Does poverty alleviation increase migration? evidence from Mexico

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27 September 2009

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[OCTOBER, 2011]

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Abstract

What is the long term effect of conditional cash transfers (CCT) on labor and migration decisions? There is scientific evidence that support short run positive effects of CCT on the levels of nutrition, health and schooling. However, there is little evidence on their long term effects on labor and migration decisions. The experimental data is limited for this purpose. I examine the short and long term effects of Progresa-Oportunidades on migration using a regression discontinuity design. The paper identifies the effects of the program among villages with poverty levels close to the cutoff point of the original eligibility criteria. The estimates show that the program caused a drop in the population size and changed the gender composition of Mexican rural villages between 1997 and 2005. Migration of fully covered village accounts for a reduction of 10 percentage points during the period. The reduction of males is significantly higher than for females, a clear sign of its effect on migration decisions.

Keywords: Cash transfers, Progresa, Oportunidades, migration, regression discontinuity design.

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I would like to thank James J. Heckman, Robert LaLonde, Dan Black, Kerwin Charles, Ofer Malamud and Ioana Marinescu and participants in the Harris School PhD Workshop for their useful comments. I am also very grateful to *Coordinacion Nacional del Programa Oportunidades* and *Instituto de Acceso a la Información Publica* (IFAI) for providing the information and data on the *Progresa-Oportunidades* program.

Introduction

What is the long term effect of conditional cash transfers (CCT) on labor and migration decisions? What is the effect of CCT programs on the demographic composition of recipient households of poor rural villages? CCT programs have demonstrated to enhance human capital investments of poor families by increasing nutrition, health and schooling levels of poor families.

CCT programs have become a very popular around the world after the introduction of *Progresa-Oportunidades*, the pioneer Mexican CCT program that started in 1997. Its unique experimental design showed evidence of its effectiveness in tacking poverty. This evidence facilitates the implementation of CCT in many different countries and regions, including Argentina, China, Colombia, Honduras, Indonesia, Jamaica and Nicaragua. Some others like Turkey, India, Pakistan and Philippines are also using cash transfers as the main strategy for development. In general, these programs distributes cash to mothers conditional on their children being enrolled in school and engaging in a series of health-promoting activities with the objective of equipping them with human capital needed to break the inter-generational transmission of poverty. However, there little evidence on the long term effects of CCT programs, particularly their effects on the demographic trends, including fertility and migration. The empirical importance of this effect is unsolved, partly because of the short period since their expansion and short period of analysis.

This paper tests the hypothesis that CCT programs are accelerating the demographic transition of poor by increasing migration and reducing the fertility rates of beneficiaries, particularly for population located close to the margin of eligibility. I use the administrative records of *Progresa-Oportunidades* and the original set of villages used for designing the original rollout plan of program. I examine the sudden drop in the population size and change in the gender composition of rural villages where the program

was implemented between 1997 and 2005. To identify the effect of the program on migration, I use a regression discontinuity design of the poverty index used to determine what villages were eligible in 1997. I find that during the period 1995-2005 the average population size in a fully covered village decreased by 10 percentage points as consequence of the increase of migration, in addition to a reduction in the fertility rate. This reduction is statistically significant higher for males than for females, which indicates a migration pattern of the adult population in those villages covered by the program.

The short term effects of *Progresa-Oportunidades* on migration have been studied during the previous years. The experimental data has been analyzed and provides not conclusive evidence on the effects of CCT on migration on the short run. Scholars have found opposite result using the same data. Stecklov, Winters, Stampini, and Davis (2005) found a short run positive effect on national migration and no effect on the international. Angelucci (2005) uses a similar technique with different specification and shows an opposite finding: "Overall, the program generates an increase in international migration but no change in domestic migration (P. 14)". Ruvalcaba (2005) finds a positive and significant effect in both national and international migration by using a third synthetic comparison group created in 2003. All these results are mainly based on the short term effect of the program and none of them has analyzed the long term effects. The large scale experiment is limited on this regard. It only provides evidence differences for a short period of time -18 months-. As consequence, long term evidence requires the use of alternative identification methods.

The contribution of this paper is two folded. First, it is the first to provide estimations using the discontinuity in the coverage of the program to test long term effects of the CCT. Second, there is a current debate on the long run effects of the effectiveness of CCT in reducing poverty. If CCT are extremely effective, we should expect a significant increase of migration if recipients increase their human capital and look for a more productive occupation. However, this could have other consequences

for the destinations where those recipients decide to migrate. This is a potential paradox, since the success of the program could represent a major public policy problem if beneficiaries who migrate find difficult to be assimilated in new labor markets. The literature on the impact of CCT on labor mobility is its early stages, so this paper could shed some light on this arena.

The rest of the paper is organized as follows. Section II describes the conceptual framework used to construct the working hypothesis to be tested. Section III provides a brief description of the main features of *Progresa-Oportunidades*. Section IV lays out the types of data used in the analysis. Section V shows the identification strategy: difference in difference and regression discontinuity design close to the original eligibility criteria used for the section of the villages included in the original rollout plan of the program. Section VI shows the estimated impacts of the program on the two variables used to approximate migration. Section VII concludes.

Conceptual Framework. Cash transfers and their effect in demographic trends

2.1 Working Theory

This paper tests the theoretical effect of a program that includes a cash transfer conditioned on assistance to school and better health habits will increase human capital of beneficiaries on migration. In particular, I will test if beneficiaries will try o search for an occupation with higher returns outside their villages where they were born.

The effect of a CCT programs on migration depends on the age and cohort of beneficiaries. The increase of human capital of older cohorts -who were out of school after the program initiates- is very limited and it is only affected by the better provision of health services. They benefit of the transfer by increasing consumption, which makes them less likely to abandon their communities. Younger cohorts receive better health services, increase their nutrition levels during the critical early childhood years and increase their schooling levels, which make them more likely to increase their productivity during adulthood [See Cunha and Heckman (2007)]. These cohorts are more likely to have higher incentives to abandon their villages of origin and find an occupation in a different labor market.

To analyze this difference I will use a simple model of migration developed by Borjas (1987) and refined by Chiquiar and Hanson (2004). Both use the Roy Model of negative selection migration from a country with relative high returns to skill in comparison with other with lower returns. Individuals with intermediate and lower levels of human capital would have more incentives to migrate depending on the modeling of the cost of migration. If costs are constant, we would expect an increase of migration of individuals in the lower part of the distribution. But if cost is increasing according to the educational levels, then we would expect migration only from individuals located in the intermediate part of the distribution. Chiquiar (2004) show negative selection can be overturned if the cost of migration

increases at different levels of education. In fact, the relaxation of constant cost of migration can result in having positive or negative selection in terms of skill, particularly depending on the size of migration.

2.1.1 The model

Decision of migration is taken only one time in life. Those who decide to stay in their local communities are indexed by 0 and those who decide to leave are indexed by 1. So, the first group face the next a wage equation

$$\ln(w_0) = \mu_o + \delta_o S \tag{1}$$

where:

- w_0 is the wage in the village of origin
- μ_0 is the base wage in the village of origin
- S is the level of schooling

As pointed by Borjas (1987) and Chiquiar (2006), the focus must be in observable skills, in specific schooling. There are random components to wage determination, but for simplicity such features are not included in the analysis. Similarly, those who decide their villages or communities face the following equation.

$$\ln(w_1) = \mu_1 + \delta_1 S \tag{2}$$

where:

- w_1 is the wage in the destination village
- μ_1 is the base wage in the destination village

It is normally assumed that returns to schooling in the local village are higher in comparison with the destination.[1] In other words $\delta_0 > \delta_1$. The cost of migration is defined as C and it can be expressed in hours of work to estimate the equivalence as a part of the full income. This last can be expressed as: $\pi = \frac{C}{w_0}$.

