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Increasing the Productivity and Earnings of Rural Women: What Works?

By James C. Knowles

Report to the Women's Economic Empowerment Project of the UN Foundation
1800 Massachusetts Avenue, N.W., Suite 400
Washington DC 20036

Abstract

This paper reviews and assesses the effectiveness of ten interventions to increase the productivity and earnings of rural women. The study rates the interventions as proven, promising, doubtful or ineffective on the basis of the currently available evidence of their effectiveness, cost effectiveness and likely institutional, financial and political sustainability. According to these criteria, only one intervention is rated as proven (conditional cash transfer to increase educational attainment), six are rated as promising (land registration, rural electrification, rural savings, farmer field schools, improved use of modern agricultural inputs, and mobile phones), and three are rated as doubtful (microcredit, crop insurance, and improved cooking stoves). The paper also provides information about the circumstances in which the interventions are likely to be more successful. The main recommendations are to support additional research to establish what works to increase the productivity and earnings of rural women before investing in the interventions themselves and that support for additional research should be targeted on the existing research gaps (i.e., gender-specific estimates of effectiveness on higher-level outcomes over a longer period and estimates of costs).

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1. Introduction

The purpose of this paper¹ is to review and assess the empirical evidence currently available on a set of interventions designed to increase the labor productivity or earnings of female producers and entrepreneurs in the rural areas of developing countries. The interventions reviewed and assessed are typically used to improve access of rural women to land, financial assets, human capital and infrastructure and/or to increase rural women's productivity and earnings in both agricultural and non-agricultural value chains. The paper seeks answers to the following questions for each intervention:

- What are the expected outcomes?
- How difficult is it to target the intervention to rural women, and who is likely to receive the benefits ultimately?
- How convincing is the empirical evidence on the effectiveness of the intervention in achieving its expected outcomes, and for which types of rural women in which economic, social and cultural contexts is the intervention more effective?
- What is the evidence on the cost effectiveness of the intervention compared to other interventions that are also designed to increase the labor productivity or earnings of rural women?
- What are the prospects for the intervention to achieve institutional, financial and political sustainability?
- Considering the evidence on effectiveness (and cost effectiveness, if available), which interventions can be considered to be proven, promising, doubtful or ineffective under different circumstances?
- What are the priority questions for which answers are needed from future research to guide policy and program design?

The interventions reviewed and analyzed were selected, following a preliminary review of the literature, from a longer list (reproduced in Annex 1) by applying the following criteria in roughly descending order of importance:

- Is the intervention suitable for rural settings, and does it have an important gender dimension?
- How much information is available on the effectiveness (and cost) of the intervention in rural areas?
- In how many countries and regions has the intervention been used in rural areas (in order to assess the effectiveness of the intervention in varying contexts)?
- Does the intervention's effect on rural productivity and earnings occur in the short term (1-2 years), the medium term (3-5 years) or only in the long term (more than 5 years)? Interventions with short- to medium-term impacts are preferred.

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- How well do the interventions “cover” the main outcomes listed in Appendix 1 (i.e., access to assets, including human capital, land, financial assets and infrastructure, and productivity in agricultural and non-agricultural activities)?

The paper is structured as follows: Section 2 describes methodological issues related to: (1) the identification of outcomes, (2) targeting the interventions to women, (3) estimating effectiveness (4) preparing cost effectiveness estimates, and (5) assessing prospects for sustainability. Section 3 is the main body of the paper. It reviews and assesses the evidence currently available on the questions listed above for 10 selected interventions. The paper concludes with a set of overall conclusions, including a set of priority questions for research to address in order to guide future policy and program design.

2. Methodology

2.1 Identification of outcomes

The review focuses on the impact of interventions on the productivity and earnings of rural women. This is straightforward conceptually, but it is a difficult outcome to measure for rural women, most of whom do not work for wages but are instead likely to be employed as unpaid family workers on family farms or in family businesses. In some cases, particularly in agriculture, it is conceptually possible to identify the separate earnings of women because they specialize on a set of activities (e.g., a crop or group of crops or a particular type of livestock or other agricultural activity). However, measuring the income earned in these activities can be a daunting task. Even in cases where women own and operate their own businesses, it may be difficult to collect accurate data on the income earned. For these reasons, most assessments of the household welfare of rural households use household consumption as the welfare measure or (increasingly) an index of housing characteristics and ownership of consumer durables (e.g., a wealth index). The problem with household-level welfare measures as outcome measures in the present context is that they convey little information about who in the household actually earns or receives household income, and specifically its gender distribution. What is sometimes done to overcome this problem is to focus on the consumption of goods and services that are specifically consumed by women and children or on consumer durables that are most often used by women, such as certain types of household appliances. However, many household surveys do not collect such information.

An alternative approach is to focus on proxy indicators of women’s productivity or earnings or on intermediate outcomes that are likely to lead to increases in women’s productivity or earnings. For example, changes in indicators of women’s empowerment may be useful as a proxy measure because there is evidence that women’s empowerment is enhanced by increased earning capacity.² Increased crop yields, use of more modern inputs or the number of business start-ups are examples of intermediate outcomes that may plausibly lead to increased productivity or earnings. Unfortunately, very few impact evaluations have collected data on indicators of women’s empowerment, and there is a considerable body of literature that warns against assuming that the observation of favorable gender-specific intermediate outcomes are indicative of benefits actually received by women, for example, that a loan or a cash grant received by a woman will necessarily benefit her or her children.

² Of course in the context of this paper, women’s empowerment is an important outcome in its own right.

Lastly, it is important to distinguish between short-term outcomes and longer-term outcomes, as well as to consider the timing of outcomes. The literature suggests that there are often important differences between the short-term and longer-term outcomes of an intervention (Bannerjee and others 2007, Hanna, Duflo and Greenstone 2012), i.e., that the effect of the intervention may not be sustainable, or that in other cases, it may take longer to manifest itself. The timing of outcomes is also important. Some interventions are effective in achieving key intermediate outcomes, but these outcomes may not translate into higher productivity or earnings for many years. Interventions targeted to school-age girls are an important example. When the effect of an intervention on earnings is delayed and/or when it is expected to last for many years, it is important to discount the effect before comparing it to the effect of an intervention that produces an immediate gain in earnings (Dhaliwal and others 2011).

2.2 Targeting

This paper is concerned with interventions targeted to rural women.³ Targeting to women is an example of characteristic targeting (with gender as the characteristic), while targeting to rural populations is an example of geographical targeting. Both types of targeting are relatively straightforward. For example, programs can be designed to serve only rural women (for example, many microfinance schemes), or they can focus on activities that are only (or mostly) pursued by women (for example, crops grown mainly by women). However, some types of interventions may be more difficult to target to women (e.g., rural electrification). Furthermore, even if women are the primary recipients of program benefits, some or all of them may “leak” to men, either because the programs themselves do not target effectively or because the benefits received by women are diverted to men within the household. Therefore, the ultimate distribution of the benefits of an intervention is itself an important outcome.

2.3 Effectiveness

Simple comparisons of outcomes between treated and untreated groups often yield biased estimates of effectiveness due to the presence of program-placement and/or participant selection bias. In assessing the strength and consistency of the empirical evidence available on the effectiveness of a given intervention, the results of carefully designed, implemented and analyzed randomized control trials (RCTs or “randomized experiments”) are considered most credible (Duflo and Kremer 2005, Duflo, Glennerster and Kremer 2006, White, Sinha and Flanagan 2006, Duvendack and others 2011).⁴ Natural experiments, instrumental variables and regression discontinuity designs can also be used to obtain credible estimates of an intervention’s effectiveness when the underlying assumptions are credible. Estimates of effectiveness obtained from quasi-experiments or from non-experimental panel data, with or without matching, or from simple trend analysis are considered less credible. Very little credibility is given in this paper to estimates obtained from non-experimental cross-section data or from qualitative data in the absence of credible quantitative estimates. When considering the credibility of impact estimates, it is

³ This report does not focus on distributional issues apart from those related to gender and location. However, it does attempt to identify interventions that are likely to benefit mainly high-income groups.

⁴ Issues related to design and implementation include: (1) randomization procedures, (2) adherence to treatment, (3) attrition (dropouts and graduates), (4) possible behavioral responses of participants to randomization, and (5) spillovers and spill-ins (Duvendack and others 2011). Issues related to the analysis of data from randomized experiments are discussed in detail in Duflo, Glennerster and Kremer (2006).

important to consider carefully the characteristics of the data and the appropriateness of both the statistical models and the estimation methods (Knowles and Behrman 2004).

Interventions are combined in many cases, for example, microfinance with entrepreneurial training. This can make it more difficult to obtain comparable estimates of the effectiveness of individual interventions in different settings (e.g., microfinance or entrepreneurship training). Increasingly, however, randomized experiments involve the use of cross-cutting designs that assign different randomized blocks of a sample to specific interventions or combinations of interventions, thereby providing a basis for estimating not only the effects of individual interventions but also the effects of interactions between two or more interventions (Duflo, Glennerster and Kremer 2006).

2.4 Cost effectiveness

Cost-effectiveness analysis is used to compare alternative interventions *with the same outcome* (e.g., female labor productivity or earnings). Cost-effectiveness analysis cannot be used to compare interventions with different outcomes (female labor productivity versus women's empowerment), and it is not the most effective tool to compare alternative interventions with multiple outcomes (e.g., female labor productivity, children's health).⁵ Benefit-cost analysis is the more appropriate tool in both cases, as long as a monetary value can be assigned to the outcomes. Since the focus of this paper is on female labor productivity or earnings, cost-effectiveness analysis is the preferred analytical tool. However, most of the impact analyses reviewed in this paper do not report effectiveness in terms of productivity or earnings (or in the form of an outcome such as years of schooling completed that can be readily converted to an estimate of productivity or earnings). Instead, most of the studies report effectiveness in terms of an intermediate outcome, such as crop yields, input use, savings (sometimes confined to a given bank), without providing any cost estimates, while others may report a benefit-cost analysis.

Both cost-effectiveness and benefit-cost analysis require both consistently prepared estimates of economic costs and credible estimates of effectiveness (Dhaliwal, Duflo, Glennerster and Tulloch 2011). Economic costs refer to the value to society of *all* inputs used in an intervention in their most valuable alternative use (i.e., the opportunity cost of the inputs). Unfortunately, estimates of economic costs are not always included in impact evaluations. Even when included, costs are often measured as financial costs rather than economic costs (Behrman, Parker and Todd 2011). The most common problems with reported cost estimates are: (1) failure to identify and cost all inputs, (2) inclusion of income transfers as a cost, and (3) incorrectly measured capital costs (e.g., omission of some capital costs, use of capital expenditure rather than an estimate of annual capital costs, including depreciation and an estimate of the opportunity cost of invested capital). It is also important to use consistent procedures to convert costs into a common currency unit, to adjust for inflation and to convert costs and effects occurring in different years into consistent present values.⁶ When costs are defined incorrectly and/or inconsistently, as is often the case, cost-effectiveness or benefit-cost estimates cannot be compared across interventions.

