

# Indirect Effects of a Social Program: the case of Progresa and consumption

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## Motivation and objectives

- The goals of this paper are:
  1. To study the spillover effects of a welfare program on consumption - i.e. to look at the program effect on non-eligible households who live in treatment villages.
  2. To understand the mechanisms through which this indirect effect occurs.
  3. To explore the effects of a liquidity injection into imperfect credit and insurance markets in developing countries.
  4. To overcome two limitations of the program evaluation literature, which:
    - (a) focuses mainly on the treated; few studies of spillover effects.
    - (b) often estimates treatment effects, but not mechanisms that cause the change in outcome.

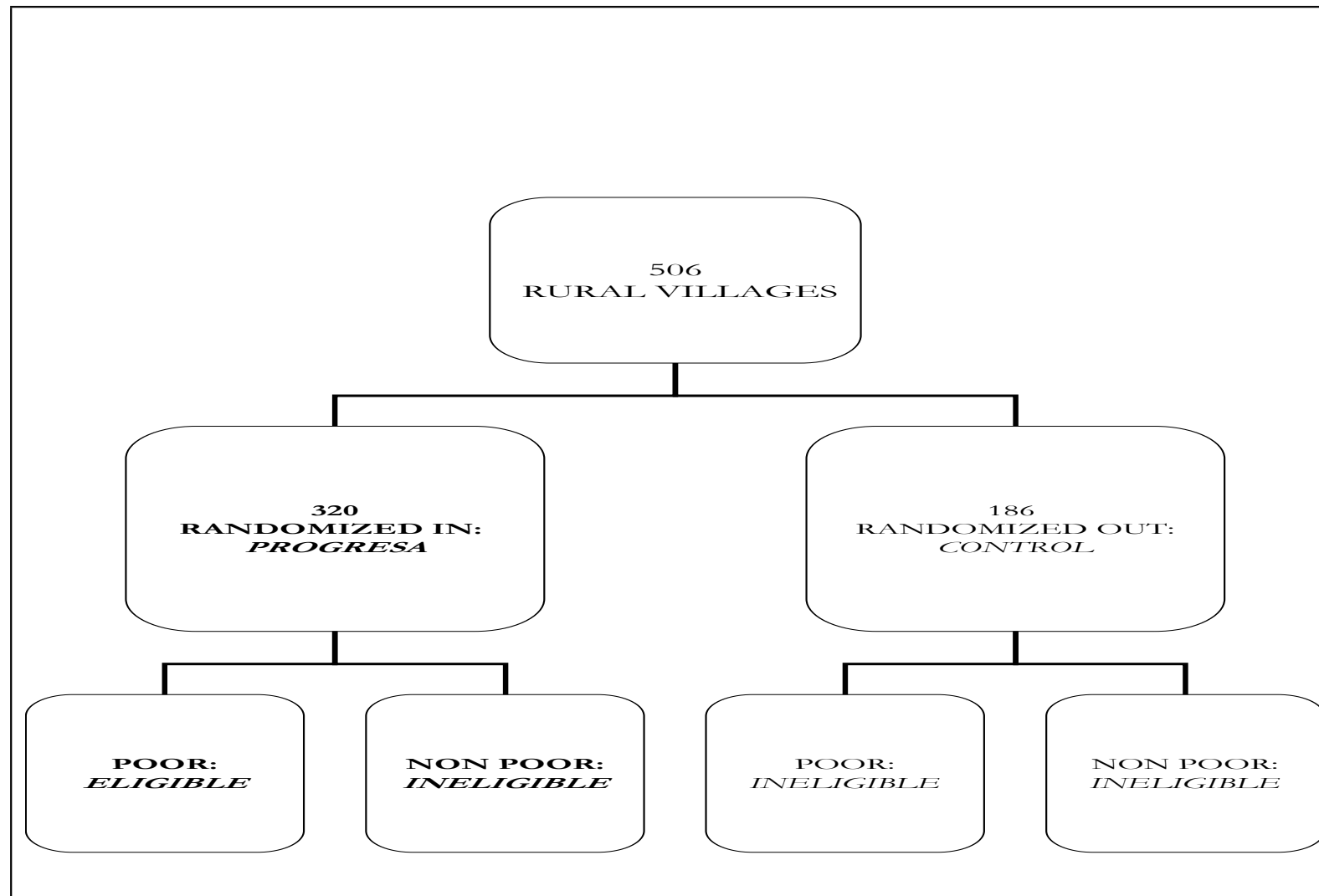
## Main results

- Using data from Progresa (rural Mexico), we find an increase in consumption for non-eligible households in treatment areas, i.e. positive spillover effects.
- This consumption increase is financed through higher loans and transfers, and through a depletion of the stock of savings, but **not** through increases in current income.
- We provide additional evidence consistent with the hypothesis that the program liquidity injection enables the non-eligibles to smooth consumption better.
- Discussion of SUTVA violation.

## Progresas: program characteristics

- Conditional cash transfer program, monetary transfers if children go to school.
- Eligible subjects: poor households in rural Mexico.
- Program monetary components are 18 to 48% median labor earnings, mainly linked to scholarships for grades 3-9.
- Data: 1) program starts in May 1998; 2) information on about 4,000 non-eligible households in October 1998, May 1999, and November 1999; 3) pre-program data available (with exceptions).

## The Experimental Design



## Indirect Treatment Effect (ITE): identification

- $Y_{1i}$  the potential outcome for non-poor ( $NP_i = 1$ ) in treatment villages ( $T_i = 1$ ) *in the presence of the treatment*.
- $Y_{0i}$  the potential outcome for non-poor ( $NP_i = 1$ ) in treatment villages ( $T_i = 1$ ) *in the absence of the treatment*.
- Note: treatment is PROGRESA transfers to poor ( $NP_i = 0$ ) in treatment villages ( $T_i = 1$ ).