This allows us to express the difference between wages as:

$$\ln(w_1) - \ln(w_0 + C) = \mu_1 + \delta_1 S - \mu_0 - \delta_0 S - \pi \quad (3)$$

Those who decide to migrate must have a positive gain of doing it. In this case, the sign of equation 3 is positive. The difference in salaries and the specific return to schooling must compensate the cost of migration. This can be formally expressed as:

$$\ln(w_1) - \ln(w_0 + C) = \mu_1 + \delta_1 S - \mu_0 - \delta_0 S - \pi \approx \ln(w_1) - \ln(w_0) - \pi \quad (4)$$

As it is mentioned before, it is feasible to relax the assumption of constant cost as expressed in the previous equation and instead using time-equivalent migration costs decrease with schooling, such that:

$$\ln(\pi) = \mu_\pi + \delta_\pi \quad (5)$$

Chiquiar (2006) derive this expression by making two assumptions. The first is the standard cost of information and the relative lower cost for those with higher income in time equivalent wage units. The second refers to the fact that individuals would require borrowing money in order to complete the cost of migration. So those individuals with credit constraints will be impeded to get it. This is true for individuals in the lowest part of the wage distribution, who are less likely to have access to credit markets, both formal and informal.

[1] In general, the problems of supply of education in the region/country of origin are not analyzed in the literature.

If we combine the equations 1 to 5 we would be able to find the cutoff points of the population with higher incentives to migrate. The case of constant cost gives us only one cutoff point with only negative selection. However, if we use the decreasing cost of migration we can derive the following conditions:

1. $\delta_{\pi} > 0$
2. $\mu_1 - \mu_0 > e^{\mu_{\pi}}$

Figure A of the Model Appendix shows the distribution of population that migrates and the one that not. Time equivalence cost of migration represents a significant part of full income and it is decreasing with schooling. There are two cutoff points: S_L and S_U. The first refers to the lowest level of education that would be able to pay for the migration cost; the second refers to the individuals with education level L who are indifferent between staying and leaving their communities.

Individuals to the left of S_L and to the right of S_U decide to stay in their communities. The figure assumes that the mean schooling level $(\overline{S})$is between these two values. This selection of migrants in terms of observable variables is related to the distribution of schooling in the country. According to the graph, two are three possible cases in the migration phenomenon:

- *Negative selection*. Those individuals who are between $\overline{S}$ and S_L. This population has a lower level of schooling than the upper part of the distribution. However, their schooling level is higher than those of the lowest part of the total distribution.
- *Positive selection*. Those individuals who are between S_L and S_U. This is the population with high levels of schooling, but not the highest of the distribution.

The final effect will depend on the composition of both types of selections: If the majority is from the lowest distribution, then the expected selection is going to be negative, while if the majority if from the

right distribution, we will have positive selection. If the proportion is the same, then we can consider the distribution as “intermediate selection”.

There are some caveats of this model. One of them is recognized by the authors and it is referred to the non-inclusion of informational networks. The more information an individual has, the lower the cost of migration, especially for low income workers who have relatives and friends with an occupation in the other labor markets. The other is referred to the frictions of the education market in the country/village of origin. While people would like to stay at school, supply is very restricted or null, which forces individuals to migrate. Although the existence of these caveats, I will next provide some extensions derived from CCT programs and their effect on migration decisions.

2.1.2 CCT and Migration in the sort and long run. Theoretical working hypothesis

CCT programs have different theoretical effects on the decision to migrate for the long and short runs. In both cases the benefit is related to horizon of analysis: immediate transfers can be considered as direct increase in the disposable income of individuals who would decide to leave their villages, especially the generation who is out of school. The cash transfer may reduce the constraint faced by poor households and members may use the extra income to fund the migration process. Once again, the final effect is not the same for households: only those households in the extreme portion of the distribution -the less poor- will be able to do this.

On the other hand, investments in human capital derived from an increase in the expenditures on health, nutrition and education forced by CCT programs will give younger cohorts more incentives to find an occupation with higher returns once they complete their education. It is important to note that not all beneficiaries will be in the same situation: those in the extreme income distribution will not be able to increase their income such as it would be feasible to fund a possible migration decision, while

those who were in the margin of the distribution will be more able to do it. For example, if two individuals have the same educational level but one of them is living in a poorer household, the other is more likely to move to a location that pays highest relative wages, net of moving costs.

In order to include these elements in to the previous model, we must change the cost of migration expressed in terms of units of labor. I will only use the model with decreasing costs. This allows expressing equation 5 as follows.

$$\ln(\pi' | Poor) = \mu_{\pi} + \delta_{\pi} S' - CT \quad (6)$$

Where:

- S' is the level of schooling increased by the program
- CT is the value of the cash transfer

This change is illustrated in Figure B, included in the Model Appendix. Note that this change only affects those individuals included in the program -below the poverty threshold- and not to the rest of the population. Higher levels of education derived from the effectiveness of CCT programs will change the margin at which people decide to migrate. This does not mean that all beneficiaries will be in the possibility of leaving their communities, but only those who are less poor. This change in the cost of migrating changes the equation of decision for the poor population as:

- $\pi' < \pi$
- $\mu_1 - \mu_0 > e^{\mu_{\pi}} > e^{\mu_{\pi'}}$

The reduction of the cost to migrate gives individuals at the margin the opportunity to leave their communities and find an occupation in other labor market different than the one in their village. The left

cutoff point of the distribution is now at S'_L. This means that that effect of the program is only on the beneficiaries of the program. The empirical strategy tests this theoretical hypothesis.

2.1 *Progresa-Oportunidades*

Progresa-Oportunidades is the pioneer CCT program. It was implemented in 1997 with the objective of breaking intergenerational transmission of poverty by investing in food, health and education of new generations. It is assumed that poverty is understood as the result of low acquisition of capabilities that translates into bad functioning during adulthood, a phenomenon that has been replicated during the past generations.

The program was created in 1997 under the name of *Programa de Educación, Salud y Alimentación* (*Progresa*). The initial design included only rural villages. Public officials in charge of the program used the results of the partial census 1995 and the poverty index of the same year to determine the original rollout plan. It was designed to cover the rural poorest villages in Mexico from 1997 to 2003. It had three main components:

1. Health and nutrition services
2. Food subsidy in cash equivalent to 35 kilograms of tortillas per month.
3. Educational cash transfer for basic education.

The first two refers to the a basic plan of preventive about health care, pregnancy care, nutritional supplements, and bimonthly cash subsidy to improve nutritional levels of children. Educational grants are provided to each member of the household under twenty one years old. Children must be registered full-time in school between the third grade of primary school and the third year of intermediate school. The idea of the educational grant is to compensate for the opportunity cost of child work or children

working in the household. The amount of money is received by the mother in the household and it varies depending on year of schooling and the gender composition of children.

The grant is higher for females in secondary and high school. The purpose of this difference is to reduce the gap of the in school attendance by gender given that females tend to leave their studies in greater numbers and at an earlier ages than males. Also, the cap is designed to reduce incentives to increase fertility. Beneficiaries are required to take preventive care and attend at least 85% of classes in order to receive the cash transfer, which is given directly to the mother of the household. The full description of this benefit is included in Table A of the Data Appendix.[2] The design, implementation and resources are the responsibility of the federal government, but the program also involves the local governments in the provision of health and educational services. Also the civil society is involved in the program through the organization of "*Asambleas Comunitarias*" that participate in the selection and incorporation of the benefited households.

In 2002 the program was redesigned and expanded to urban and semi-urban villages under the name *Programa de Desarrollo Humano Oportunidades.* This expansion included a redefinition of the methodology followed to select the eligible households, the inclusion of urban areas and the extension of the educational grants to the intermediate and higher education. This paper only includes the original expansion of the program in rural villages between 1997 and 2003.

Progresa-Oportunidades has shown to be efficient in terms of poverty reduction. The large academic work focused on CCT is mainly based on large scale field experiment implemented for 18 months

[2] For more details see http://www.oportunidades.gob.mx/

between 1998 and 2000 that included random provision of the program in villages of ten states of the country.[3] Scholars have found causal evidence on the effect of the program. This includes:

- Positive effect the school attendance of both boys and girls in primary, secondary and high-school
    1. Boys in secondary school: 8 % (0.64 additional years)
    2. Girls in secondary school: 14% (0.72 additional years). This represents 10% of additional education
- Negative impact on children's labor market (boys)
- Effectiveness in keeping children in school especially during the critical transition from primary to secondary
- Reduced stunting among children 1-3 years of age
- 12% lower incidence of illness in children ages 0-5

The implementation o*f Progresa-Oportunidades* coincides with the reduction of poverty levels in Mexico since 1997 [Szekely (2004)]. The increase of disposable income of poor families has alleviated some of the basic needs of the poor families. However, the objective of the program is to reduce poverty conditions and expand capabilities of beneficiaries throughout their life cycles. This it is highly relevant to evaluate the long term effects of the program, particularly the effects on the labor mobility of young beneficiaries.