⁵ Attempts to do so involve developing an index that can simultaneously reflect multiple outcomes. An example is the DALY (disability-adjusted life year) which is often used in the health sector as a measure of both mortality and morbidity impact.

⁶ For a thorough discussion of this subject, refer to Dhaliwal, Duflo, Glennerster and Tulloch 2011).

Both the cost and effectiveness of interventions may change over time or when an intervention is scaled up (Dhaliwal, Duflo, Glennerster and Tulloch 2011). There may be economies of scale that can be exploited when an intervention is scaled up, for example, if there are opportunities to spread large fixed costs over more beneficiaries or if large quantities of inputs can be purchased at lower cost. It may be useful to identify start-up costs separately (e.g., the cost of training of trainers and the cost of preparing training materials) from longer-term operating costs in order to obtain more accurate estimates of the cost of scaling up an intervention. Costs may also change if the intervention is modified before it is scaled up. Because standardized costs must be used in cost-effectiveness analysis, they may give a misleading indication of the cost of scaling up an intervention in a given setting if it uses an input intensively whose cost varies importantly across settings (e.g., skilled labor).

Effectiveness may also change over time or with a scale-up as more people become aware of and are affected by the intervention and market prices adjust to changes in supply or demand caused by the intervention (e.g., changes in the wages of skilled workers induced by changes in supply due to an education intervention). Even when costs are carefully standardized, the cost effectiveness of an intervention may also vary importantly in different settings due to different baseline characteristics. For example, the effectiveness of an intervention providing rural women with iron supplements is likely to be much larger where iron deficiency anemia prevalence is high.

2.5 Sustainability

Sustainability has institutional, financial and political dimensions. Institutional sustainability refers to the capacity of governments and/or private institutions to continue to provide services after project support has terminated. Some interventions may be more technically demanding to implement than others and may therefore require substantial technical assistance and capacity building before they are rolled out on a larger scale. Institutional sustainability also requires that if government staff are involved in the intervention that they have sufficient incentives to perform effectively. In the case of NGOs, institutional sustainability is concerned as well with the prospects of the organization's long-term viability.

Financial sustainability is most often concerned with the government's fiscal capacity to finance an intervention after donor funding has terminated. However, in some cases (e.g., microfinance) it may also be concerned with the ability of NGOs to continue attracting funding from government, donors or charities. Another important consideration for financial sustainability is the extent to which unit costs can be expected to increase or decrease over time (for example, due to economies or diseconomies of scale, increased utilization, or the effects of learning). Lastly, financial sustainability is also concerned with the prospects for recovering costs from the beneficiaries of an intervention.

Political sustainability is concerned with the degree of support for or opposition to an intervention from various groups (stakeholder analysis). Some interventions may be politically acceptable only if financed by donors. There may also be a tradeoff between targeting and building political support (Gelbach and Pritchett 1997). Political sustainability is enhanced if the benefits of an intervention are broadly distributed. However, political support may be secured even when interventions are targeted narrowly to the poor, if conditions attached to the benefits are perceived to reduce the extent of poverty over time. An example is conditional cash transfers (Feiszbein and Schady 2009).

3. Review and analysis of specific interventions

Table 1 lists the interventions that are reviewed in this paper, indicating the paths by which the intervention is believed to improve rural women’s productivity. These interventions cover a broad range of the outcomes in the longer list of interventions in Appendix 1. Most have been widely used. Several of them are often grouped together in various combinations with the suggestion that they would make an effective package (for example, land registration, microfinance (credit or savings), farmer field schools, improved use of modern agricultural inputs, and crop insurance). The fact that only ten interventions are reviewed should not be taken to imply that none of the remaining interventions in Appendix 1 are unlikely to be workable. It reflects only length and time constraints applying to the preparation of this paper. Summaries of the main studies reviewed under each intervention are provided in Appendix 2.

Table 1. Interventions to increase rural women’s productivity and earnings reviewed in this paper

Intervention	Expected outcome
Conditional cash transfers	Increases productivity and earnings directly by increasing women’s educational attainment
Land registration	Increases agricultural productivity directly by increasing women’s access to agricultural land and indirectly by stimulating investment in the land. May also increase women’s income from renting out land.
Rural electrification	Increases productivity indirectly by increasing the length of the work day, by reducing the time required for housework and fuel collection and by providing new business opportunities
Microcredit	Increases productivity indirectly by increasing investment in rural microenterprises and income-earning assets
Rural savings	Increases productivity indirectly by increasing investment in rural microenterprises and income-earnings assets
Farmer field schools	Increases agricultural productivity directly by increasing women’s agronomic knowledge
Improved use of modern agricultural inputs	Increases agricultural productivity directly by increasing the use of more productive agricultural inputs
Crop insurance	Increases agricultural productivity indirectly by encouraging cultivation of higher-yielding but riskier crops
Mobile phones	Increases productivity indirectly by reducing the time required to obtain information and to conduct financial transactions
Improved cooking stoves	Increases productivity indirectly by reducing the time required to prepare food and to collect fuel and by reducing working time lost due to indoor air pollution-related morbidity

3.1 Conditional cash transfers

Problem

Girls in many developing countries frequently drop out before completing secondary school. This makes them less productive as adults. It also leads to early marriage and less effective parenting.

Description of the intervention

Conditional cash transfers (CCTs) are given to parents (but sometimes to the student) under the condition that their child(ren) attend school for a minimum amount of time (typically 85%, as well as occasionally some measure of schooling performance). Other conditions are sometimes attached (for example, that children under five obtain recommended vaccinations and other preventive health care, that mothers obtain perinatal care and attend health education meetings). In 2009, CCTs were operating in 29 different countries (Baird and others 2011).

Expected outcomes

Increased schooling completed by girls, leading to increased future labor productivity and earnings, as well as improved health, nutrition, and education of their children. Distributional outcomes include increased household income (consumption) and reduced poverty. The labor supply of all household members is usually affected as well.

Targeting

CCTs are relatively easy to target to rural girls (as distinct from *poor* rural girls). CCTs are sometimes provided only for girls, or at higher levels for girls than boys (as in Mexico). Targeting them additionally to the poor, as is often done in practice, is more challenging and expensive. When targeted to poor children, either geographical targeting or some type of means testing is usually employed. The cash grants are usually provided to the mothers in the belief that they are more likely to spend the money in ways that will benefit themselves and their children.

Effectiveness

There is a large literature on the effectiveness of CCTs, much of it focused on the PROGRESA program in Mexico (subsequently renamed *Oportunidades* when it was expanded to urban areas), the design of which included a large randomized experiment. PROGRESA/*Oportunidades* currently covers about 25% of all Mexican households (Behrman, Parker and Todd 2011). Impact evaluations of PROGRESA/*Oportunidades* indicate that it has had positive effects on the educational enrollment of both boys and girls, particularly during the transition from primary to secondary school (Schultz 2004). The short-term impact on household consumption and poverty reduction has also been significantly positive, and Gertler, Martinez and Rubio-Codina (2012) report that CCTs provided under PROGRESA/*Oportunidades* have been used in part to finance productive investments that should help beneficiary households achieve higher living standards even after transitioning off the program.

More generally, impact evaluations in many countries have found that CCTs have significant positive impacts on per capita consumption and poverty reduction and on educational enrollment (particularly among groups of students with previously low enrollment rates), a significant negative impact on child labor among children benefiting from CCTs, and little impact on the labor supply of other household

members (Feiszbein and Schady 2009). However, CCTs have not led to better performance on achievement tests, suggesting that the potential of CCTs to improve learning on their own may be limited. The effects of CCTs on cognitive development in early childhood (via their effects on children's health and nutrition) are slightly more encouraging (Behrman, Parker and Todd 2009). The reason for only modest gains in education may include household characteristics that are not conducive to learning or the poor quality of schools available to poor children (Feiszbein and Schady 2009).

Although evaluations of short and medium-term CCT impact have been done in many countries, less is known about their longer-term impacts. In terms of education impact, for example, most existing evaluations have focused on the impact of CCTs on current school enrollment, usually by grade level, age and gender. However, the impact of CCTs on labor productivity and earnings depends on their longer-term impact on educational attainment. In a recent study, Behrman, Parker and Todd (2011) have estimated the impact of 5.5 years of PROGRESA/Oportunidades on schooling compared to those never receiving benefits. Their estimates indicate that girls ages 9-12 pre-program accumulated 0.7 to 0.8 additional grades of schooling as a result of the program, with no significant impacts on older girls, while boys ages 9-12 pre-program accumulated 0.9-1.0 additional grades, and boys ages 13-15 accumulated about half an additional grade. They conclude that children's educational attainment increased approximately linearly with the number of years of participation in PROGRESA/Oportunidades.

One issue in CCTs is whether they should go beyond attempting to increase enrollments to try to improve cognitive performance, for example, using merit-based payments. In Kenya, merit scholarships were awarded to 6th grade girls in randomly selected schools in two predominantly rural districts (Busia and Teso) who scored in the top 15 percent on government-administered tests (Kremer, Miguel and Thornton 2009). The winning girls received a grant for the next two years to cover school fees (US\$6.40), paid to her school, and a grant of US\$12.80 for school supplies paid directly to her family, as well as public recognition at an awards assembly. The program increased test scores by 0.19 standard deviations and increased teacher attendance by 4.8 percentage points (and by 7.6 percentage points in the 6th grade). Although the award winners came from relatively advantaged households, there is evidence that the program had positive externalities on the entire class.

Another issue in CCTs is whether it is necessary to impose conditions. A recent randomized experiment in Malawi assessed the role of conditionality by randomly selecting girls to receive either an unconditional cash grant (UCT) or a cash grant conditional on school attendance (CCT). There was a modest decrease in the dropout rate in the UCT group compared to the control group, but it was only 43% as large as the decrease in the CCT group. The CCT group also outperformed the UCT group in tests of English reading comprehension (Baird, McIntosh and Özler 2011).

More recent evaluations have focused on ways to improve the cost effectiveness of CCTs, for example, by using mobile phones to facilitate the distribution of cash grants (Aker and others 2011), by providing incentives to save or to graduate (Barrera-Osorio, Bertrand, Linden and Perez-Calle 2011), or by introducing merit-based payments or removing conditions, as discussed above.