- Identification assumption: no program effect on  $NP_i = 1$  and  $T_i = 0$ :  $E(Y_{0i}|T_i = 1, NP_i = 1) = E(Y_{0i}|T_i = 0, NP_i = 1)$ .

$$\begin{aligned}
 ITE &= E(Y_{1i} - Y_{0i}|T_i = 1, NP_i = 1) \\
 &= E(Y_i|T_i = 1, NP_i = 1) - E(Y_i|T_i = 0, NP_i = 1)
 \end{aligned}$$

## ITE: estimation

The equation we estimate is:

$$Y_i = \alpha + \beta T_i + \gamma X_i + u_i$$

$\beta$  identifies the *ITE*.

- The outcome of interest changes.
- We add conditioning variables  $X$  to improve precision of the estimates.

**(Log-)Consumption: ITE and ATT estimates**

	Food consumption			Non-food consumption		
	1998o	1999m	1999n	1998o	1999m	1999n
$\hat{ITE}$	-0.0213	0.0514	0.0669	0.0629	0.1384	-0.0602
	[0.0256]	[0.0257]**	[0.0211]***	[0.0672]	[0.0655]**	[0.0623]
$\hat{ATT}$	0.1033	0.1699	0.1892	0.0959	0.1675	0.1128
	[0.0236]***	[0.0219]***	[0.0211]***	[0.0651]	[0.0613]***	[0.0540]**

**Progresa increases consumption of Non-Poor households.**



## Why does Progresa increase non-poor consumption?

Increased liquidity in treatment villages may affect:

- Goods and labor markets:
  1. increased schooling reduces treated labor supply (higher wages; higher employment for non-treated)
  2. increased treated consumption may imply higher goods sales for non-treated (higher non-labor earnings)
  3. the more integrated the markets, the smaller the effects

- Credit and insurance markets:
  1. Credit and insurance market imperfections in developing countries result into informal loans/transfers through social networks (family and friends can enforce/monitor)
  2. higher liquidity permits more borrowing to invest/smooth consumption)
  3. expected sizeable effect because informal credit market is segmented
- Savings:
  1. if constraints in credit and insurance markets are relaxed, households can reduce savings

To summarize:

$$\Delta Y_i + \Delta L_i = \Delta C_i + \Delta S_i + \Delta I_i$$

## Effects on goods and labor markets

We did the following tests:

- Hours of work
- Labor earnings
- Migration
- Prices at the village level
- Sales of goods
- Receipt of additional welfare programs

We found no evidence of significant increase in income (with the exception of a small increase in receipt of welfare programs).