[3]For more information about the results of the program see: IFPRI, Is Progresa Working? Summary of the Results of an Evaluation By IFPRI, July 2001. http://ageconsearch.umn.edu/bitstream/16418/1/fc010118.pdf

Empirical Strategy

The eligibility criteria used in the design of the program for the rural areas was based on the Marginalization Index 1995 or povery index (Indice de Marginacion) created by the Mexican Population Council (CONAPO). It is based on the results of the partial census of 1995. Other criteria included availability of schools and clinics to the eligible population.[4]

The Index 1995 measures the degree of marginalization of every village included in the partial census. It has nine components that describe level of education, quality of housing and public services, urbanization and income of the population living in two categories of villages, urban and rural.[5] It has a continuous distribution. Its distribution is used to classify every village into five levels of marginalization: very low, low, medium-range, high, and very high. A complete description of the components, their weight in the index and the cutoff values are included in Tables B, C and D of the Data Appendix.

The original plan for the rollout of *Progresa* was designed with 18 phases during a period of six years, from 1998 to 2003.[6] It only included rural villages classified in the middle, high and very high levels of marginalization. This criteria rule would work as an instrument to estimate causal effects of the program. The continuous distribution of the index can be used to create comparison groups around the cutoff point of the eligibility. Villages classified with low marginalization, but very close to the cutoff value can work as a comparison group of those who just qualified to the program (treatment group).

For the purpose of this paper it is possible to use a regression discontinuity design (RDD) to estimate the effect of the *Progresa-Oportunidades* on migration patterns.

[4] Schools and clinics are key components of the program and the lack of provision makes impossible to comply with the conditions of the program explained in the previous section.
[5] The criteria used for this classification is the total population living in the village. The threshold for a rural village is 2,500 inhabitants.
[6] Secretaría de Desarrollo Social (1996). Resultados del Programa de Salud y Educación (PASE), mimeo.

The validity of all different RD techniques relies on the local continuity assumption which says that, in the absence of treatment, outcome variables would be continuous functions of the assignment variable. This last variable is the marginalization index 1995 used to determine the eligibility of the villages. The two following subsections describe the analysis to identify RD.

4.1 Why not to use the experimental framework for long term effects

The majority of the academic research focused on *Progresa-Oportunidades* is based on the random experiment designed to estimate the impact of the program on health, nutrition and educational outcomes. Mexican authorities took advantage of phase expansion and chose a random sample of villages that were incorporated in phase 1 of the program in 1998 (treatment villages), and other group (comparison group) originally planned to be incorporated during phase 18 in 2003. The treatment group was composed by 320 villages whose inhabitants received the benefits of the program in September 1998. The control group included 186 villages.[7] Two of the poorest states were not used as part of the universe for the randomization process for political reasons, Oaxaca and Chiapas.[8] Other states, particularly in the northern part of the country –with a large historical tradition of migration – were also not included. Experimental villages were mainly located in the central part of the country, which are certainly different than the entire distribution.

The original plan to evaluate the program using the experiment changed in 2000. Political pressures derived from the federal election of 2000 forced authorities to incorporate the control group in January

[7] The randomization process included two parts. The first corresponds to the poverty levels and the second to the total population. For more details on the randomization process see Berman (1999)

[8] In both cases, there was a risk of contamination of the field experiment: the governor of Oaxaca was hostile towards any program from the federal government and wanted to control the assignment of the beneficiaries. In the second case, the presence of the "Zapatista" rebellion forced authorities to avoid its inclusion given the political risk of doing so. Interview with Daniel Hernandez, former Director of Progresa-Oportunidades Program.

of 2000.[9] This significantly reduced the time frame and the estimation of the long term effects of the program. In addition, the lack of national representativeness of the experiment –it only included 7 out of 32 states in the country- makes not possible to analyze the effect of the program on migration and labor decisions for regions with different characteristics. The levels of information about the conditions in other labor markets (national and international) vary significantly from one region to other. The sample included in the experiment does not capture this regional variation. Finally, as described by Fernald, Gertler and Neufeld (2009) there is a problem of attrition of the original sample of households included in the program for the last round of interviews, which took place in 2004.

The original experiment had a great impact on applied economic literature. However, the lack of national and regional representatives does not allow estimating marginal effects of the program in those households that are located in the marginal distribution of the program, particularly in those states with long tradition of migration. It is necessary to use alternative identification strategies to analyze long term effects of the program.

The literature on the long term effects of CCT is limited and not conclusive. The main contribution of this paper is to propose this discontinuity in the expansion as the instrument to identify those effects. This could provide a better estimation of the program, particularly on labor decisions and migration.

[9] Although there is no documentation on this regard, several interviews with Santiago Levy, former Vice-Ministry of the Treasury and Daniel Hernandez, former Director of Progresa-Oportunidades, reveal in this matter.

4.2 Estimation of Migration

The first step for estimating the effect of the program is to homologate the information cointained in the censuses to estimate the level of migration in the villages every 5 years. To this we need to firs determine the sources of changes in the population. Following Guillot, Heuveline and Preston, (2001), the flows that determine the stock of a population from one period can be expressed as follows.

$$P_{i,t} = P_{i,t-1} + C_{i,t} - D_{i,t} + I_{i,t} - E_{i,t} \quad (7)$$

Where

- $P_{i,t}$ is the total population in village i who were born before the implementation of the program in future periods (2000 or 2005)
- $P_{i,t-1}$ is the total population in village i who were born before the implementation of the program in the baseline period (1995)
- $C_{i,t}$ represents the total population in born in village i, who were born between the baseline period (1995) and the next periods (2000 and 2005)
- $D_{i,t}$ represents the total population who died in village i between the baseline period (1995) and the next periods (2000 and 2005)
- $I_{i,t}$ represents the total population who immigrates to village i between the baseline period (1995) and the next periods (2000 and 2005)
- $E_{i,t}$ represents the total population who emigrates from village to other location, between the baseline period (1995) and the next periods (2000 and 2005)

The information included in the censuses does not permit to compare immigration and emigration during all periods. In general, these villages no not receive more population, so the emigration is higher than the immigration. So, the last two terms are collapsed to one term (M). This could bias the estimation; however, if this is the case, the bias would attenuate the effect of the program on migration. So, equitation (7) becomes.

$$P_{i,t} = P_{i,t-1} + C_{i,t} - D_{i,t} - M_{i,t} \quad (7')$$

The resulting population can be divided between males and females. This allow us to determine if the change in the population the same for both genders, or if one increases or decreases with respect to the other. The first two variables are reported in every Census included in this paper. The third element can be estimated using the death rates used in official tables reported by the Mexican Population Council. So, the only source of variation is the flows of migrants from every village.

4.3 Difference in difference (DID)

Every ex-post period (2000 and 2005) makes feasible to use a difference in difference (DID) estimation where each observation measures the change in the variables between the baseline and the ex-post period. This means that I use an indicator variable if the village is included in the program.

$$P_{i,t} = \alpha + \phi_t + \beta C_t + \varepsilon_{i,t} \quad (8)$$

Where:

- $P_{i,t}$ Total population in village i in period t
- α is a vector of fixed characteristics of the village
- ϕ is a vector of variable characteristics of the village

- C is the variable that describes the coverage of the program of eligible village j in time t= 2000, 2005 according to the original plan designed using 1995
- ε is a vector of unobservable characteristics

This equation allows us to express the pre-program period (1995) as follows:

$$P_{i,1995} = \alpha + \phi_t + \varepsilon_{i,1995} \tag{9}$$

for the post program period, t= 2000 or 2005, we have:

$$P_{i,t} = \alpha + \phi_t + \beta C_t + \varepsilon_{i,t} \tag{10}$$

The difference in differences (DD) model is given by:

$$P_{i,t} - P_{i,1995} = (\phi_t - \phi_{1995}) + \beta C_t + (\varepsilon_{i,t} - \varepsilon_{i,1995}) \tag{11}$$

This equation indicates the difference of the population living in the village is a difference of the variable characteristics and the coverage of the program.