Cost effectiveness

There have not been many attempts to estimate either the cost effectiveness or benefits and costs of CCTs. Because CCTs usually have multiple outcomes (e.g., poverty reduction, improvements in education, nutrition and health), benefit-cost analysis is perhaps a more appropriate tool for the economic analysis of CCTs than cost-effectiveness analysis. One benefit-cost analysis in Colombia monetized the estimated impacts of a CCT program on health, nutrition and schooling and compared them to program costs, including, the cost of related health and schooling infrastructure investment and service delivery costs, program-related private household costs (for example, the costs of additional food and education expenditure, and the cost of collecting transfers), and the cost of raising the government revenue to finance the program. Under the assumption that an additional year of schooling increases future earnings by 8 percent and that an additional 0.4 kilograms of birth weight increases future income by 5% (based on international evidence), they estimated the total net present value of the program's benefits to be US\$259.4 million and the program's costs to be US\$163 million (Feiszbein and Schady 2009).⁷

A benefit-cost analysis of PROGRESA/*Oportunidades* that is particularly relevant to this paper because benefits are limited to the future earnings of the increased schooling attainment of students affected by the program is reported in Behrman, Parker and Todd (2011). The estimated costs of the program include the administrative costs of targeting, distributing transfers and monitoring compliance with the conditions, the private household costs associated with participation in the program, and the cost of raising the revenue needed to finance the program. Based on their analysis of Mexican data, they used three alternative assumptions concerning the impact of one additional year of schooling on future earnings (6%, 8% and 10%) and three alternative discount rates (3%, 5% and 10%). Their estimates of the benefit-cost ratio corresponding to an estimated impact of +0.83 grades of completed schooling range from 1.43 to 5.92, except in the single extreme case of a discount rate of 10% in combination with a return to schooling of 6%, where the benefit-cost ratio is only 0.13.

Sustainability

The fact that CCTs have been implemented successfully in many different low and middle-income developing countries, in some cases for more than a decade (i.e., Mexico and Brazil), suggests that institutional sustainability is not an issue. However, financial and political sustainability are issues. In terms of budgetary impact, CCT programs are expensive. However, most of the financial cost is involved in the transfer itself, which is not an economic cost and can be justified mainly on distributional grounds. The fact that conditions are usually attached that are designed to reduce poverty over time probably makes them more politically acceptable to middle and upper-income households that are ineligible to receive the benefits (Fiszbein and Schady 2011). In fact, CCT programs have survived changes of government in several countries (most notably in Mexico and Brazil).

Conclusions

CCTs are a proven intervention that is effective in increasing the productivity and earnings of rural women in a wide range of settings. They are most cost-effective when targeted to girls of secondary

⁷ The discount rate used is not reported.

school age when drop-out rates are high and in settings in which schools of reasonably good quality are both physically and socially accessible. Their main drawback is the considerable time lag that is involved between program implementation and the resulting increases in labor productivity and earnings (i.e., 5-10 years, assuming girls begin receiving benefits at ages 8-13 and enter the labor force at age 18). The benefits also accumulate over many years. Whether CCTs are cost-effective compared to alternative interventions depends in part on the discount rate

3.2 Land registration

Problem

In most settings, female farmers have access to less land and to poorer quality land than male farmers (World Bank, 2011, FAO 2011). This situation may be due to traditional practices, such as inheritance laws that favor male heirs over female heirs, or it may be due to government policies, such as land redistribution or titling schemes that transfer ownership or titles exclusively to male heads of households or to the extension of formal land rights that erode women's customary rights. Even where attempts are made to strengthen women's land tenure rights under the law, they are often frustrated by enduring traditional practices and procedures favoring men.

Description of the intervention

Many interventions have been used to improve rural women's access to land, including: (1) requiring that land distribution or registration schemes provide joint titles in both spouses' names (or provide land equally to both spouses, in the case of land distribution schemes), (2) reforming land tenure, marriage and inheritance laws to protect the rights of women (including vulnerable groups such as widows), (3) educating and motivating local land officials to respect gender equity (e.g., by establishing gender equity targets or by employing more women in land offices), (4) including women as members of local land committees; (5) educating women about their land rights and providing supportive legal services, (6) organizing groups of women to lease or purchase land and farm it collectively; and (7) forming land banks to lease land to farmers (World Bank 2011a, FAO 2011, Agarwal 2003, Aryeetey and Udry 2010). The review in this paper focuses on land registration interventions (i.e., interventions that issue land titles or land-use certificates).

Expected outcomes

The ultimate outcome of these interventions is to increase women's agricultural productivity and income. Intermediate outcomes include increasing the amount and quality of land farmed by women, improving the security of women's land tenure and thereby the level of land-related investment, and enhancing women's participation in land markets (e.g., renting out land). Increases in women's individual land ownership (as distinct from other types of use-rights) can enhance women's power within the household (Agarwal 2003) and provide collateral that can be used to access credit to finance women's land-related investments (Goldstein and Udry 2008, Besley and Ghatak 2010). However, other constraints may remain to impede women's participation in rural credit markets, such as lack of productive investment

opportunities, limited land markets or reluctance to incur risk (Boucher, Carter and Guirkinger 2008, Barham, Boucher and Carter 2008). Other possible outcomes include reduction in rural crime rates and costs of protecting property rights (e.g., remaining at home instead of participating in labor markets) and increased willingness of female spouses to work or invest in the land (Deininger, Ali and Alemu 2009).

Targeting

Most of the interventions used to improve women's access to land are only indirectly targeted to women, i.e., women's rights are protected in connection with interventions directed to both males and females. When interventions are targeted only to women (e.g., organizing groups of women to lease or purchase land), there may be resistance from males. Although there is little danger that the benefits of these interventions would be captured by their spouses or other males in their families, there is a risk that land titling can lead to land-grabbing that benefits mainly the rich and powerful, for example, by enabling them to obtain ownership rights over common land (Deininger, Ali and Alemu 2009).

Effectiveness

Land registration is the only intervention whose effects have been widely studied. Unfortunately, there are no randomized experiments of the effects of land registration. However, econometric methods have been used in several more recent studies to remove selectivity bias (i.e., the tendency for more skillful farmers with more fertile plots to obtain titles). For example, Deininger, Ali and Alemu (2009) used panel data and a regression model to obtain difference-in-differences (DID) estimates of the impact on investment of a land registration scheme that covered 20 million plots over five years in Ethiopia. This study looked at three outcomes: perceived tenure security (only use-right certificates were provided, as private land ownership is not permitted in Ethiopia), land-related investments and participation in land rental markets (but not overall land productivity or household income). The results indicate that the land registration program had significant positive impacts on all three outcomes examined, including a large positive impact on investments in land conservation. Of particular interest for this paper, the results indicate that registration facilitated the renting out of land by relatively poor female heads of households.

In another study of the impact of a land registration program in Rwanda, Ali, Deininger and Goldstein (2011) obtained impact estimates by estimating regression models using cross-section data from rural households located in the proximity of administrative borders that determined whether an area was included or not included in a pilot registration program (i.e., the discontinuity of the administrative borders was used as an identification strategy). The outcomes examined include perceived risk of land expropriation, soil conservation investments, female land ownership, knowledge of which household members will inherit land, and participation in land markets. The results indicate that the land registration program did not have a significant effect on the perceived risk of expropriation, but that it approximately doubled investment in soil conservation measures, with the estimated effect almost twice as large for plots owned by female-headed households. The results also indicate that the registration program had a large positive effect on female land ownership among women in formal marriages⁸ and that it significantly reduced uncertainty about who would inherit land, increased the number of child heirs, and virtually

⁸ The 1999 Inheritance Law extended rights of land ownership to females only in formally registered marriages.

eliminated gender difference among designated child heirs (except that girls were less likely to be designated as heirs in female-headed households).

Jacoby and Minten (2007) obtained estimates of the effect of land titling on land-related investment, productivity and land values in Madagascar in a relatively fertile rice-growing area in which about half of the plots are titled. Because most of the sample farmers own multiple plots, they were able to obtain their estimates using a fixed-effects model with cross-section data that eliminates endogeneity bias due to unobserved household-level variables. Because possible endogeneity bias at the plot level cannot be controlled (i.e., the likelihood that more fertile plots due to unobserved variables are more likely to be titled), they regard their estimates as providing the upper bounds of the true estimates. Their results indicate that titling has no significant effect on land-related investment or productivity and only a modest positive effect (+6%) on land values. The small effects in Madagascar may be due in part to the apparently low risk of expropriation of untitled land (i.e., less than one percent annually).

Goldstein and Udry (2008) analyze data on farm productivity in an area of Ghana in which the annual risk of having land expropriated while lying fallow is about one in three and conclude that security of tenure has an important effect on land productivity, via investments in soil fertility (i.e., lengthening the duration of the fallow period), and that security of tenure is related to an individual's position in the political and social hierarchy. More politically powerful land holders are able to leave their land fallow for longer periods because doing so does not carry the same risks of expropriation as it does for the less powerful. Women land owners are disadvantaged in this case because they are rarely politically powerful or socially influential.

Cost effectiveness

In addition to wide-ranging differences in the estimated effectiveness of land registration interventions (e.g., Ethiopia and Rwanda versus Madagascar), large variations are reported in the cost per land parcel registered. The reported cost of Ethiopia's registration program (\$1 per parcel) is considerably lower than that of other African schemes, which range from \$7-10 per parcel or more (Deininger, Ali and Alemu 2009). Accordingly, the estimated effect of the Ethiopia program on soil conservation alone is sufficient to obtain a benefit-cost ratio in excess of one after only one year, using a 10% discount rate. In the Madagascar study (Jacoby and Minten 2007), however, the estimated upper value of the effect of land titling on land values is about US \$60 per hectare, while the cost of titling is about \$350 per plot. Because most of the plots are less than one hectare in size, the private benefits of titling do not appear to justify the private costs.

Sustainability

The issue of institutional and financial sustainability arises in connection with maintaining the land registration system over time to reflect exchanges of property and inheritance. Unfortunately, there is no information available on this issue. However, it is likely that relatively complicated and expensive centralized registration procedures are less sustainable than relatively inexpensive community-level procedures.

Political sustainability is an important issue with this intervention. Formal systems of land registration may replace traditional systems in many settings, and those who have benefited from the local system (e.g., local chiefs and other traditional leaders) may oppose formal registration. To the extent that a land registration system increases women's rights, there may also be opposition by males. Both sources of opposition could potentially either block implementation or pose a threat to the sustainability of any land registration system.