## Effects on loans and transfers

- We observe loans (70% from family and friends), transfers, and migrant remittances.
- About 13% of non-poor household have loans, transfers or remittances.
- 4 *peso* increase in loans (40% higher likelihood) and 6.5 *peso* increase in transfers in 1999.

# *ITEs on loans and transfers*

	1998 Oct.		1999 May.		1999 Nov.	
	Probit	Tobit	Probit	Tobit	Probit	Tobit
Loans:						
$\hat{ITE}$	0.0073	4.0375	0.0151	3.7937		
	[0.0064]	[3.5252]	[0.0076]*	[2.0264]*		
Obs.	4598	4595	3671	3802		
Monetary transfers from family and friends:						
$\hat{ITE}$	0.0007	1.561			0.0074	6.562
	[0.0057]	[3.5437]			[0.0048]	[3.720]*
Obs.	4600	4525			4246	4194

## Effects on savings

- Rural households' savings are primarily in the form of grains and livestock.
- Non-poor households in treatment villages start consuming part of their stock of grains and animals:
  1. 4.5 percentage point drop in the likelihood of reducing the grain stock; 9 *peso* significant increase in consumption of own grains in 1999;
  2. stock of chickens decreases significantly by 0.6 in 1998 (among households who own chickens); likelihood of owning pigs drops significantly by 3, 6, and 4 percentage points in October 1998, May 1999, and November 1999.
- Increase in number of animals, and quantity and value of the stock of grains owned by the poor in treatment villages.

## Why does non-poor consumption increase? Summary

- Consumption increases by about 100 and 70 *pesos* per household per month in 1999.
- No sizeable increase in current income.
- Changes in the credit and insurance markets:
  1. Loans/transfers increase by about 10 *pesos* per month per household.
  2. Part of stock of grains and animals is now consumed.
- Increases in loans and transfers, and reduction in precautionary savings consistent with hypothesis that the program liquidity injection improves insurance against risk.

## Progresa and insurance against risk: tests

- Compare indirect program effects for households who have and have not been hit by a negative shock (natural disasters: drought, flood, frost, fire, plague, earthquakes, and hurricanes).
- Predictions: All *NP* households in Progresa villages consume more; among them, (1) families **hit** by a shock would smooth consumption more, and (2) borrow more than those not hit by a shock. (3) Households **not** hit by a shock reduce their savings.
- If shocks are random between villages (treatment and control) and household type (i.e. within the non-poor), we can compare *ITEs* for households hit/not hit by shocks.
- Note that (1) there is substantial within-village variation of shock; (2) pre-program consumption does not differ for non-poor households with or without a shock, conditional on observables.



## ITE by shock: identification

New parameters of interest:

$$ITE^{S0} = E(Y_{1i}^{S0} - Y_{0i}^{S0} | T_i = 1, S_i = 0, NP_i = 1)$$

$$ITE^{S1} = E(Y_{1i}^{S1} - Y_{0i}^{S1} | T_i = 1, S_i = 1, NP_i = 1)$$

where  $S$  is a negative idiosyncratic shock.

Identification assumptions:

$$2.1 \quad E(Y_{0i}^{S0} | T_i = 1, S_i = 0, NP_i = 1) = E(Y_{0i}^{S0} | T_i = 0, S_i = 0, NP_i = 1)$$

$$2.2 \quad E(Y_{0i}^{S1} | T_i = 1, S_i = 1, NP_i = 1) = E(Y_{0i}^{S1} | T_i = 0, S_i = 1, NP_i = 1)$$

## ITE by shock: estimation

We estimate the following equation:

$$Y_i = \alpha + \beta_1 T_i + \beta_2 S_i + \beta_3 T_i S_i + \gamma X_i + u_i$$

$$ITE^{S0} = \beta_1 = [E(Y_i | T_i = 1, S_i = 0) - E(Y_i | T_i = 0, S_i = 0)]$$

$$ITE^{S1} = \beta_1 + \beta_3 = [E(Y_i | T_i = 1, S_i = 1) - E(Y_i | T_i = 0, S_i = 1)]$$

$$ITE^{S1} - ITE^{S0} = \beta_3 = [E(Y_i | T_i = 1, S_i = 1) - E(Y_i | T_i = 0, S_i = 1)] \\ - [E(Y_i | T_i = 1, S_i = 0) - E(Y_i | T_i = 0, S_i = 0)]$$