4.4 Sharp Regression Discontinuity Design (RDD)

The rural expansion of *Progresa-Oportunidades* finished in 2003 and included only villages classified in the middle, high and very high marginalization of Index 1995. This means that en there should be a clear discontinuity in the coverage of the program at the cutoff of eligibility.

The analysis begins by examining graphically the discontinuity of the treatment and the outcome variables used to see if there is a change in the migration of the villages. Similar to Bruhn (2007), the marginalization index is constrained to a small interval (-1.7 to -0.5, which includes those villages point

wide) starting from the cutoff and going in both directions. It takes the non-weighted average of the outcome variables within each of these small intervals.

Figure 1 shows local averages and the estimated polynomials against the marginalization index around the cutoff point between poor and non-poor villages. The first figure shows the coverage of the program in 2000 according to the Index of 1995. The second shows the coverage in 2005 and the same index of 1995. In both cases, it is clear to see a discontinuity in the coverage of the program from those villages with low levels of poverty to those located in the middle.

Using the previous set of equations, we can rewrite equations 9 and 10 to estimate a parametric RD regression of the form:

$$P_{i,t}^{j} = \alpha + \phi_t + \beta D_t^j + \varepsilon_{i,t}^{j} \tag{12}$$

The difference in differences (DD) model is given by:

$$P_{i,t}^{j} - P_{i,1995}^{j} = (\phi_t - \phi_{1995}) + \beta D_t^j + (\varepsilon_{i,t}^{j} - \varepsilon_{i,1995}^{j}) \tag{13}$$

where D is the indicator variable of the program of eligible village j in time t= 2000, 2005. ε is an error term (see Hahn et al., 2001, and Van der Klaauw, 2002). In this equation, the cutoff value of the marginalization index 1995 was covered by *Progresa-Oportunidades*, while municipalities below the cutoff point were not covered. The marginalization index varies within the intervals of coverage and it is correlated with the outcome, so it is included in the estimation. The local continuity assumption required for using the index is satisfied as it is explained at the end of this section.

4.5 Fuzzy Regression Discontinuity Design (RDD)

The last estimation takes into account that coverage for eligible villages was not complete and some non-eligible villages included households in the program. In other words, the marginalization index 1995 has not sharp RD design. To take into account these differences, a fuzzy RD design is included. It is based on a two-stage least squares, using the index as instrument for the coverage. The parametric analysis in this paper uses only villages that lie the interval around the cutoff corresponding to the interval (-1.7, -0.5) of Index of 1995. This interval includes 17,113 villages. The local continuity assumption is likely to be satisfied in small intervals around the cutoff since the villages are similar in terms of the marginalization index of 1995. As described in the next section, other intervals were included to show the effect of the program.

4.6 Validity of the Local Continuity Assumption

The validity of the RD technique is based on the assumption of the local continuity of the independent variable. This means that the villages around the cutoff must be similar. This assumption is highly difficult to test. Nevertheless, the number of villages in the distribution makes feasible to compare pre-program outcome variables like population and gender composition. A similar distribution of these pre-program characteristics makes credible the assumption of using the low coverage villages as a valid counterfactual.

The use of RD design can be invalidated if the assignment variable is manipulated by two reasons. First, the cutoff that determines eligibility to *Progresa* could have been set to include villages that are significantly different around this value. However, this is not possible since this index was determined by CONAPO, before the introduction of Progresa. Second, any manipulation of the index could violate local continuity assumption since it results from a sorting process around the cutoff. Similar to the previous

point, the sorting process was not possible since the estimation of the index depended on variables of the 1995 census. In that year Progresa was not even designed. Moreover, it seems unlikely that villages could manipulate their Census data. In the presence of the manipulation of the eligibility criteria could produce discontinuities in pre-program characteristics around the cutoff. However, the value of the observed characteristics included in the census is continuous as shown in Figures 2, where there are no significant differences by population size and gender composition. In sum, there is no evidence to invalidate the use of RDD as a proper identification strategy.

Data and Descriptive Statistics

This paper is based on three sets of data: census data from the Mexican Census Bureau (INEGI) that includes information on population, households and dwellings characteristics; poverty indexes from the Mexican Population Council (CONAPO); and the roll out information of *Progresa-Oportunidades* from the administrative records provided by the Ministry of Social Development and National Office for the Administration of Oportunidades. All data is reported at village level, the basic geographic unit used by the Mexican Census Board, which has a unique identifier that allows comparison every single village in the country across time.[10]

Variables are reported every five years–the period between partial and complete censuses- from 1990 to 2005. The number of variables collected by INEGI at village level has increased over time. So, it is not possible to collect the exact same variables for the four periods, except for the basic information. 1990 and 1995 are taken as pre-program periods given that the program started its expansion in 1997.

Census data is used by the Mexican Population Council for estimating a poverty index every five years. The indexes measure the degree of marginalization of every village based on nine variables that describe

[10] Each village id has nine digits: 2 for the state, 3 for the municipio and 4 for the village. Concatenating all digits makes the id unique.

level of education, quality of housing and public services, urbanization and income of the population living in two categories of villages, urban and rural.[11] The distribution of the index CONAPO classified municipalities into five levels of poverty - very low, low, medium-range, high, and very high, using the Dalenius and Hodges stratification method (Dalenius and Hodges, 1959). A complete description of the components, their weight in the index and the cutoff values are included in Tables B, C and D of the Data Appendix.

Information on *Progresa-Oportunidades* was taken from the historical census of beneficiaries provided by the Mexican Ministry of Social Development (Secretaría de Desarrollo Social –SEDESOL-) and the National Office for the Administration of Oportunidades. The records are reported at the end of every phase and at the end of each year. The last large expansion finished in 2003. From that year up now the number of beneficiaries in rural areas has remained almost identical. Changes come from households that not comply with the conditions of the program only. As explained in the Data Annex, the estimated coverage reflects the effective number of households included in the program according to the rollout calendar at the end of every ex-post period.

The set of villages included in the analysis are those classified as rural in the partial census of 1995. The total number of villages in 1995 was 50,666. INEGI uses a population threshold living in the village equal to 2,500 inhabitants to classify rural villages. Table 1 gives summary statistics. It contains data on the size of the total population from 1990 to 2005; the population between 0 and 5 years old –children-; the generation of the population born before the implementation of *Progresa-Oportunidades*; the male ratio of this population (as the indicator of migration); total deaths; total households; poverty indexes and coverage of the program.

[11] The index is estimated using a principal components method and has changed its estimation over time. To see the details of its estimation see http://www.conapo.gob.mx/index.php

As shown in the table, the average population size of the villages increased between 1990-1995 and 1995-2000, with a lower growth rate during the last period. From 2000 to 2005 there is a negative growth, which reduced the average size to similar levels of 1995 –around 390 inhabitants-. The population born before the implementation of *Progresa-Oportunidades* permanently decreased from 1990 to 2005, going from 393 to 300 during this period. The average number of children –population under 5 years old- increased from 1995 to 2000 (from 51.8 to 54.7), but significantly decreased from 2000 to 2005 (45.5 on average). This last can be explained by different reasons, particularly, the increase in migration (less adults having children) and less children of those staying at the village because of better provision of family planning services included in the program.

The data also shows a permanent reduction of the ratio males/females. It decreased from 1.03 in 1995 to 1.00 and to 0.95 in 2000 and 2005, respectively. This indicates a higher reduction of the male population living in those villages during this period. As explained in the previous section, the only possible source of this reduction is a higher rate of male migration, since there are no reported changes in differences of death rates. The number of deaths remained the same on average during the period – around 8 people, while the number of households increased from 76 to 88. These two facts also indicate changes in migration patterns: the number of households increased over time, number of deaths remained constant and a significant reduction of the male population.