Conclusions

The available evidence suggests that the positive effects of land registration on land productivity are largest when there is a significant risk of expropriation, where there are attractive opportunities for land-related investments, and where land and financial markets are relatively developed. However, these findings—though promising—are not based on careful randomized experiments but on less reliable impact estimates prepared by applying econometric methods to either cross-section or panel data in an effort to remove selectivity bias with respect to the characteristic of parcels registered or the farmers registering them. Cost effectiveness is sensitive not only to the estimated effectiveness but also to the large observed variation in cost per land parcel registered. There is no evidence that more complex registration procedures (e.g., including the preparation of maps and centralized computer-based registries) are more effective than simpler community-based procedures. Based on the limited evidence of effectiveness, cost effectiveness and sustainability (both financial and political) land registration is rated only as promising. Unfortunately, there are no reliable estimates of the effectiveness of the other interventions listed above that are designed to improve women's access to land, although some of them (e.g., joint titling of spouses, inclusion of female members in local land committees) are incorporated into land registration schemes for which impact evaluations are available (e.g., Ethiopia).

3.3 Rural electrification

Problem

Many rural people in developing countries are still without affordable access to electricity. According to World Bank estimates, 1.6 billion people worldwide were without electricity in 2007 (Grogan and Sadanand 2011). Since alternative forms of lighting are relatively expensive, the absence of electricity limits the amount of time rural households can devote to many productive activities, including supplementary income-earning activities such as the processing of agricultural products. Households without electricity cannot use many time-saving appliances that could free-up women's time to pursue income-earning activities, and it is more difficult for children to study. Access to electricity also facilitates the use of water pumps for irrigation or household use. Even in communities with access to electricity, many poorer households remain unconnected because they cannot afford the connection charges. In rural India, for example, 90% of villages have electricity, but only 40% of households are connected (World Bank 2008). In Thailand, after 20 years, 25% of households remain unconnected in electrified villages.

Description of the intervention

The most typical rural electrification intervention involves extending the grid to previously unserved communities. Less commonly, subsidies are provided to encourage unconnected households to connect to existing grids (World Bank 2005, World Bank 2008). In remote areas, rural electrification may also involve the provision of off-grid electricity sources, such as local grids based on small hydroelectric or fossil-fuel burning power plants or electricity from solar, wind or geothermal power.

Expected outcomes

The main intermediate effects of electrification are a reduction in the cost of lighting and a resulting increase in the use of lighting and television, thereby extending the time when household members can engage in work and other activities, including leisure. Electricity may also be used to power appliances that increase productivity in housework, which is disproportionately done by women. These intermediate outcomes may in turn lead to increased income-earning activities in the home and changes in women's labor supply outside the home. There is also some (somewhat puzzling) evidence that home access to electricity may have a positive effect on the use of modern cooking fuels other than electricity, particularly natural gas, thereby reducing the use of firewood as a cooking fuel and freeing up more time for household members. Broader outcomes, including gender empowerment, improved access to schooling, health care and information, reduced fertility, and enhanced public safety have also been cited (Köhlin, Sill, Pattanayak, and Wilfong 2011). Some of these broader impacts may be obtained in part by increased access to television.

Targeting

The *availability* of electricity in a community cannot be targeted to women. However, community-level effects such as street lighting and the availability of electricity in schools and health facilities may be particularly beneficial to women (Köhlin, Sills, Pattanayak and Wilfong 2011). Bringing electricity into the home may also benefit women more than men because women tend to spend more time at home than men performing activities in which productivity is more susceptible to improvement with access to electricity. Electricity may also make it possible to mechanize post-harvest food processing tasks that are more often performed by women than by men. However, women's preferences may not be adequately reflected in household's decisions to connect to an existing electricity grid or, once connected, in the appliances purchased or the locations in which lighting is installed. Targeted subsidies can be provided to the poor and to female-headed households to reduce connection charges, which are often high in rural areas (World Bank 2005, Köhlin, Sills, Pattanayak and Wilfong 2011). The available studies indicate that connection subsidies are generally more equitable than rate subsidies, not only because the poor are less likely to connect to a grid but also because poor consumers often do not understand complex rate structures (World Bank 2008).

Effectiveness

Most of the information on the gender impacts of rural electrification is anecdotal (Köhlin, Sills, Pattanayak and Wilfong 2011). The main problem confronting quantitative assessments of the impact of infrastructure investments such as rural electrification is that of placement bias (Bernard and Torero 2011). Infrastructure investments are not made randomly but instead reflect technical, cost, economic, social and political considerations. Randomizing electricity investments at the community level is not

practical for grid-related investments, and it is not acceptable on ethical grounds at the household level. Accordingly, rural electrification impact is usually estimated (if it is estimated at all) using techniques such as instrumental variables estimation, propensity score matching and difference-in-differences estimation with panel data (Köhlin, Sills, Pattanayak and Wilfong 2011).

A novel approach that has been applied to a rural electrification project in Ethiopia is to randomly allocate vouchers providing discounted connection costs (Bernard and Torero 2011). The results indicate that richer and male-headed households are more likely to connect to the grid, along with households receiving a voucher, while households with higher connection costs are both less likely to connect and to connect later (Bernard and Torero 2012). A particularly important finding is that households become more likely to connect to the grid as more of their neighbors connect (suggesting a “bandwagon effect” was present). However, because Ethiopian rural households are so poor, electricity use is still mainly limited to lighting after 12 months. Time-use diaries show no significant changes in the time devoted to specific activities between the baseline and endline surveys (although no gender-specific estimates are provided).

One study of the impact of rural electrification in Nicaragua used two proxies for the cost of extending the electric grid from urban to rural areas of a municipality (i.e., population density and the mean slope gradient in the municipality) as instruments to identify the impact of electrification on labor supply (Grogan and Sadanand 2011). This study estimated that providing electricity to rural households increased the female propensity to work outside the home by 23%, without any effect on male labor supply, and that households with electricity are more likely to use modern cooking fuels, such as gas (although the relationship may not be causal). The main question about this study is whether the instruments are appropriate, i.e., uncorrelated with employment outcomes.

Another study used both an instrumental variable (land gradients) and fixed-effects models to estimate the impact of South Africa’s rural electrification program in Kwa-Zulu Natal province, which includes about 20% of the total population (Dinkelman 2010). The first estimation approach (instrumental variable estimation) uses community-level Census data from 1996 and 2001, while the second estimation approach uses a panel of individual-level household survey data from the years 1995, 1997, 1999 and 2001 collapsed to 38 district-level aggregates. The instrumental variables (IV) estimates indicate that electrification significantly raises the female employment-to-population ratio by 9.5 percentage points (i.e., by 30-35% compared to the baseline) within five years, compared to an insignificant increase of 3.5 percentage points in the male employment-to-population ratio. The fixed-effects estimates are broadly consistent with the IV estimates. The findings suggest that household electrification increases employment both by releasing women from home production (including the collection of wood for cooking as the use of wood fuel decreases) and by enabling micro-enterprises. The study also finds that electrification has a positive impact on net in-migration. The study includes a very careful assessment of the suitability of land gradients as an instrument in this context, establishing that the findings are credible.

Cost effectiveness

Most benefit-cost analyses of rural electrification interventions involve benefits that are based on willingness to pay (WTP) estimates (e.g., willingness to pay for lumens or hours of TV). Most WTP

estimates are in the range of US\$0.10-0.40 per Kilowatt hour (kWh) for lighting and TV services alone.⁹ This exceeds estimates of long-run costs of electricity obtained from grids, which are in the range of \$0.05-0.12 per kWh (World Bank 2008). Off-grid schemes or grid-extension interventions in sparsely populated areas have higher costs and lower benefits and often experience serious technical problems that further lower their benefit-cost ratios (World Bank 2008).

Sustainability

Low connection rates are a problem adversely affecting the sustainability of many rural electrification programs in Sub-Saharan Africa (Bernard and Torero 2012). Subsidizing connection fees may be effective in raising connection rates, as the Ethiopian study indicates, but they raise the issue of financial sustainability. However, to the extent that the “bandwagon” effect is present in other settings, subsidies might be effective as a short-term policy. Both technical losses (i.e., loss of current during transmission) and non-technical losses (theft of power) are important problems in many developing countries, with a negative impact on financial sustainability. Most off-grid schemes involve substantial subsidies (World Bank 2008).

Conclusions

The available evidence suggests that rural electrification is a promising intervention for increasing rural women’s labor productivity and earnings, particularly if the intervention consists of providing targeted subsidies to unconnected households in communities with previously established access to a grid. The available evidence also suggests that rural electrification is less effective in very poor settings, such as in rural Ethiopia, where households cannot afford time-savings appliances or where women have limited opportunities to work outside the home or to start businesses. The distribution of benefits is also an important issue for grid extension interventions because connection charges are often a barrier preventing low-income households from connecting to the grid. More credible evidence of effectiveness is necessary before this intervention can be considered proven.

3.4 Microcredit

Problem

Rural women have poor access to credit due to the limited presence of financial institutions in rural areas (due in part to the high unit costs of collecting reliable information on potential borrowers) and the lack of collateral that is typically available to rural women. As a consequence, rural women tend to borrow (if they can borrow at all) from money lenders, family members and friends, often paying high interest rates.

Description of the intervention

Microfinance institutions (MFIs) have typically organized groups of women who together are expected to guarantee the individual loans of their members. More recently, however, many MFIs have also begun to

⁹ Some benefit-cost analyses of rural electrification interventions include other benefits, such as education, health and even fertility reduction, but most of these other benefits should already be reflected in household WTP (World Bank 2008).

extend loans to individuals. Repayments are usually at frequent intervals, for example, weekly. MFIs often also commit their members to save on a regular basis and provide financial literacy or business training to their members. The groups organized by MFIs are often (but not always) limited to women, out of a belief that women are more likely to repay their loans than men and are more likely to make better use of the proceeds of a loan as well as any additional income they may earn if they invest the proceeds of their loans (Pitt and Khandker 1998). Conditions are sometimes also attached to microfinance loans designed to empower women or to promote other positive outcomes, for example, in the case of loans to purchase land or houses, requiring that they be registered in women's names or requiring businesses receiving loans to employ women. MFIs typically charge interest rates that are higher than commercial lenders but lower than the rates charged by informal lenders. MFI operations are typically subsidized, at least initially, with the expectation that they can become sustainable within 3-7 years (Morduch 1999, Dzene and Fred 2010).

Expected outcomes

The main expected outcome of microcredit interventions is increased income of members from investing their loan proceeds productively. In addition, many other possible outcomes have been identified in the literature, including: increased household consumption, attenuation of household risks and consumption smoothing, repayment of household debt, female empowerment, reduced fertility, improved health, and increased children's schooling (Pitt, Khandker and Cartwright 2006, Duvendack and others 2011).

