistically significant effect. Variables related to the opportunity cost of time, such as age and years of education, have the expected sign and are significant. Distance to the registration center and availability of a babysitter have the predicted effect but are not significant. The former is intriguing; perhaps distance is

not a very precise indicator of travelling time between the house or labor location and the registration office. The latter points to the need to do more research on the arrangements made, perhaps with their neighbors, by mothers of small children in order to apply to the program.

4.3 Determinants of information acquisition

We have estimated equation (3) using the whole sample of households in our dataset. We define as informed households those that reported knowing where to go in order to apply the program. An alternative definition of being informed could have been reported being aware of the existence of program's registration centers in the locality or neighborhood.[10] We prefer to define as informed those who report knowing actually where to go in order to apply consistent with our view of information as instrumentally useful. In practice, there is little difference between one definition and the other since most households who report not knowing where to go in order to apply to the program also report not being aware about the program's registration centers.

We include as explanatory variables the expected benefit of knowledge and a set of variables reflecting the cost of information. The latter include variables attempting to capture exposure to relevant information, taking into account that advertising was directed by local authorities to the poorest blocks, as well as variables related to the opportunity cost of time of the mother. As before, since we use the results from equation (2) to estimate the expected benefit of knowledge, we have bootstrapped the standard deviations.

The results are reported in Table 6. Consistent with the model, the expected benefit of knowledge has an important and statistically significant effect. Among the variables related to the cost of information, the proportion of eligible households in the block, the participation in other programs,

[10] The question for awareness in the survey preceded the question about location of the registration center (footnote 9). The exact question was *¿Supo usted o alguna persona que vive aquí, en este hogar, que había módulos cerca de su localidad (vecindario) en los que podía solicitar entrar al Programa Oportunidades (Progresa)?* (Did you, or anyone else living here, in this house, know that there were registration centers in this neighborhood in which it was possible to apply to the Oportunidades program?)

TABLE 6
DETERMINANTS OF LEARNING[a]

Household characteristic	Estimated coefficient	Marginal effect
Expected benefit of knowledge	3.993***	0.951***
	(0.635)	(0.151)
Proportion of eligible households in block	3.674***	0.875***
	(0.274)	(0.065)
Participation in other programs	0.827***	0.186***
	(0.064)	(0.014)
Participation in organizations	0.085	0.020
	(0.062)	(0.015)
Distance to registration (kilometers)	-0.059**	-0.014**
	(0.026)	(0.006)
Mother works outside home	0.049	0.012
	(0.057)	(0.014)
Mother speaks indigenous language	0.292***	0.070***
	(0.093)	(0.022)
Family size	0.089***	0.021***
	(0.017)	(0.004)
Age of mother	0.018*	0.004*
	(0.011)	(0.003)
Square age of mother	-3.0E-4***	-7.5E-5***
	(1.3E-4)	(3.2E-5)
Years of education of mother	-0.038***	-0.009***
	(0.009)	(0.002)

[a]Observations: 8121. Source: *ENCELURB.*
Regression includes neigborhood fixed effects and control for missing information about distance. Bootstrapped standard errors are shown in parenthesis. *Significant at 10%; **Significant at 5%; ***Significant at 1%.

and whether the mother speaks an indigenous language appear to be both quantitatively important and statistically significant. We think that these are related to a lower cost of information through two different channels. One of them is the availability of information, given word-of-mouth communication and advertising targeted to poor blocks. Another is possibly a lower stigma of participation in social programs, given the social contacts of the household. Two other variables that appear to be statistically significant are distance to the registration center and family size. In the case of these two variables, the relationship to the lower cost of information may be due primarily to the first channel. Participation in organizations has the expected sign but is not significant.[11] The same is true for whether the mother works outside home, which we expect provided the mother with more opportunities to hear about the program.