Finally, the average coverage of *Progresa-Oportunidades* increased from zero in 1995 (pre-program period) to 0.34 in 2000 and 0.63 in 2005. So there is a coincidence in the expansion of the program with the increase of migration in these villages. The empirical strategy described in the previous section is now used to disentangle the causal effect of the program in the increase of migration.

Estimation

This section provides the estimations of the effect of the expansion of *Progresa-Oportunidades* on migration and gender composition in rural areas. There are three main estimations: OLS for the entire set of villages covered by the program; RD for the villages around the cutoff point of the program; and RD with two stage least squares, where the coverage of the program is instrumented using the original marginalization index. These three estimations are used for the short run period (1997-2000) and other three estimations for the long run (1997-2005). Table 2 and Table 3 show the estimations of the effect of the program on migration and gender composition, respectively. Table 4 includes different calipers to show the robustness of the estimations.

Columns 1 and 4 of Table 2 show the OLS estimation for the short run and long run. In the first case, there is a significant effect of the coverage of *Progresa-Oportunidades* on reducing the population size by increasing migration. The coefficient for period 1997-2000 is 14 percentage points and 29 percentage points for the period 1997-2005. Both estimations are significant at 1 percent level with robust standard errors clustered by municipio and include 47,918 and 47,085 villages in 2,295 municipios, respectively. [12] The regressions also include fixed effects by municipio–to eliminate constant unobserved characteristics at this geographic level-. Two additional controls -total population in 1990 and the poverty index in 1995- were included to control for unobserved heterogeneity that could affect population trends. However,the estimations are robust when both controls are not included. [13] These results mean that fully covered village in 2000 decreased the size of its population born before the implementation of the program by almost 15 percentage points, while for the long run (2005) it decreased by almost 30 percentage points. These results are consistent with the model described in Section II. The increase of

[12] The lack of some information for some variables is the reason for the drop in the number of observations. In fact, some villages completely disappear between 1995, 2000 and 2005.

[13] The estimations without these controls are not reported, but can be provided by the author.

the resources increased general migration in a very small scale in the short run, but as individuals increase their human capital, the level of migration is higher.

Columns 2 and 5 contain the estimation using the reduced form of the results using the RD around the cutoff point of eligibility. Similar to the previous estimation, the first regression shows estimations for the period 1997-2000 and the second for the period 1997-2005. It contains the same controls, municipality fixed effects and robust clustered standard errors. These samples include 17,113 and 16,891 villages for each case.[14] The magnitude in this case is lower than for all the population: the effect of coverage of *Progresa-Oportunidades* on the total change of population born before the implementation of the program is 5 percentage points and 11 percentage points, for short and long terms respectively. Both results are significant at 1 percent level. These results mean that for villages with very similar characteristics, the effect of having a fully covered village decreased the double in the long run.

Finally, columns 3 and 6 display the instrumental variables results, where the coverage of the program is being instrumented using the poverty index of 1995. The effect of the coverage on migration in the short run 7.6 percentage points, while for the long run, the effect is 9.7 percentage points. Both estimations are significant at 1 percent and have the same controls, fixed effects by municipio and robust and clustered standard errors.

Results in Table 2 indicate that the program increase migration in both, short and long, terms. The magnitude of this effect is significantly higher for smaller and poorer villages, but it is smaller for villages similar as shown in the RD.

[14] As we can see, a larger number of villages have incomplete information in 2005. This could affect the estimation, since it could be assumed that complete villages disappeared or 100 percent migration. I decided not to impute zero values to those villages not reported in the data.

We now turn to the effect of the program on the gender composition of the villages described in Table 3. This table is organized in the same way as Table 2: columns in the upper part describe the short-term effect (1997-2000), and the bottom part long term (1997-2005). The first set of columns show OLS estimations; the second the reduced forms; and, the third shows the instrumental variables results. All of them include fixed effects by municipio and the additional controls. They include robust standard errors clustered by municipio.

In the case of OLS, we can see that the magnitude is close to zero and not significant for the short run, while for the long run is almost two percentage points for the long run. The estimation is significant at 1 percent level. In both cases the constant is also significant at 1 percent level with negative values of 1.8 and 4.65 respectively. This means that both periods there is a reduction of total males compared to females, but this difference is almost forty percent higher in the long run for a fully covered village (a not covered village reduced its male population by 4.6 percentage points, while a fully covered reduced it by 6.4 percentage points.

The estimation for the reduced form is very similar. The magnitude of the short run is 1.0 negative percentage points, but insignificant. For the long run is 1.4 negative percentage points. Similarly, the value of the constant is negative for the estimations, 2.0 and 4.6 negative percentage points, respectively.

Finally, for the instrumental variable results the effect is significantly higher in both periods. The coefficients are 7.4 and 2.4 negative percentage points. This means that the males migrated more than females in a fully covered village.

Overall, the estimations suggest a causal effect of the expansion of *Progresa-Oportunidades* on migration. The long term effects are significant for both variables used for the estimations, population

born before the introduction of the program and the male/female ratio. There is a significant reduction of population in the long run and higher for males. This suggests an acceleration of the migration from rural villages to other locations.

Conclusions

Conditional cash transfer (CCT) programs have been widely expanded over the last decade across the world. The large scale field experiment of *Progresa-Oportunidades* showed scientific evidence on reducing poverty, increasing levels of health, nutrition and education and made them very attractive to national governments. Today more than twenty countries have initiated efforts to expand CCT and increase human capital levels of the poorest populations. However, there are some open questions about the long term effects of these programs, particularly in the long run, and the experimental evidence is limited on this regard.

New generations with higher levels of health and education are more productive and would have incentives to find different occupations in other labor markets. This effect is not the same for all the population covered by a CCT program. As suggested by theory, the effect of the program should be higher for those individuals considered relatively less poor of the population. Young healthier and marginally more educated individuals would decide to abandon their communities and find a job in a different market. This paper shows the empirical evidence of this phenomenon.

There is a significant effect of *Progresa-Oportunidades* on increasing rural migration. The estimation uses data from the Mexican Censuses 1990, 1995, 2000 and 2005, the poverty index used to determine the eligibility to the program and the administrative records of the rollout of the program. As a first step, the initial set of villages eligible to be included in the program was replicated according to the poverty index from the 1995 census –pre-program period-. This included 50,666 villages classified as rural (a population threshold of 2,500 inhabitants).

The sample size allowed several estimations of the effect of the expansion of *Progresa-Oportunidades* on migration. It included OLS estimates for the entire dataset and a RD –sharp and fuzzy- around the

eligibility criteria used to classify villages in the original rollout plan of the program. Migration rate of the population born before the introduction of the program increased more in those villages covered by the program, for both short (1997-2000) and long term (1997-2005). OLS and RD estimation shows that migration increased between 14 and 5 percentage points for the first case and between 29 and 10 percentage points in the second period. In the case of the gender composition for the same cohorts, we find no significant differences for the first period, and significant reduction of males for the second period. Both estimations suggest a cumulative effect of the program over time.

This evidence supports the hypothesis that conditional cash transfers would be accelerating migration patterns of marginal individuals who once increase their human capital levels. They decide to leave their villages and go to another location. This does not mean that all poor population is leaving their communities, but only those who once the program has increased their marginal productivity will decide to leave. These findings contribute to the literature on the impact of CCT program labor mobility, a phenomenon that will increase given the large expansion of this type of programs around the world.