Targeting

It is relatively easy to target microcredit services to women by restricting MFI membership to females. However, this does not by itself ensure that the proceeds of loans are used to benefit women and children.

Effectiveness

The literature on microcredit is replete with claims about its effectiveness. According to the FAO (2011), for example, "A large body of evidence shows that lending to women helps households diversify and raise income and is associated with other benefits such as increased livelihood diversification, greater labour market participation, more education and better health." Indeed, early impact evaluations found evidence of strong positive impacts (Hashemi, Schuler and Riley 1996, Pitt and Khandker 1998, Pitt, Khandker and Cartwright 2006). However, many of these findings were almost immediately challenged (Morduch 1998). Indeed, the early studies have been shown to have low validity when replicated in recent studies (Roodman and Morduch 2009). Evidence has also emerged that in many cases women were not able to control their new assets and that their husbands were the main beneficiaries, particularly in settings in which women wield relatively little power within the household and/or do not have the possibility to invest funds productively (Goetze and Sengupta 1996, Garikipati 2008, Ngo and Wahhaj 2009).

More recently, a few randomized experiments have been conducted in different countries (including in rural areas of Morocco and Mongolia) that have obtained results that cast doubt on the effectiveness of microcredit in increasing women's (or even household) income or in empowering women, improving health or increasing children's schooling (Karlan and Zinman 2010, Bannerjee, Duflo, Glennerster and

Kinnan 2010, Crepon and others 2011, de Mel, McKenzie and Woodruff 2009, Attanasio and others 2011). A recent systematic review of 58 impact evaluations¹⁰ of microcredit interventions (culled from 2,643 studies on the basis of their methodologies) concludes that there is no clear evidence that microcredit interventions have positive outcomes, including poverty reduction and women's empowerment (Duvendack and others 2011).¹¹

Cost effectiveness

The cost of microcredit has mainly been discussed in relation to the subsidies received by MFIs and their implications for MFI sustainability, not in the context of cost-effectiveness analysis or benefit-cost analysis. Consequently, most of the available cost estimates refer to financial costs, not economic costs. For example, they typically exclude the opportunity cost of the time spent by members attending meetings. Weiss and Montgomery (2004) discuss some cost-effectiveness estimates in Bangladesh reported by Khandker (1998) and in Bolivia reported by Mosley (2001). In Bangladesh, cost effectiveness is defined as financial costs per currency unit of income (or consumption) generated by an intervention, while it is defined as financial cost per individual brought above the poverty line in Bolivia. According to these estimates, the Grameen Bank (but not BRAC) is a cost-effective development intervention in both Bangladesh and Bolivia. However, the effectiveness estimates on which these cost-effectiveness estimates are based are not valid (Duvendack and others 2011), and there is no discussion of how cost is defined in any of the interventions (some of which include income transfers). Schreiner (2003) estimated that the unit subsidies of the Grameen Bank during the period 1983-1997 averaged about US\$20 per person-year of membership and about US\$0.22 per dollar-year borrowed and concluded that "Grameen—if not necessarily other microlenders—was probably a worthwhile social investment." However, these ratios are subsidy-output ratios, not cost-effectiveness ratios.

Sustainability

The large number of MFIs that have existed worldwide for many years attests to the institutional and political feasibility of microcredit schemes. However, in terms of financial sustainability, questions have been raised about the cost of their lending operations and their continued dependence on subsidies. According to Cull, Demirguc-Kunt and Morduch (2009) microcredit annual operating costs are relatively high, ranging from 17-26% of loan value (which is about twice as high as comparable ratios internationally). Some have argued that efforts to make microcredit sustainable (for example, by raising interest rates or by extending membership to males) may reduce its effectiveness (although its effectiveness is also open to question, according to the findings of recent randomized experiments). Increased competition may also be a potential challenge to the sustainability of microfinance institutions, although one study in Ghana found that industry competition increases sustainability (Dzene and Fred 2010). An important issue is whether the unit costs of microfinance institutions can be expected to

¹⁰ 31 of these studies are from Bangladesh, while an additional 10 are from India.

¹¹ This study observes (p. 75): "If indeed there is no good evidence to support the claim that microfinance has a beneficial effect on the well-being of poor people or empowers women, then, over the last decade or so, it might have been more beneficial to explore alternative interventions that could have better benefitted poor people and/or empowered women."

decrease over time. Caudill and others (2009), by analyzing 2003-2004 cost data for MFIs from Eastern Europe and Central Asia, found that some MFIs (but not all) are able to reduce unit costs over time.¹² Those relying more on deposits than on subsidies as a source of loanable funds, those operating in Central Asia, and those not in networks tend to achieve lower costs over time. There is a strong negative relationship between the age of an MFI and unit costs for about half of the sample studied when a “mixture model”¹³ is used. Clearly, microfinance institutions cannot rely on continued subsidies unless they are able to demonstrate to governments and donors more effectiveness and cost effectiveness than have been demonstrated to date.

A stable macroeconomic environment in terms of interest rates and inflation has been found in some studies to be an important determinant of microfinance sustainability (Ahlin, Lin and Maio 2010, Dzene and Fred 2010). However, no evidence of such a relationship was found in the study by Caudill and others (2009). Several evaluations have been conducted recently, and more are currently ongoing, to determine the effectiveness of varying other features of microcredit practices. For example, Field and others (2010) have investigated the effects of varying the term structure of microcredit loans on the use of loan proceeds and on loan repayment, Giné, Goldberg and Yang (2011) have evaluated the effects of an improved personal identification system on borrowing and loan repayment, Giné and Karlan (2011) have investigated the effects of individual versus group lending, and Karlan and Valdiva (2011) have examined the effects of adding business training to a group lending program in Peru. The findings of these studies may be helpful in reducing microcredit unit costs.

Conclusions

The main advantages of microcredit are its proven track record in terms of institutional and political sustainability and its ability to reach out to large numbers of rural women. The main caveats are with respect to very weak evidence of its effectiveness on targeted outcomes (i.e., women’s earnings and empowerment), a related lack of evidence of its cost effectiveness, and questions about its financial sustainability, due to continued reliance of MFIs on subsidies. Most existing evaluations of microcredit schemes have been of group lending schemes in South Asia, where (with the exception of some parts of India) there are important barriers to the participation of women in microenterprises and where women’s intra-household bargaining power is weaker than in other regions. Under these conditions, the proceeds of microcredit loans are more likely to benefit men than women and to be used for consumption than for business investment. More credible impact evaluations of both group and individual lending schemes are needed in multiple regions. However, at this time, the available evidence indicates that microcredit interventions are of doubtful effectiveness.

3.5 Rural savings

Problem

Many rural women, especially the poor, save very little or not at all, even when there are opportunities to invest additional funds productively or where there are obvious consumption smoothing needs (Fletschner

¹² The number of borrowers and the volume of loans were used as output measures in defining unit costs.

¹³ A mixture model is a statistical model that is designed to deal with the possibility that different behavioral models are appropriate for different parts of a sample when it is not known which sample units belong to each group.

and Kenney 2009, FAO 2011, Banerjee and Duflo 2011). When rural women do save, they tend to use informal mechanisms such as savings clubs in which members help each other to achieve their savings goals or rotating savings clubs (ROSCAs) in which members meet regularly contributing the same amount into a common pot with one member receiving the entire pot at each meeting (Banerjee and Duflo 2011). Because physical access to banks and other financial institutions is often very limited in the rural areas of low-income developing countries, leading to high transaction costs, rural women often give their savings to deposit collectors to be deposited in a bank or to local money lenders or other “money guards” or keep their savings in physical assets (e.g., gold, livestock, housing). However, limited access to financial institutions is only one of the factors that may constrain rural savings. Social and psychological barriers are also important. Intra-household and social obligations to help one’s spouse, other family members or neighbors at times of need often frustrate women’s efforts to save, along with temptations to spend on unessential items, limited attention to the task of setting aside money at regular intervals, and/or a sense of helplessness to improve their future circumstances (Banerjee and Duflo 2011). In some cases, these barriers are so strong that women borrow money from one bank at a high interest rate and deposit the funds in a savings account at another bank, receiving a much lower interest rate, because the strong obligation to repay the debt provides the necessary discipline to save on a regular basis.

Description of the intervention

Some interventions are designed to address the problem of poor access to formal financial institutions, which arises because the high fixed costs of regulated financial institutions make their operations unprofitable in rural areas where accounts are typically very small. These often take the form of pilot projects in which the project pays the cost of opening an account to see whether additional accounts are opened and savings increases. However, this still leaves the often substantial travel costs of accessing the account. One alternative is to establish low-cost microfinance institutions in the rural areas to provide a vehicle for savings as well as credit. Another alternative is to establish a network of rural deposit collectors who forward the collected deposits to a bank. However, such arrangements are often not authorized under existing bank regulations. More recently, mobile phone-based systems such as M-Pesa in Kenya (discussed below) have begun to provide a savings service by linking up with a bank. Interventions to address social and psychological barriers include “commitment savings” schemes in which individuals agree to save either for an agreed-upon time period or until they accumulate an agreed-upon amount, usually without being able to withdraw their savings until their commitment has been fulfilled.

Expected outcomes

The main outcome of rural savings schemes are increased savings leading to higher investment in income-producing assets and/or increased consumption smoothing and gender empowerment, if women’s increased financial assets translate into additional influence within the household.

Targeting

Rural savings interventions can be easily targeted to women by putting the accounts in their name and by preventing others from accessing the funds. However, there is always a risk that funds withdrawn from

savings accounts can be used by men, particularly in settings where women have relatively little power within the household.

Effectiveness

There have been several randomized field experiments in recent years that have either focused on rural savings or have had an important rural savings component. However, most have limitations, including: narrowly defined savings outcomes and participant samples that raise questions about the possibility of the interventions crowding out other household savings and the external validity of the findings, time periods that are too short to reveal whether interventions are sustained, absence of cost data, and the non-reporting of gender-specific effects. Another consideration is that the main outcome measured in these studies is household savings, which like household income is relatively difficult to measure reliably (compared to household consumption, housing characteristics or the ownership of durables).