The variables related to the opportunity cost of time of the mother work very differently for information acquisition than for the application decision. The age of the mother is not important for information acquisition. Education significantly lowers the probability of being informed. This is in contrast with the finding of Heckman and Smith (2004) that education increases the probability of being aware of the JTPA program in the US. We interpret the negative effect of education on (self-reported) knowledge about the location of registration centers as possibly the result of stigma.[12]

4.4 The costs of application and information

We calculate the expected utility cost of application for household h as

$$\mathtt{E}\max(-(\beta_{ax}/\beta_{ag})X_{ah} + \eta_{ah}, 0).$$

Solving the expectation we get the expected utility cost of application is

$$-(\beta_{ax}/\beta_{ag})X_{ah} + (1/\beta_{ag})\ln(1+\exp(\beta_{ax}X_{ah})).$$

[11] The range of organizations mentioned in the survey are cooperatives, rotating credit assotiations, political organizations, communal organizations for the provision of local public goods, and religious organizations.

[12] Previous related work (Martinelli and Parker 2007) shows that more educated applicants are more likely to overreport their desirable household characteristics, that is to report (during an screening interview at the registration center) desirable household characteristics which in fact they lack, thus reducing the probability of being enrolled into the program.

TABLE 7
COSTS AND BENEFITS OF PARTICIPATION[a]

	Eligible		Ineligible	
Costs and Benefits	Mean	Std. Dev.	Mean	Std. Dev.
Expected cost of application	302	155	344	467
Expected cost of information	298	171	399	503
Certainty-equivalent benefit of application	397	292	289	241
Probability of acceptance conditional on application	0.80	0.14	0.59	0.19

[a]Costs and benefits in Mexican pesos (2002); 11 pesos is approximately US$1.

Using compensating variations and assuming $\rho = 1$, we can estimate the monetary cost of application as

$$(4) \qquad Y_h \left(1 - \exp\left((\hat{\beta}_{ax}/\hat{\beta}_{ag})X_{ah} - (1/\hat{\beta}_{ag})\ln(1 + \exp(\hat{\beta}_{ax}X_{ah}))\right)\right),$$

where Y_h is the total preprogram household expenditure.

Similarly, we can estimate the monetary cost of information acquisition as

$$(5) \qquad Y_h \left(1 - \exp\left((\hat{\beta}_{kx}/\hat{\beta}_{kg})X_{kh} - (1/\hat{\beta}_{kg})\ln(1 + \exp(\hat{\beta}_{kx}X_{kh}))\right)\right).$$

For comparison purposes, we estimate the certainty-equivalent gain of application as

$$(6) \qquad Y_h \left((1 + B_h/Y_h)^{F\left(\hat{\alpha}_e + \hat{\beta}_e X_{eh}\right)} - 1\right).$$

Note that we calculate the gain of application using the estimated subjective probability of being enrolled in the program if applying.

Table 7 reports the mean and the standard deviation of the cost of application, the cost of information, the certainty-equivalent gain of application and the probability of acceptance into the program for all eligible and all ineligible households in the sample, not only those who are informed or apply. Both the costs of application and the cost of information are higher for ineligible households. The cost of information in particular, is approximately 25%

higher for ineligible households. There is considerable variation in both costs for ineligible households, which explains why many ineligible households apply to the program. Due to the lower probability of acceptance and smaller potential benefits given the number of children, the certainty-equivalent benefit of application is also about 25% lower for ineligible households. Thus, the lower rate of application to the program for ineligible households can be attributed both to higher information costs and lower expected benefits.

Figure 2 presents information on costs and benefits of participation, this time disaggregated by socioeconomic status, as measured by household per capita expenditure.[13][14] The cost of application and the cost of information are increasing in household per capita expenditure, with the information cost being particularly steep. Note that the cost of information is higher than the cost of application except for the lower expenditure households; the mean household per capita expenditure is 492 pesos for eligible households and 777 pesos for ineligible households (Table 3). The certainty-equivalent benefit of application is decreasing in household per capita expenditure and is also very steep. Thus, the pattern of information, application and acceptance described by Figure 1 can be explained by both lower expected benefits of application and higher costs for relatively better off households. As noted earlier, there is considerable variation in costs and benefits, in particular in the cost of information. As a consequence, the rate of application into the program is not negligible even for the better off households in the sample, as seen in Figure 1.

[13] Figure 2 is produced using nonparametric regressions (lowess).