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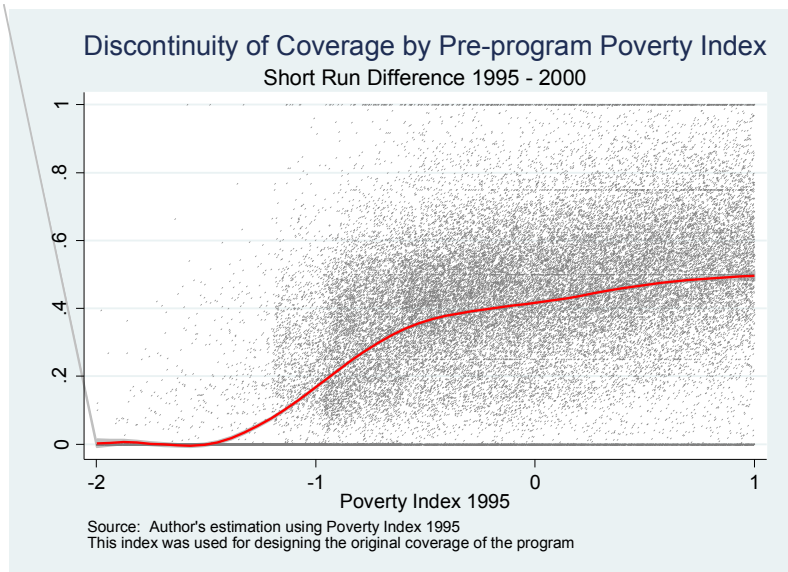
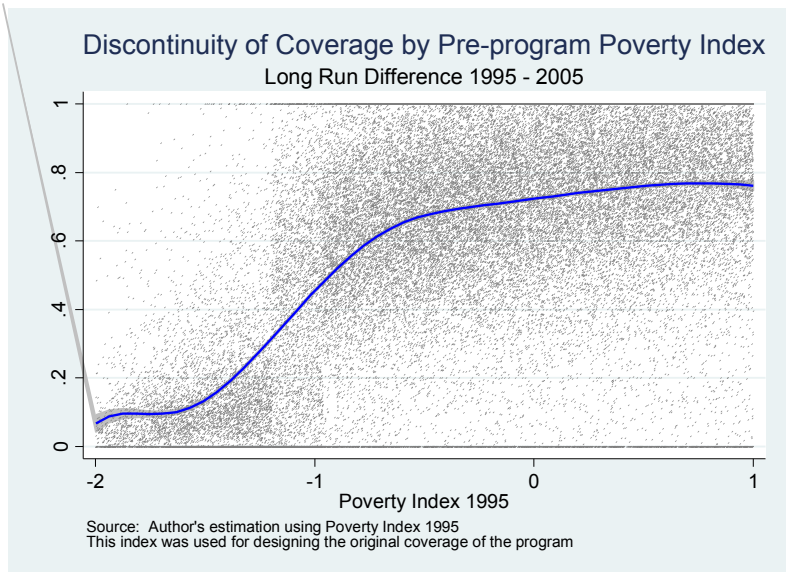
Figure 1

Discontinuity of Coverage in 2000 and 2005 by Poverty Index 1995





Notes:

- Every dot represented a village included in the design of the rollout plan of the program. It only includes rural villages (less than 2500 inhabitants in 1995
- Those villages located to the left of Marginalization Index are considered less poor (frequency of the poverty variables is lower), while those to the right are poorer. This explains the increase of the coverage of the program.
- The solid line is the local polynomial of degree 2 of a Kernel function. It provides the estimated coverage of the population living in the villages included in the program.

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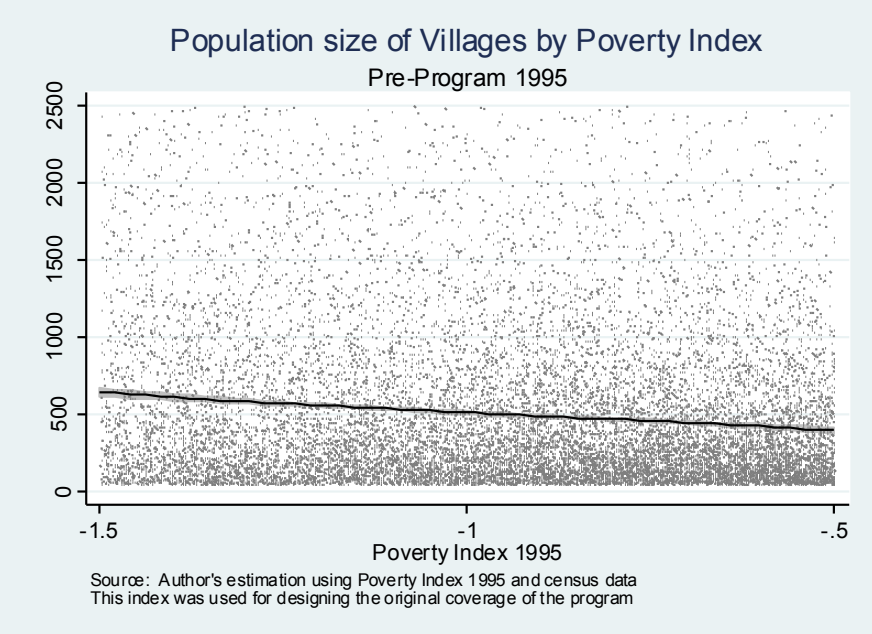
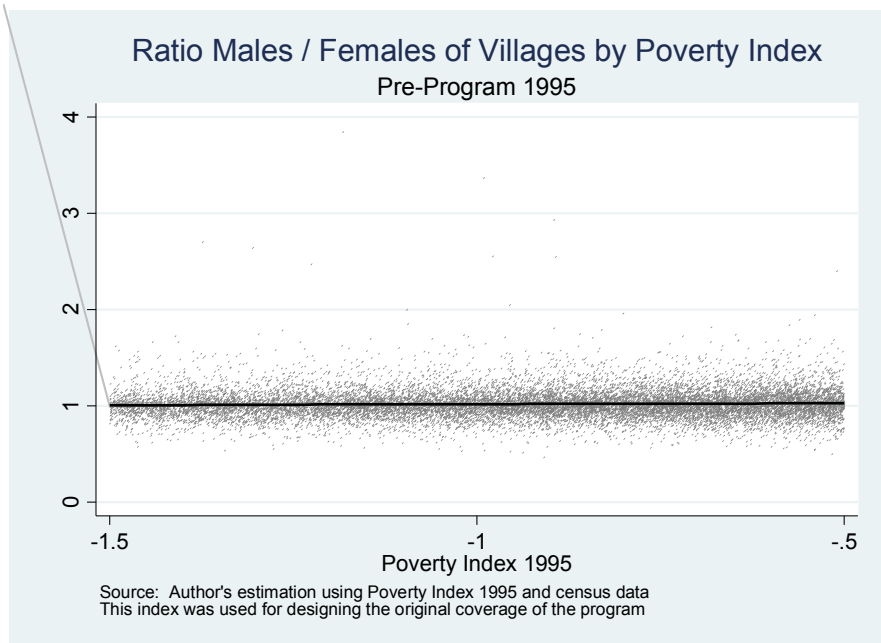
Figure 2

Pre-Program Characteristics for the RDD sample





Notes: The solid line is the local polynomial of degree 2 using a kernel function. It provides the estimated population and the ratio males/females in 1995 (pre-program period) of villages included in the program.

Table 1
Summary statistics

Variable	Obs	Mean	Std. Dev.	Min	Max
Population 1990/[1]	50666	364.05	440.21	0	23067
Population 1995/[1]	50666	393.12	435.26	50	2500
Population 2000/[1]	50666	402.06	474.51	0	12946
Population 2005/[1]	50666	391.57	509.70	0	19559
Adults 1990/[1]	50666	364.05	440.21	0	23067
Adults 1995/[1]	50666	393.12	435.26	50	2500
Adults 2000/[1]	50666	355.45	417.55	1	9678
Adults 2005/[1]	50666	300.54	391.93	0	12638
Children 1995/[1]	50666	51.84	58.01	0	465
Children 2000/[1]	50666	54.76	70.22	0	3291
Children 2005/[1]	50666	45.45	67.69	0	3861
Male ratio 1995	50666	1.04	0.25	0.063	29
Male ratio 2000	50666	1.00	0.20	0.129	19
Male ratio 2005	50666	0.96	0.24	0.000	17.36264
Dead 1990-1995/[2]	50666	8.70	10.52	0	551
Dead 1995-2000/[2]	50666	8.15	9.08	1	54
Dead 2000-2005/[2]	50666	8.29	9.77	0	231
Households 1995/[1]	50666	76.19	86.49	1	643
Households 2000/[1]	50666	83.37	99.61	0	2621
Households 2005/[1]	50666	88.59	115.76	0	4314
Coverage Progresa 1995/[3]	50666	0.00	0.00	0	0
Coverage Progresa 2000/[3]	49428	0.34	0.26	0	1
Coverage Progresa 2005/[3]	48402	0.64	0.31	0	1
Poverty index 1995/[4]	50666	-0.28	0.74	-1.99915	0.999972
Poverty index 2000/[4]	49428	-0.34	0.69	-2.8852	2.750869
Poverty index 2005/[4]	48402	-0.38	0.65	-2.00348	2.621933

Sources:
1/ INEGI: Mexican National Board of Statistics. Censuses 1990, 2000 and 2010. Partial Censuses 1995 and 2005
2/ Estimations using official death rates from CONAPO
3/ SEDESOL. Mexican Ministry of Social Development. It measures the total households estimated in 1995 to be covered by the initial rollout plan.
Note: the reduction in the number of observations is given by the lack of complete information for eligibility.
4/ CONAPO. Mexican Population Council. This is the office in charge of the estimation of the poverty index based on the results of the censuses and partial censuses. The index 1995 was used to determine the eligibility to Progresa-Oportunidades and to determine the rollout plan.