One randomized experiment in rural Western Kenya was designed to increase savings that could be used to invest in preventive health care or to reduce vulnerability to health shocks (Dupas and Robinson 2012). The experiment was conducted among members of 113 ROSCAs in one district, with 74% female members.¹⁴ Simply providing a safe place to keep money (a metal box) was sufficient to increase preventive health investments by 68% after 12 months. Earmarking the funds for health use (i.e., when the key to the box was kept by the program officer until the individual had achieved his/her savings objective) was only helpful when funds could be used for health emergencies, i.e., health savings accounts (HSAs) administered by ROSCA treasurers. Savings were reduced when funds were earmarked only for preventive health investments because the liquidity cost of tying up money was too great. Providing social pressure and credit through ROSCAs (most of whose members are women) had very large positive effects. In a follow-up survey conducted three years after the treatment began, 39% of the participants who received metal boxes were still using them for savings, 83% of whom reported that they were saving for a specific goal. Similarly, 48% of those who saved with other ROSCA members for a specific preventive health investment reported that they were still doing so, while 53% of those who participated in ROSCA-administered HSAs were still participating in them after three years. Effects were larger among married than among unmarried females, suggesting that intra-household heterogeneity of savings preferences may be a barrier to savings. The study also found evidence that the two ROSCA-based interventions had diffused into several of the control ROSCAs after three years and that the ROSCA discontinuation rate was 23-29% for ROSCAs whose members were provided with a metal box, compared to only 6% in ROSCAs whose members did not receive a box.

Another randomized field experiment in rural Malawi conducted in collaboration with a microfinance institution and two large private agri-business companies provided randomly selected rural smallholders (94% male) with either an ordinary savings account, with direct deposits of sales revenue from the participating agri-businesses, or both an ordinary and a “commitment savings” account that required the funds to remain in the account until a future date selected by the customer (Brune, Giné, Goldberg and Yang 2011). Both treatment and control groups also received information about the benefits of having a

¹⁴ Analysis found that ROSCA members were mostly female and slightly richer and better educated than ROSCA non-members (i.e., the experiment was conducted in a sub-group that was probably more likely to save than the general population).

formal savings account. Only the commitment account treatment group exhibited statistically significant effects that were also significantly larger than the effects among those provided only with an ordinary account, including large positive effects on (1) deposits and withdrawals immediately prior to the next planting season, (2) land under cultivation (+9.8% over the control group) and use of agricultural inputs in the next planting season (+26.2% over the control group), (3) crop sales from the subsequent harvest (+22.0% over the control group), and (4) household expenditures during the post-harvest period (+17.4% over the control group). No gender-specific estimates of effects are reported. However, the study also found evidence suggesting that the positive impact of commitment accounts derives from its ability to prevent savings from being shared with one's social network rather than its ability to prevent account holders from spending their savings prematurely.

Three randomized experiments in the Philippines, Bolivia and Peru tested the effect of sending monthly reminders by text message or letter to individuals who had previously opened savings accounts and established a savings goal for the first year (Karlan, McConnell, Mullainathan and Zinman 2011). In one case (the Philippines), the account was a "commitment savings" account, and the funds could not be withdrawn before the client had reached a pre-set goal or the goal period had elapsed. In the other two countries, no commitment was involved, but the clients were rewarded for sticking to their goal. Overall, savings in the banks sending reminders were 6% higher for clients receiving a reminder (no data were collected on other household savings). However, in Peru, where randomly selected clients were sent a reminder mentioning their savings goal, savings were 16% higher while reminders that did not mention the client's saving goal had no effect.

A randomized experiment was also conducted in a semi-urban area of the Philippines (i.e., the greater Butuan City area) to test the impact of a commitment savings scheme in the Philippines (Ashraf, Karlan and Yin 2006, 2008). Each participating individual in the treatment group was asked to select either a "date" or "amount" savings goal, and was not permitted to open the lock box containing their savings until they had met the goal, except to pay for urgent health care costs (the rural savings bank participating in the project retained the key). The outcomes of interest were household savings and household decision-making. The study found that household savings in the participating bank increased by 81% in the treatment group relative to the control group after one year (without crowding out other savings) and that the intervention led to more decision-making power in the household for women (based on an index of household decision making), plausibly responsible for an observed increase in purchases of female-oriented durable goods. The impact on women's empowerment was concentrated among married women with below-median decision-making power prior to the intervention. However, analysis of bank administrative data 32 months after the intervention found that the estimated increase in savings in the participating bank was only 32% (instead of 81% at 12 months) and was no longer statistically significant (Ashraf, Karlan and Yin 2006). This is one of the few experimental studies that have analyzed the gender impact of savings interventions in detail (Ashraf, Karlan and Yin 2008).

A randomized experiment in Chile among micro-enterprise owners (location unspecified) compared the effects on savings of strong peer group pressure (individuals' savings progress was reviewed at weekly meetings of a microcredit association) to those of an increase in the interest rate (to a 5% real interest rate, compared to the normal rate of 0.3%) relative to a control group (Kast, Meier and Pomeranz 2012). The study found that individuals in the peer pressure treatment group saved 3.5 times more often than

individuals in the control group and that their accumulated savings were twice as high after one year. In contrast, a higher interest rate had almost no measurable effect on savings. The study also tested the effects of text messages one year after the accounts were opened and found that text messages alone had almost as large an effect as peer group pressure. No gender-specific effects are presented in the study (in fact, gender was not even used as a control in the regression models).

A randomized experiment in Nepal offered flexible savings accounts to female-headed households in 19 peri-urban slums around Pokhara with no opening, deposit or withdrawal fees (Prina 2012). After one year, the study found that 80% of those offered the account opened one and used it actively, making an average of 0.8 deposits per week and saving about 8% of their weekly income. After one year, total household assets had increased by 16% (including an increase of 50% in monetary assets), with larger effects observed in the lower and middle asset-ownership groups. The study also found that the intervention had strong positive effects on health and education expenditure.

A randomized experiment in Guatemala offered a new set of commercial savings products to the microfinance borrowers of Guatemala's largest public-sector bank (Atkinson, de Janvry, McIntosh and Sadoulet 2010). The treatments involve varying ways to encourage borrowers to save in conjunction with the loan repayments, i.e., asking them to establish their own monthly savings targets, in one treatment, or suggesting (but not requiring) that they accept the bank's recommendation of a target equal to 10% of their loan repayment, in the other treatment, and prompting them to follow through with their plans each time they make a monthly loan repayment. No financial incentives or penalties were involved in the treatments. The study finds that prompting for savings at the time of loan repayment leads to a doubling of savings deposits relative to the control group, and suggesting a savings deposit equal to 10% of the loan repayment causes savings to double again. Loan repayment and savings also appear to be complementary behaviors. Only a few gender-specific effects are reported in this study, including: (1) that women are significantly more likely to take up the offer of a savings account, and (2) women's accumulated net savings are significantly lower overall.

Cost effectiveness

The Malawi study, which is most relevant to cash-crop farmers who use a centralized marketing system for their products, includes a benefit-cost analysis for an intervention that includes the offer of a commitment savings account and direct deposit of crop proceeds into those accounts (Brune, Giné, Goldberg and Yang 2011). The costs include one-time costs of opening new accounts for each customer and ongoing costs for each deposit or withdrawal a customer is likely to make in the course of one growing season. These costs are estimated to be US\$23.34 per account opened and maintained for one growing season. The estimated cost per customer for time and transportation costs to attend training and to conduct transactions at the bank are \$11.30. Benefits per customer are based on the estimated effect of the intervention on one season's farm profits (\$133.88). The resulting benefit-cost ratio is 3.86.

Sustainability

Only one study (the Kenyan study) provides evidence that the estimated effects were sustained. The Philippine (Ashraf, Karlan and Yin 2006) study presents evidence that the observed effects after one year were not sustained after two and one-half years. Other studies do not present evidence of longer-term

impacts. When these interventions are done with an established rural savings bank, institutional sustainability is probably less of an issue than when it is done with a subsidized microfinance institution. There may be some losers from these interventions (i.e., those participating in the informal savings systems that are supplanted by formal savings schemes). However, the main individuals involved are the women themselves as participants in traditional savings schemes, such as ROSCAs. Accordingly, political sustainability is probably not an issue. Because these interventions do not usually involve significant subsidies, financial sustainability is also not an issue.

Conclusions

The rural savings interventions whose effects have been carefully analyzed appear promising, particularly when women producers are organized into groups who sell their output to a single large buyer (as in the Malawi study). However, broader and longer-term randomized field studies that would measure impact on total household savings and higher-level outcomes, such as women's income, are needed. The evidence on the effectiveness of commitment savings accounts is mixed. In the Kenya study, commitment accounts had a positive impact only when the funds were used to pay for curative health care. Setting funds aside for preventive care appeared to yield too few benefits compared to the cost of reduced liquidity. In the Malawi study, in contrast, only the commitment accounts had a significant impact on outcomes. However, the analysis found that most funds were actually saved in ordinary savings accounts, even in the commitment group, suggesting that the main effect of commitment accounts was to provide an excuse not to share savings with other social network members. In the Philippines, the observed impact on household savings was large after one year, but essentially disappeared after two and one-half years. The findings of the existing studies suggest that commitment savings accounts are likely to have more impact in settings in which intra- and inter-household transfers are an important obstacle to women's savings. The studies in Chile, the Philippines, Bolivia and Peru also suggest that periodic reminders via text messages may be an effective savings intervention, particularly in light of the rapidly increasing availability cell phones in rural areas. Given the generally positive, but limited and relatively narrow evidence on the effectiveness and cost effectiveness of this intervention, it is rated as promising.

3.6 Farmer field schools

Problem

Women are often ignored or under-served by agricultural extension services. As a consequence, they often do not use the most effective cultivation practices (FAO 2011, World Bank 2011a).

Description of the intervention

Farmer field schools (FFS) are a form of adult education based on the belief that farmers learn optimally from field observation and experimentation (Berg 2004). Regular sessions of 20-25 neighboring farmers are typically held between planting and harvest, with some experimentation done by the group.

Expected outcomes

Increased productivity and/or income of female farmer participants in FFS is the main expected outcome. FFS may also have a positive impact on the productivity of neighboring farmers (externalities). A wide range of other outcomes of FFS have also been claimed, including educational, environmental, health, political and social (Braun and others 2006).

Targeting

It is relatively easy to target FFS to women by restricting participation to female farmers. A more subtle, yet effective approach to gender targeting is to focus on crops that are mainly cultivated by women. However, even when FFS are open to both men and women, impressive female participation rates of 50% have been achieved in East Africa (Davis and others 2010). Ensuring high rates of participation of women in FFS requires that the scheduling of sessions be sensitive to women's important time constraints (FAO 2011).