Note:  $X$  includes average shock at the village level

# ITEs on food consumption by shock

	Oct. 1998	May 1999	Nov. 1999
$ITE^{S0}$	-0.0235	0.0911	0.0544
	[0.0303]	[0.0421]**	[0.0277]*
$ITE^{S1}$	0.0168	0.066	0.1444
	[0.0360]	[0.0350]*	[0.0364]***
$ITE^{S1} - ITE^{S0}$	0.0403	-0.0251	0.0900
	[0.0422]	[0.0366]	[0.0431]**
Obs.	4615	3825	4264

*ITEs* on loans and transfers by shock

	1998 Oct.		1999 May.		1999 Nov.	
	Probit	Tobit	Probit	Tobit	Probit	Tobit
<b>Loans:</b>						
$ITE^{S0}$	-0.0057	-4.2357	0.0063	-0.2219		
	[0.0079]	[4.3411]	[0.0127]	[2.7923]		
$ITE^{S1}$	0.0264	16.6777	0.0249	7.5166		
	[0.011]***	[4.976]***	[0.0139]**	[2.6014]***		
$ITE^{S1} - ITE^{S0}$	0.0321	20.9134	0.0186	7.7385		
	[0.0109]***	[7.5773]***	[0.0163]	[4.1162]*		
<b>Monetary transfers from family and friends:</b>						
$ITE^{S0}$	0.0013	0.9502			0.0125	11.8295
	[0.0069]	[20.8995]			[0.0072]*	[4.3498]***
$ITE^{S1}$	-0.0004	4.3990			-0.0009	-1.9762
	[0.0076]	[5.7945]			[0.0074]	[5.8670]
$ITE^{S1} - ITE^{S0}$	-0.0017	3.4488			-0.0134	-13.8057
	[0.0089]	[6.0505]			[0.0098]	[7.5441]*
Obs.	4600	4525			4246	4194

## Progresa and insurance against risk: results

- Define household shock status as  $S$ ;  $S = 1$  are households hit by a shock,  $S = 0$  otherwise.
- Program effect on consumption is positive for both  $S = 0$  and  $S = 1$ , and  $S = 1$  smooth consumption more (9% points in Nov. 1999).
- $S = 1$  borrow 21 and 7.7 *pesos* more than  $S = 0$  in 1998 and 1999 (although  $S = 0$  receive more transfers).
- Grain stock:
  1.  $S = 0$  increase consumption of home-produced corn (10 *pesos* per month) and beans (imprecise estimate);
  2.  $S = 0$  8% higher likelihood of depleting grain stock.
- Livestock:
  1.  $S = 0$ , significant depletion of chickens and pigs.

## SUTVA violation

- Stable Unit Treatment Value Assumption (SUTVA) normally required to identify program effects. SUTVA rules out program indirect effects on the non-treated.
- This exercise has shown how in some cases the SUTVA may not hold.
- Though normally non-testable, this exercise highlights cases when the SUTVA may be unrealistic.
- This may occur when:
  1. Program transfers are large w.r.t. pre-program income
  2. Many individuals are treated in the local economy
  3. The local economy is not integrated (e.g. geographic or economic distance)
  4. Social networks (or similar informal arrangements) are important
  5. The program indirectly relaxes pre-existing constraints

## Conclusions

- This class of aid policies, which inject liquidity in poor villages, has important positive spillover effects: consumption of non-poor households increases.
- No changes in the labor and goods markets. Effect occurs through credit and insurance markets: higher loans and transfers, and lower savings.
- Shocks: higher food consumption and loans for non-poor households hit by a negative shock, and lower savings for non-poor households not hit by a shock.
- Evidence consistent with program transfers relaxing lending constraints and improving insurance against idiosyncratic risk.
- Broader lessons in terms of effect of liquidity injection into imperfect informal credit and insurance markets.
- Interesting example of violation of SUTVA.