Table 2

Effect of Rollout of Progresa-Oportunidades on Migration (1995-2000-2005)

Short Run: 1995 - 2000	**(1) OLS**	**(2) RDD**	**(3) RDD. 2SLS**
	Migration 2000/A	**Migration 2000/B**	**Migration 2000/C**
Coverage 2000	-0.14916***	-0.05828***	-0.07642***
	[0.010]	[0.007]	[0.021]
Constant	-0.03802***	-0.08525***	-0.09468***
	[0.004]	[0.009]	[0.011]
Muncipality FE	YES	YES	YES
Observations	47918	17113	17113
R-squared	0.145	0.227	0.034

Long Run: 1995 – 2005	**(4) OLS**	**(5) RDD**	**(6) RDD. 2SLS**
	Migration 2005/A	**Migration 2005/B**	**Migration 2005/C**
Coverage 2005	-0.29889***	-0.11453***	-0.09770***
	[0.016]	[0.010]	[0.024]
Constant	0.10784***	0.0209	-0.02118
	[0.012]	[0.020]	[0.031]
Muncipality FE	YES	YES	YES
Observations	47085	16891	16891
R-squared	0.202	0.259	0.073

* significant at 10%; ** significant at 5%; *** significant at 1%
Robust Standard errors clustered by municipio
Notes:
In addition to the variables displayed in the table, all regressions include two control variables: poverty index 1995 and population of 1990.
Coverage 2000 measures the total households included in Progresa-Oportunidades based on the number of households estimated for the rollout plan.
/A This is the change of population who born before 1995 (before the introduction of Progresa) after the estimation of the death population.
/B The sample is restricted to villages with poverty index 1995 between -1.7 and -.5.
/C Coverage is instrumented by the poverty index 1995in the vicinity included in the vicinity between -1.7 and -.5.
Source: Author's estimations using Censuses 1990 and 2000, and partial censuses 1995 and 2005.

Table 3

Effect of Rollout of Progresa-Oportunidades on Gender Composition of Villages

(1995-2000-2005)

Short Run: 1995 - 2000	**(1)** **OLS**	**(2)** **RDD**	**(3)** **RDD. 2SLS**
	Change Males Ratio (Males/Females)	**Change Males Ratio (Males/Females) /A**	**Change Males Ratio (Males/Females) /B**
Coverage 2000	-0.00201	-0.01019	-0.07434**
	[0.004]	[0.016]	[0.032]
Constant	-0.01801***	-0.02092*	-0.04380***
	[0.002]	[0.012]	[0.008]
Muncipality FE	YES	YES	YES
Observations	47917	7405	7405
R-squared	0.08	0.219	0.018

Long Run: 1995 - 2005	**(4)** **OLS**	**(5)** **RDD**	**(6)** **RDD. 2SLS**
	Change Males Ratio (Males/Females)	**Change Males Ratio (Males/Females) /A**	**Change Males Ratio (Males/Females) /B**
Coverage 2005	-0.01775***	-0.01442*	-0.02428***
	[0.005]	[0.008]	[0.007]
Constant	-0.04651***	-0.05293***	-0.07639***
	[0.004]	[0.009]	[0.013]
Muncipality FE	YES	YES	YES
Observations	47070	16887	16887
R-squared	0.15	0.209	0.087

* significant at 10%; ** significant at 5%; *** significant at 1%
Robust Standard errors clustered by municipio
Notes:
In addition to the variables displayed in the table, all regressions include two control variables: poverty index 1995 and population of 1990.
Coverage 2000 measures the total households included in Progresa-Oportunidades based on the number of households estimated for the rollout plan.
/A This is the change of population who born before 1995 (before the introduction of Progresa) after the estimation of the death population.
/B The sample is restricted to villages with poverty index 1995 between -1.7 and -.5.
/C Coverage is instrumented by the poverty index 1995in the vicinity included in the vicinity between -1.7 and -.5.
Source: Author's estimations using Censuses 1990 and 2000, and partial censuses 1995 and 2005.

Table 4

Effect of Rollout of Progresa-Oportunidades on Migration (1995-2000-2005) using different Callipers

Short Run: 1995 - 2000	**(1)**	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**
	RDD1	**RDD2**	**RDD3**	**RDD1. 2SLS**	**RDD2. 2SLS**	**RDD3. 2SLS**
	Change Population 2000 /A, B	**Change Population 2000 /A, B**	**Change Population 2000/A, B**	**Change Population 200/A, C 0**	**Change Population 2000/A, C**	**Change Population 2000/A, C**
Coverage 2000	-0.07392**	-0.06179**	-0.12739***	-0.149222***	-0.21912**	-0.02718
	[0.034]	[0.026]	[0.020]	[0.178]	[0.087]	[0.042]
Constant	-0.09729***	-0.09596***	-0.03473*	-0.0575	-0.10311***	-0.10019***
	[0.026]	[0.031]	[0.020]	[0.041]	[0.027]	[0.026]
Muncipality FE	YES	YES	YES	YES	YES	YES
Observations	7405	5968	12519	7405	5968	12519
R-squared	0.327	0.305	0.256	0.037	0.034	0.029
Long Run: 1995 - 2005	**(7)**	**(8)**	**(9)**	**(10)**	**(11)**	**(12)**
	OLS	**RDD**	**RDD. 2SLS**	**RDD. 2SLS**	**RDD. 2SLS**	**RDD. 2SLS**
	Change Population 2005 /A, B	**Change Population 2005/A, B**	**Change Population 2005/A, B**	**Change Population 2005/A, C**	**Change Population 2005/A, C**	**Change Population 2005/A, C**
Coverage 2005	-0.14112***	-0.13089***	-0.28412***	-0.11996*	-0.07283*	-0.06934
	[0.028]	[0.026]	[0.026]	[0.081]	[0.062]	[0.066]
Constant	-0.12557***	-0.14047***	0.06800***	-0.13591**	-0.16908***	-0.17487***
	[0.038]	[0.045]	[0.024]	[0.062]	[0.052]	[0.065]
Muncipality FE	YES	YES	YES	YES	YES	YES
Observations	7318	5897	12331	7318	5897	12331
R-squared	0.329	0.394	0.31	0.097	0.103	0.043

* significant at 10%; ** significant at 5%; *** significant at 1% Robust Standard errors clustered by municipio

Notes: In addition to the variables displayed in the table, all regressions include two control variables: poverty index 1995 and population of 1990.

Coverage 2000 and coverage 205 measure the total households included in Progresa-Oportunidades during those years based on the number of households estimated for the rollout plan.

/A This is the change of population who born before 1995 (before the introduction of Progresa) after the estimation of the death population.