Effectiveness

FAO (2011) reports that FFS “have proved to be a participatory and effective way of empowering and transferring knowledge to women farmers” and that they should therefore be scaled up. However, despite the large number of farmer field schools that have been implemented worldwide, there are very few (if any) rigorous impact evaluations (Davis and others 2010, Feder, Anderson, Birner and Deininger 2010, Brown 2011). Most existing studies are subject to program placement bias (FFS are usually held in areas considered more receptive) and selection bias (FFS often target farmer leaders and skilled farmers) (Feder, Anderson, Birner, Deininger 2010, Brown 2011). There are no randomized experiments of the impact of FFS (Brown 2011). One important impact evaluation in East Africa, based on difference-in-differences (DID) estimates with propensity score matching, argues (incorrectly) that self-selection and the need for community control prevent the use of randomized experiments (Davis and others, 2010). This study found that FFS were particularly beneficial to women, increasing the value of crops produced per acre and agricultural income per capita. However, another oft-cited study in Indonesia, based on DID estimates with panel data, found only a modest impact on the knowledge of FFS graduates and no impact on the knowledge of their neighbors (Feder, Murgai and Quizon 2004). Because there are so few rigorous impact evaluations, it is difficult to determine whether FFS are more or less effective in certain settings.

Cost effectiveness

The cost of farmer field schools has been estimated and reported in some studies (e.g., Zuger 2004, Braun and others 2006). However, probably due to whether or not project costs are included in the estimates, the cost estimates vary greatly and are not comparable (Berg 2006). The absence of any reliable effectiveness estimates precludes the preparation of credible cost-effectiveness or benefit-cost analysis.

Sustainability

FFS have been implemented in many countries by government bureaucracies, NGOs and other organizations in a wide range of settings, so they are clearly technically and institutionally feasible. Implementing FFS by existing government bureaucracies would be expected to be more politically acceptable than implementing them through the private sector. However, if incentives need to be paid to

government workers (which may face political obstacles), it may be cost-effective to implement FFS through the private sector using performance-based contracts. Unfortunately, there is no reliable evidence bearing on this question.

Some have argued that FFS require high initial investments and significant recurrent costs and are therefore not sustainable (Feder, Murgai and Quizon 2004). However, Braun and others (2006) dispute this view. Clearly more comparable cost estimates are needed.

Conclusions

The main weakness of FFS is that their effectiveness in achieving the expected outcomes has not been established through rigorous impact evaluation. Rigorous impact evaluations of FFS that include the preparation of comparable cost estimates and that look at impacts both on FFS participants and their neighbors in a variety of settings, are clearly needed. Positive features of FFS include relative ease in targeting the intervention to women and their demonstrated feasibility. In addition to information on cost and effectiveness, more information is needed on the most sustainable way to implement FFS (e.g., through the existing government bureaucracy or through contracting to NGOs or other private sector entities). Although farmer field schools have been widely implemented throughout the world, with some positive effects observed, this intervention is rated only as promising, reflecting the lack of convincing evidence on its effectiveness and cost effectiveness.

3.7 Improved use of modern agricultural inputs

Problem

Farmers in many developing countries (and particularly female farmers) use less than optimal levels of modern inputs, such as fertilizer and improved seeds (FAO 2011, Peterman, Behrman and Quisumbing 2011).

Description of the intervention

A variety of interventions have been piloted (with several others currently ongoing) to improve the use of modern agricultural inputs. In some cases, the inputs are simply distributed to farmers, usually in combination with regular visits from extension workers. In other cases, incentives are provided (e.g., subsidized prices or subsidized credit), sometimes in combination with savings or advance purchase schemes that make it easier for farmers to purchase the inputs or with crop insurance to reduce the risk of adopting new technologies. More recent interventions have focused on efforts to increase agronomic knowledge among farmers, including the use of social networks to disseminate knowledge.¹⁵

Expected outcomes

The expected outputs are higher female productivity in the activities that use the supported inputs and higher household income overall. It is important to consider the effect of the intervention on total

¹⁵ Abdul Latif Jameel Poverty Action Lab (www.povertyactionlab.org).

household income because of the possibility that other household income-earning activities may be curtailed as the result of higher potential returns in the activities that use the supported inputs.

Targeting

It is relatively easy to target women with this intervention. For example, inputs can be distributed only to female farmers or the supported inputs (e.g., improved seeds) may be specific to crops grown mainly by women. However, there is a risk that inputs like fertilizer can be diverted to male crops.

Effectiveness

There is a comparatively small literature evaluating these schemes. However, there are a number of completed randomized experiments and several more are ongoing.¹⁶ One experiment in a Kenyan district in which only 40% of farmers reported ever having used fertilizer, involved distributing free fertilizer and hybrid seeds to randomly selected farmers and assisting farmers in applying the inputs correctly and harvesting the crop (Duflo, Kremer and Robinson 2008). Different treatments of seeds and fertilizer were applied to different randomly selected plots of each participating farmer. Median increases in yields, compared to comparison plots farmed by the same farmers using traditional methods, ranged from 9% to 49% (depending on the treatment). However, median rates of return were positive only for one of the treatments (i.e., 24% over the season using one-half teaspoon of top dressing fertilizer), underlining the importance of using the correct amount of fertilizer in a given setting (which may also vary from one season to another, depending on rainfall patterns).¹⁷

In another randomized experiment in the same district of Kenya (Duflo, Kremer and Robinson 2009), farmers were offered the chance to purchase a voucher immediately after the harvest (one randomly selected group), a voucher at a later time of their choosing (a second group), fertilizer at the regular price (with free delivery) 2-4 months after the harvest (a third group), or fertilizer at a 50% subsidy (with free delivery) 2-4 months after harvest (a fourth group). Fertilizer use increased significantly in three of the four groups (from 14-22 percentage points, on a base of 23 percentage points), with the third group being the exception.

Another randomized experiment in Malawi sought to increase the use of high-yielding hybrid maize and groundnut seeds by offering two different randomly selected groups of farmers either credit to purchase the seeds or credit plus a requirement to purchase rainfall insurance at an actuarially fair rate (Giné and Yang 2009). Take up was 33% among the first group and 13% lower among the second group. The authors suggest that take up was less by farmers in the second group either because they did not feel the need for insurance, given the limited liability inherent in the loan contract, or possibly because the offer of insurance may have signaled to farmers that the seeds were a risky investment (see discussion of crop insurance below).

¹⁶ The website of the Abdul Latif Jameel Poverty Action Lab (www.povertyactionlab.org) is a good source of information on both completed and ongoing field experiments.

¹⁷ One of the treatments was based on the standard advice of the Ministry of Agriculture. Although this treatment achieved the highest median increase in yields, it achieved the lowest median rate of return (-49%).

Aside from the small number of completed evaluations, the main limitation of evaluations of the effectiveness of these interventions is that they focus exclusively on intermediate outcomes, i.e., input use and crop yields. They do not look at overall labor productivity, income or consumption. This is an important limitation because the typical farm household has multiple sources of income. Another important limitation of the evaluations is that they do not focus at all on gender. No information is provided on gender-specific effects.

Cost effectiveness

There is almost no information on the cost of interventions designed to improve the use of modern agricultural inputs. However, the study of the impact of fertilizer subsidies in Kenya (Duflo, Kremer and Robinson 2009) provides benefit-cost estimates of both small, time-limited subsidies and large subsidies that suggest that the former are robustly preferable to a do-nothing (*laissez-faire*) alternative, whereas the benefit-cost estimates for heavier subsidies are more sensitive to the parameter estimates and assumptions. However, costs in this study are limited to the deadweight cost of the government revenue needed to finance the subsidies. They do not include administrative and support costs (there was no indication that more farmer labor was required by the intervention).

Sustainability

A key question for sustainability is whether increased use of agricultural inputs continues after subsidies and other incentives are withdrawn. Such an outcome would be expected if increased use of inputs leads to knowledge of their effectiveness. However, the binding constraints may be the inability to save or manage risk or lack of agronomic knowledge to take advantage of increased inputs. One ongoing study in Mozambique by Michael Carter, Rachid Laajaj and Dean Yang is studying the effect of combining free fertilizer vouchers with alternative savings schemes.¹⁸

Another important consideration is whether subsidies may be difficult to remove, once introduced. This argues for the use of small, time-limited subsidies, such as those used for groups 1 and 2 in the second Kenya study described above rather than the 50% subsidy provided to group 4 (Duflo, Kremer and Robinson 2009).

Conclusions

One important drawback of the interventions designed to improve farmer use of modern inputs is the absence of information on their impact on higher-level outcomes such as total farm income or other measures of household welfare, as well as the very limited information on their cost effectiveness and sustainability. Increasing input use may not lead to higher incomes if the inputs are not used properly or if local conditions are such that the apparent under-utilization is in fact profit maximizing, given the constraints actually facing a given group of farmers in a given locality. Limited access to cash or credit may also prevent increased use of modern inputs. High risk due to highly variable rainfall or crop prices may also be an important barrier to the use of more modern inputs. Accordingly, these types of interventions need to be field tested carefully in the areas where they are to be used (including the

¹⁸ Abdul Latif Jameel Poverty Action Lab (www.povertyactionlab.org).

possible sensitivity of impacts to seasonal variations in climate), and there should be adequate technical support provided to farmers, through either government extension agents or NGOs, to ensure that the inputs are applied properly, as well as access to credit and crop insurance, if needed. Based on the limited evidence of effectiveness, cost effectiveness and sustainability, these interventions are rated only as promising.

3.8 Crop insurance

Problem

Farmers are subject to considerable risk of crop failure from one growing season to the next, particularly in areas where crops are rainfed rather than irrigated. They are also frequently subject to additional risk from fluctuations in crop prices. Farmers receive incomplete insurance against these risks from informal risk-sharing networks, particularly if such networks are unable to indemnify against aggregate risk (as opposed to farmer-specific losses). It has been suggested that this risk is an important barrier to agricultural investment (FAO 2011).

Description of the intervention

Crop insurance includes both rainfall insurance and crop price insurance. Formal rainfall insurance is usually based on official index of rainfall in a given local area, with the insurance paying out when annual rainfall is below a certain minimum level (signaling drought) or above a certain maximum level (signaling flooding). One problem is that, even with formal index-based rainfall insurance, there is a risk of mismatches between payouts and actual losses due to the remote location of the rainfall gauge (sometimes referred to as “basis risk”). Informal risk that is able to cover such idiosyncratic losses can enhance the benefits of formal index-based insurance (Mobarak and Rosenzweig 2012). When rainfall insurance is based on an exogenous, publicly observable index, problems of moral hazard and adverse selection that are common to insurance schemes that indemnify individual losses are unlikely to arise.

Crop price insurance partially indemnifies farmers against abnormally low crop prices. It has been used less widely than rainfall insurance.

Expected outcomes

Increased agricultural investment and agricultural income among female farmers by encouraging the cultivation of higher-yielding, riskier crops.

