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**Innovation Adoption and Liquidity Constraints in the
Presence of Grassroots Extension Agents:
Evidence the Peruvian Highlands**

Jean-Philippe Platteau

(with Isabelle Bonjean and Vincenzo Verardi)

Centre of Research for Development Economics (CRED)

University of Namur

1. Introduction

- The need for technical change in agriculture, esp. In developing countries is as strong as ever.
- There is a wide variety of factors influencing innovation adoption in those countries:
 - information problems and lack of education (Munshi, 2006; Weir and Knight, 2000; Foster and Rosenzweig, 1996);
 - credit constraints (Bhalla, 1979; Salasya *et al.*, 1998; Croppenstedt *et al.*, 2003; Miyata and Sawada, 2007; Barrett *et al.*, 2004; Gine and Klonner, 2995; Minten *et al.*, 2007);

- consumption risks (Dercon and Christiaensen, 2005);
- poor learning effects due to low density of social networks (Foster and Rosenzweig, 1996; Munshi, 2004; Bandiera and Rasul, 2006; Conley and Udry, 2008);
- problems of access to, and timely delivery of modern inputs (Hassan *et al.*, 1998; Makokha *et al.*, 2001; Wekesa *et al.*, 2003; Moser and Barrett, 2006; Dercon and Christiaensen, 2007; Suri, 2009; Carter et al., 2014;);
- ill-adaptation of technical innovations on offer (Griliches, 1957).

Our approach

- We use a shock in the form of an external intervention by a NGO that had the effect of homogenizing communities along the information and input distribution dimensions. This intervention is based on the mobilization of extension agents who have the characteristics depicted in the next slide.
- By estimating the effect of the shock on innovation adoption among households of varying initial wealth, we are thus able to control for important confounding factors when assessing the role of initial wealth.

The originality of the study

1. Our dataset contains a large nr of innovations on offer under NGO program. We can differentiate the effect of the wealth constraint according to innovations and their specific characteristics.
2. We test whether the proximity of extension agents (possibly granting seller credit for purchases of costly inputs) encourages adoption of costly innovations among poorer hhlds. Information about extension agents/innovation suppliers, and its articulation with key characteristics of would-be adopters, are an innovative feature of our work.

Community-based Market Activation involves four defining characteristics:

1. Market-activating agents are recruited locally and in consultation with their communities;
2. They are allowed to work as independent business operators;
3. They benefit from serious training, follow up, monitoring, and credit;
4. They are embedded in a supra-local network that is itself supported by one or several non-state and non-profit agencies.

Impact on innovation adoption

- only 5 out of 423 hholds (1.18%) had not adopted any innovation in 2007 (compared with a proportion of more than 60% in 2002).
- At the other end of the spectrum, only 4 households had adopted all the available innovations in 2007, and the modal value of the number of innovations adopted is 6.
- The rate of use of the innovation potential –the ratio of the aggregate number of innovations actually adopted by all sample households to the maximum number of adoptable innovations– was 52 percent in 2007, as against 6 percent in 2002.

The wealth constraint

- Thanks to the cheapness and divisibility of many innovations and the possible mitigating role of the EAs, innovation adoption has not been much affected by the liquidity constraint except in the case of the highest-ranked innovation.
- For two innovations, the intervention of the extension agents had the effect of cancelling the disadvantage of low income but only when they reside in the same community as the (poor) adopters.

3. One of these two innovations involves an important externality and is comparatively profitable (vaccination) while the other one is associated with complementary indivisible assets which the extension agents own and can lend (multiple ploughing).
4. The most important innovation causing a liquidity problem (precocious weaning) regardless of the role of extension agents, is largely indivisible, and it embodies costly inputs that are widely acquired outside the network of these agents.

Effect of the program on inequality

- Our results do not guarantee that the household income distribution did not change much after the start of the PA program: poorer adopters may well have acquired smaller doses of the divisible innovations.
- Gini coefficients: inequality in household monetary incomes has only slightly increased, from 0.540 to 0.567 between 2002 and 2007.
- Same conclusion when the initial and final distributions of average productivity of cowherd are compared. The proportion of households owning improved pastures has risen tenfold, from 9.2% in 2002 to 90.6% in 2007.
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- It is the EAs' support for the widespread adoption of the critical innovation, vaccines, among cattle herders of their own community that appears as the key inequality-dampening factor in the PA program.

The central channel is:

vaccination → increased herd size → increased supply of milk for sale → increased price

Echo of the debate around the Green Revolution

The pessimistic scenario has been largely invalidated by the facts: evidence failed to confirm that the Green Revolution technology would cause an increase in the income distribution:

“in short, the Green Revolution has not been a major force of rising inequality... there is no evidence of any overall influence of technological change in the direction of increasing inequality” (Lanjouw and Stern, 1998: 406).

Hayami and Ruttan (1971: 337, 340, 345): neither farm size nor tenure had been a serious constraint to adoption of the Green Revolution technology.