/B The sample is restricted to villages with poverty index 1995. The first (regressions 1 and 7) is between -1.7 and -0.5.; the second (regressions 2 and 8) is between -1.7 and -1; and the third (regressions 3 and 9) is between -1.5 and -1 -1.2

/C Coverage is instrumented by the poverty index 1995 using the previous calipers. . The first (regressions 4 and 10) is between -1.7 and -0.5.; the second (regressions 5 and 11) is between -1.7 and -1; and the third (regressions 5 and 12) is between -1.5 and -1 -1.2

Model Appendix

Figure A

Theoretical prediction of Migration Decision According to Returns to Schooling

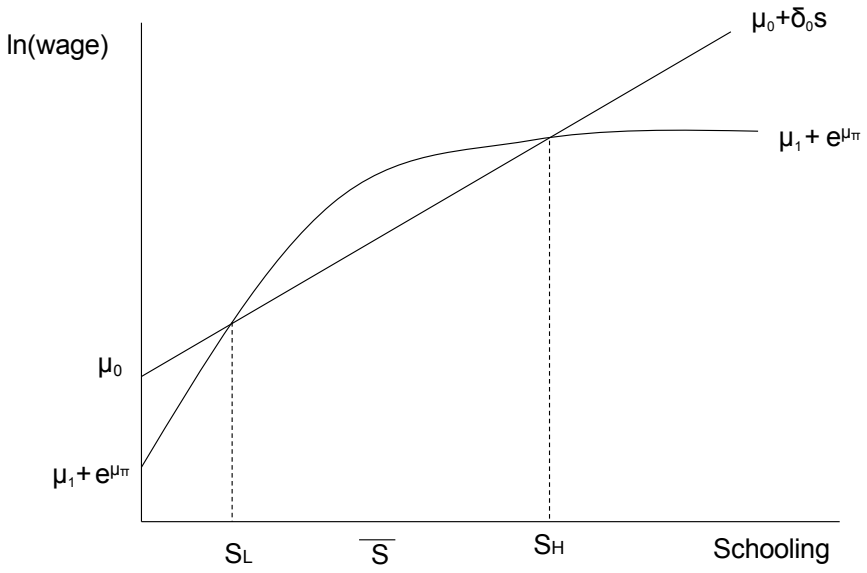
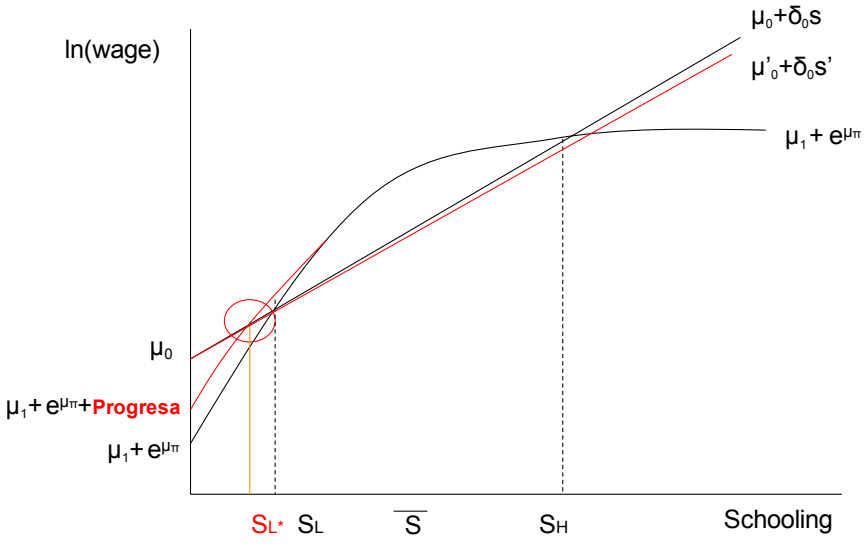


Figure B

Theoretical prediction of the Effect of CCT Migration Decision



Data Appendix.

Progresa Oportunidades

Table A

Marginalization Index. Variables used for its estimation

School Level		Grant Boys	Grant Girls	Max. Food + School Per Household
Elementary	3	$12.00		$110
	4	$14.00		
	5	$18.00		
	6	$24.00		
Secondary	7	$35.00	$37.00	
	8	$37.00	$41.00	
	9	$39.00	$45.00	
High School	1	$58.50	$67.50	$185
	2	$63.00	$71.50	
	3	$66.50	$76.00	

Source: Oportunidades, Rules of Operation 2010. www.oportunidades.gob.mx

Marginalization Index 1995.

Table B

Components and Score of Variable Used for Estimating the Marginalization Index 1995

Variable	Score
Illiteracy	0.22325
% no water	0.19664
% no drainage	0.20779
% no Electricity	0.2176
Overcrowding	0.21237
% Soil floor	0.25506
Fraction in agriculture	0.16382

Source: Mexican Population Council (CONAPO).

Table C

Cutoff Values of Marginalization Index 1995

Level of Marginalization	Ranges of the index
Very low	[-2.56376028 a -1.58761244]
Low	(-1.58761244 a -1.19721803]
Medium	(-1.19721803 a -0.61144459]
High	(-0.61144459 a 0.03946112]
Very high	(0.03946112 a 3.94443420]

Source: Mexican Population Council (CONAPO).

Table D

Variables used to construct the Marginalization Index

Dimensions	Type of exclusion	Variable of Census	Source
Education	Illiteracy	Fraction of the illiterate population 15 years and older	Partial Census
	Elementary dropout	Fraction of population with incomplete elementary education 15 years and older	Census full survey
Dwelling	Without potable water	Without potable water	Partial Census
	Without drainage	Without drainage	Partial Census
	Without electricity	Fraction of dwellings without electricity	Partial Census
	With soil floor	Fraction of dwellings with soil floor	Census full survey
	Overcrowding	Fraction of population living in overcrowded dwelling	Census full survey
Dispersion of Population	Rural population	Village with less than 5000 inhabitants	Partial Census
Monetary income	Occupied population earning less than 2 minimum wages	Occupied population earning less than 2 minimum wages	Census full survey

Source: Mexican Population Council (CONAPO).

Construction of Variables

The total number of villages in Mexico has a large variation in every period of 5 years, particularly those with less than 50 inhabitants. It was only considered these villages as the universe and did not include new villages created between 2000 and 2005. The criteria used for the selection of villages eligible to the program are exactly the same as the used in 1997 in the original design of the program and are the following:

1. Rural. Villages with less than 2500 inhabitants but more than 50. This criterion would guarantee the minimum people required for the correct functioning of the program. Total villages in 1995 that meet this criterion were 50,666 with partial information for 2000 and 2005.

2. Eligible. Villages classified in middle, high and very high marginalization (poverty) with access to health clinics and schools in order to being able to comply with the conditions of the program. Total villages in 1995 that meet this criterion were 29,791; the survivors in 2000 were 29,276 and 28,997 in 2005. However, some other villages (classified as low and very low marginalization) also included some families in the program.

Variables

Total adult population. This variable describes the population born before the implementation of the program in 1997. It includes total population in 1995, population older than 5 years old in 2000 and population older than 10 years old in 2005.

Progresa. Progresa-Oportunidades is reported by village in every phase and at the end of every fiscal year. This variable refers average number of families included in the program in the village.

Coverage of Progresa. Variable defined as “coverage”. This variable refers to the coverage of the program by village as a percent of the total households included in the census 1995 and used as the baseline for the rollout program. The average values are 0 for 1995, 0.32 in 2000 and 0.63 in 2005.

Other explanatory variables.

Indicator variables of the program. Variable defined as “ind_prog”. It indicates if there is at least 10 percent of the total number of households covered by Progresa. The values are zero for 1995 and one for 2000 and 2005.

$$D_t = \begin{cases} 0, t = 1995 \\ 1, t = 2000,2005 \end{cases}$$

Indicator variables of inclusion of the village in the program. Variable defined as “inclusion”. It indicates if the program is present. The values are zero for 1995 and one for 2000 and 2005.

Indicator variables of the program. Male ratio indicates the ratio of males and females of the population born before the implementation of the program. Its difference was estimated as follows.

$$(MR_t - MR_{t-1}) = \frac{Males_t}{Females_t} - \frac{Males_{t-1}}{Females_{t-1}}$$

The value of this ratio decreased from 1.03 to 0.95 during the period.

Poverty. This continuous variable refers to the poverty level of the village in every period. It goes from 1 to 5, where the lowest represents villages with lower levels of poverty and 5 the highest. The discontinuity approach uses different ranges between values 4 and 3 to see difference in the demographic change. Villages in the RDD vicinity showed a reduction from 2.61 in 1995 to 2.54 in 2005.