[14] The estimates in Table 7 and Figure 2 are more useful in relative than in absolute terms, since they depend on the normalization explained in footnote 7. (In absolute terms, they can only be taken as a lower bound on the actual costs and benefits, which depend on the time horizon and discount rates of potential applicants.)

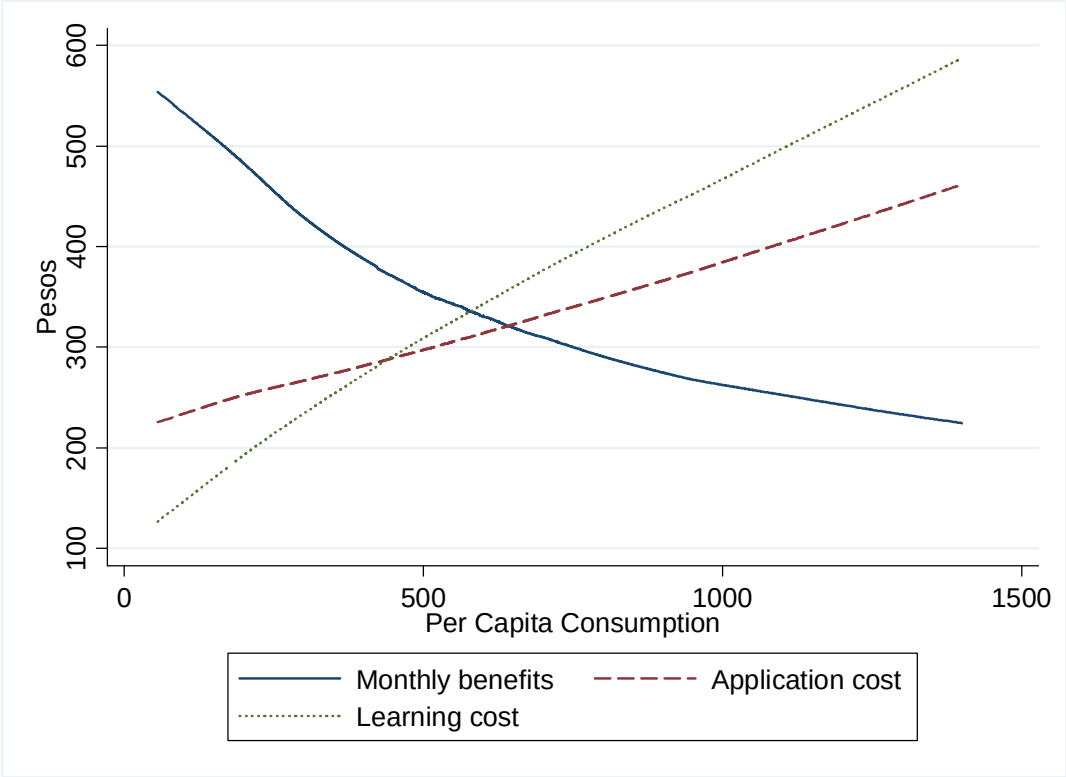

FIGURE 2.–Costs and benefits of participation by expenditure levels.

5 Concluding Remarks

In this paper, we study participation in a social program from a theoretical and an empirical perspective. On the theoretical side, we build upon the idea of Heckman and Smith (2004) of analyzing participation as a process, and propose a formal model of participation as a sequential decision problem in which an agent contemplating whether to become informed about the application procedure must form expectations about the likely costs of application and the probability of being accepted. On the empirical side, we estimate this model of participation using a dataset from *Oportunidades* when first introduced in urban localities. Consistent with the model, our estimation procedure uses the rational expectation hypothesis to tie the different stages of the participation process. We find that the application and information

costs are actually progressive and help in targeting the program benefits to those most in need. This is in contrast with the empirical literature about social programs in the US which has emphasized the harmful effect of information costs on the participation of groups which are vulnerable due to language barriers.

A clear policy implication of this paper is the usefulness of a self-selection component in the targeting of social programs. This is especially so in developing countries, in which the absence of verifiable information about income implies that the official criteria for eligibility into social programs usually rely on imperfect measures of socioeconomic status. The poverty regression approach, used by *Oportunidades* and many other social programs around the world, gives only a very imperfect picture of socioeconomic status (see e.g. the discussion by Ravallion 1996). Moreover, the poverty regression approach can be subject to strategic manipulation by potential applicants (Martinelli and Parker 2007). In these circumstances, eliminating or attenuating the self-selection component (as in fact has happened in *Oportunidades* after our dataset was collected) risks worsening the targeting of the program. The "invisible hand" of self-selection is particularly useful when the "visible hand" of administrative assignment of weights to (presumably) observable household characteristics cannot confidently be relied upon.

References

[1] Aizer, A. (2003), "Low Take-Up in Medicaid: Does Outreach Matter and for Whom?," *American Economic Review Papers and Proceedings* 93: 238-241.

[2] Aizer, A. (2007), "Public Health Insurance, Program Take-up and Child Health," *Review of Economics and Statistics* 89: 400–415.

[3] Ashenfelter, O. (1983), "Determining Participation in Income-Tested Social Programs," *Journal of the American Statistical Association* 78: 517-525.

[4] Besley, T. and S. Coate (1992), "Workfare versus Welfare: Incentive Arguments for Work Requirements in Poverty-Alleviation Programs," *American Economic Review* 82: 249-261.

[5] Blundell, R., V. Fry and I. Walker (1988), "Modelling the Take-Up of Means-Tested Benefits: The Case of Housing Benefit in the United Kingdom," *Economic Journal* 98: 58-74.

[6] Cleveland, W. (1979), "Robust Locally Weighted Regression and Smoothing Scatterplots," *Journal of the American Statistical Association* 77: 829–836.

[7] Currie, J. (2006), "The Take-Up of Social Benefits," in A. Auerbach, D. Card and J. Quigley (eds), *Public Policy and the Income Distribution*, New York: Russell Sage.

[8] Daponte, B., S. Sanders and L. Taylor (1999), "Why Do Low Income Households Not Use Food Stamps? Evidence from an Experiment," *Journal of Human Resources* 34: 612-628.

[9] Duclos, J.-Y. (1995), "Modelling the Take-Up of State Support," *Journal of Public Economics* 58: 391-415.

[10] Heckman, J., and J. Smith (2004), "The Determinants of Participation in a Social Program: Evidence from a Prototypical Job Training Program," *Journal of Labor Economics* 22: 243-298.

[11] Hernandez, M. and S. Pudney (2007), "Measurement Error in Models of Welfare Participation," *Journal of Public Economics* 91: 327-341.

[12] Martinelli, C. and S. Parker (2007), "Deception and Misreporting in a Social Program," forthcoming in *Journal of the European Economic Association*.

[13] Micklewright, J., A. Coudouel and S. Marnie (2004), "Targeting and Self-Targeting in a New Social Assistance Scheme," Discussion Paper No. 1112, Institute for the Study of Labour (IZA), Bonn, Germany.

[14] Moffitt, R. (1983), "An Economic Model of Welfare Stigma," *American Economic Review* 73: 1023-1035.

[15] Parker, S., L. Rubalcava and G. Teruel (2007), "Evaluating Conditional Schooling and Health Programs," in T. P. Schultz and J. Strauss (eds.), *Handbook of Development Economics, Volume 4*, Amsterdam: Elsevier.

[16] Pudney, S., M. Hernandez and R. Hancock (2007), "The Welfare Cost of Means-Testing: Pensioner Participation in Income Support," *Journal of Applied Econometrics* 22: 581-598.

[17] Ravallion, M. (1996), "Issues in Measuring and Modelling Poverty," *Economic Journal* 106: 1328-1343.

[18] Reglas de Operación del Programa Oportunidades de Desarrollo del Capital Humano para el Ejercicio Fiscal 2002, *Diario Oficial de la Federación*, May 8, 2002.

[19] Remler, D. and S. Glied (2003), "What Other Programs Can Teach Us: Increasing Participation in Health Insurance Programs," *American Journal of Public Health* 93: 67-74.

[20] Train, K. (2003), *Discrete Choice Methods with Simulation*, Cambridge, UK: Cambridge University Press.