Targeting

Gender targeting is feasible by offering coverage only (or on more favorable terms) to female farmers. Indirect targeting can be achieved by selectively covering losses of crops that are grown predominantly by women or are used predominantly for home consumption. It is important that cash indemnities be paid to women (or placed in a savings account from which only they can withdraw the funds) in settings in which women have little power within the household. In the case of crops grown by women or for home consumption, it may be useful (although more expensive) to indemnify in kind rather than in cash.

Effectiveness

The available evidence indicates that the take-up rates for crop insurance are very low, even when the insurance is offered at actuarially fair prices that do not cover administrative costs (Mobarak and Rosezweig 2012, Giné and Yang 2009). One possible explanation for this apparent anomaly is that risks are already covered through informal risk-sharing mechanisms. Mobarak and Rosenzweig (2012) used a randomized experiment in rural India from three states (Andhra Pradesh, Uttar Pradesh and Tamil Nadu) to assess the effects of basis risk and informal risk-sharing on the demand for crop insurance. They found that access to informal risk-sharing against *aggregate* losses reduced the take-up rate for formal index-based rainfall insurance, whereas access to informal risk-sharing against *individual* losses increased the take-up rate in the presence of basis risk (i.e., when households were located some distance from rainfall gauges). Using additional follow-up data collected only in Tamil Nadu, they also found that households offered formal index-based rainfall insurance at randomly determined discounted prices tended to plant a portfolio of rice varieties that were higher yield but less drought resistant. Although data on crop revenue and costs were collected, they are not reported. No gender variables were specified in any of the models, and no gender-specific information on the take-up rate (about 40% overall) or on any other outcomes is provided.

There are two other randomized experiments of the demand for formal index-based rainfall insurance in India. Cole and others (2010) conducted an experiment in Andhra Pradesh and Gujarat, India in which rainfall insurance was offered to randomly selected farmers at different discounted prices. They found that take up was strongly related to price, with estimated price elasticities ranging between -0.66 to -0.88. They also found evidence of cash constraints and distrust of the insurer as important barriers. Although gender was included in the models, the results were not reported. Gaurav, Cole and Tobacman (2011) conducted a separate experiment in Gujarat, India in which randomly selected farmers were offered a rainfall insurance product, including some randomly selected farmers who were offered the product with a money-back guarantee (the equivalence of a 60% price discount). A randomly selected half of the sample were also given financial literacy training in two 3-hour sessions. They found that the training significantly increased take-up by 8.1 percentage points (compared to a base take-up rate of 8%), while the price discount significantly increased take-up by 6.9 percentage points.

In an evaluation conducted in Eastern Ghana, randomly selected growers of maize and eggplant were offered loans with or without crop price insurance and financial literacy training (Karlan, Kutsoati, McMillan and Udry 2011). Take-up rates were high (i.e., 92% of farmers offered loans with crop price insurance and 86% of farmers offered loans only). There was some evidence that crop price insurance led to the use of more chemical inputs, the planting of more eggplants than maize, and a greater likelihood of bringing their produce directly to markets rather than selling to middle-men (who offer guaranteed purchase contracts at lower prices locked in before harvest). Gender did not have a statistically significant effect on loan take-up (gender-specific information on other outcomes was not reported). The high loan take-up rate in the absence of crop price insurance suggests that crop price uncertainty may not be as important a barrier to investment as the researchers expected it to be.

Cost effectiveness

Gaurav, Cole and Tobacman (2011) include some cost estimates in their study. Basic cost estimates include the cost of the training course (US\$3.33 per person trained) and the cost of a marketing visit (US\$2.20). They estimated that the cost per policy sold of the financial literacy training was \$US62.83,¹⁹ whereas the cost per policy sold with the money-back guarantee was \$US43.62.²⁰ In both cases, the cost of marketing a policy exceeds by a substantial margin the premium charged for the insurance (US\$18). Although seemingly high, the authors observe that the costs of marketing a rainfall policy may not be so high if compared to the costs of expensive relief services in the event of a severe drought.

Sustainability

The idea behind the subsidies provided to encourage the purchase of crop insurance is to overcome initial reluctance of farmers to purchase crop insurance. If this initial reluctance can be overcome, perhaps by combining crop insurance with other interventions such as credit, the subsidies might no longer be necessary. Crop insurance is currently being offered commercially in India and some other countries. However, it is unclear whether it has ever been profitable, given the low take-up rates (i.e., it may be cross-subsidized in some cases by profits from the other products sold by the same insurer).

Conclusions

Low take-up rates for formal index-based rainfall insurance appear to be due partly to the complexity of the product and partly to other barriers (cash constraints or the effective coverage of informal insurance mechanisms). The currently available evidence suggests that these barriers can be partially overcome with financial literacy training and subsidies, but even with such measures take-up rates remain low. Although crop insurance may be cost-effective in some settings as a social protection intervention, there is only weak evidence that crop insurance stimulates additional agricultural productivity, which is the rationale for supporting it in the context of this paper. Accordingly, this intervention is rated as doubtful.

3.9 Mobile phones

Problem

One of the most serious constraints facing rural women is their limited time (World Bank 2011a, FAO 2011). Rural women tend to work very long days balancing a variety of tasks, such as crop and livestock production, wage employment, child care, care of the sick and elderly, and other household-related activities (e.g., food preparation, water and firewood collection). These tasks limit their ability to participate in more productive work, recreation or leisure or to accomplish tasks that require time-consuming travel. In some settings, women also face social constraints that limit their ability to travel.

¹⁹ The point estimate of the effect on take up of a financial education invitation is 0.053, yielding a cost per policy sold of $\$3.33/0.053=\62.83 .

²⁰ The point estimate of the effect of a money-back guarantee is 0.069, implying an outreach cost of \$32.03 per policy sold. The policy is expected to pay out 40% of the time, at an estimated cost of \$11.59 (including a \$2 administrative fee). The total cost is $\$32.03+\$11.59=\$43.62$. However, it is noted that the pay-out from the money-back guarantee is a transfer, not a cost, because it does not involve the use of any productive resources (apart from the administrative costs incurred in making the payout).

Description of the intervention

Modern technological innovations, such as mobile phones, prepaid phone cards and biometric cards, have the potential to reduce rural women's need to travel long distances to obtain market information or to conduct financial transactions, potentially raising the effectiveness of interventions such as labor market interventions, rural savings schemes, conditional cash transfers, agricultural extension, health interventions and migration (Aker and Mbiti 2010). For example, Kenya's successful "m-money" system M-Pesa, which is widely used for domestic payments and remittances, has recently partnered with a local bank to provide interest-bearing savings accounts and insurance.

Expected outcomes

The main expected outcomes from the expanded use of mobile phones by rural women are increases in women's labor productivity and earnings or time savings that can potentially be turned into increased productivity and earnings, recreation or leisure. Increased use of mobile phones may also result in resource savings, improved health and other desirable outcomes such as increased household savings, increased and more timely remittances, insurance protection and more effective consumption smoothing.

Targeting

The use of mobile phones to obtain market information or to conduct financial transactions is typically higher in upper-income groups and among males (Duncombe and Boateng 2009, Aker and Mbiti 2010, Mbiti and Weil 2011). This suggests that any general subsidies provided to "m-money" schemes might be largely captured by rich males. However, when "m-money" services are subsidized in connection with other effectively targeted interventions, such as conditional cash transfers, targeting is likely to be more effective. For example, in Niger's unconditional cash transfers program, both transfers and mobile telephones were distributed to poor rural women (Aker 2011).

Effectiveness

The effectiveness of mobile phones in facilitating access to market information in agriculture and fisheries, leading to less dispersion in local market prices and consequent welfare gains, has been well documented (Abraham 2007, Jensen 2007, Aker 2008, Muto and Yamano 2008). Less is known about their impact on labor market outcomes or their effectiveness in facilitating financial transactions using "m-money" (Duncombe 2009, Aker and Mbiti 2010, Aker and Mbiti 2010). In particular, only a few randomized experiments have been conducted to assess the impact of mobile phone interventions.

Most evaluations of the impact of "m-money" have relied on either fixed-effects estimation using panel data or instrumental variables estimation. For example, a study on rural South Africa that used topographical terrain properties²¹ as an instrument for the timing of network coverage in a locality found that employment increased by 15 percentage points after a locality received network coverage, with most

²¹ According to local engineers, the cost of mobile phone coverage is U-shaped with respect to the degree of terrain ruggedness, with the lowest costs observed in areas with moderately rugged terrains.

of the effect concentrated in additional female employment (Klonner and Nolen 2008). Although the study found no evidence of an effect on average household income or on the incidence of moderate poverty, it did find significant effects on household income among households with no children (positive) and on severe poverty (negative).

Kenya's M-Pesa service is one of the most successful and widely studied "m-money" schemes. Introduced by Kenya's largest mobile phone operator (Safaricom) to facilitate domestic money transfers (mainly urban to rural remittances from migrants), both the number of users and the amount of money transferred has grown explosively (Mbiti and Weil 2011). With service initiated in March 2007, the number of registered users and cumulative amount of money transferred had grown to 8.5 million and US\$3.7 billion by September 2009. M-Pesa is now also widely used as a means of payment and has recently partnered with a local bank to provide interest-bearing savings accounts. Although no highly credible impact analysis of M-Pesa is yet available, data from the 2009 FinAccess Survey indicate that 26% of M-Pesa's users also use the service for saving, including 35% of banked users and 19% of unbanked users (Mbiti and Weil 2009).²²

One randomized experiment in Niger examined the impact of using mobile phones to provide unconditional cash transfers to the targeted beneficiaries of a drought-relief program (Aker and others 2011). The design of the study was able to separate the impact of using "m-money" from that of providing mobile phones. The results indicate that use of mobile phone technology reduced the variable costs of the program both to the implementing agency and to the recipients.

Several initiatives have been undertaken in recent years to use mobile phone technologies to provide information to rural farmers on cultivation practices, pests and disease management, and weather conditions using voice or text messaging (Aker 2011). It is hoped that these interventions can provide a "shot in the arm" to existing agricultural extension systems, which are often viewed as ineffective. Unfortunately, there is little reliable information currently available on the effectiveness of these mobile phone interventions.

Cost effectiveness

The Niger study includes cost-effectiveness analysis, comparing the cost per recipient of a cash transfer to an "m-money" transfer (Aker 2011). The cost per recipient was \$12.76 in the control villages and \$13.65 in the treatment villages. However, excluding the cost of the mobile phone, the cost per recipient was \$8.80 in the treatment villages. The monthly transfers of \$45 were provided over a 5-month period corresponding to the dry season. The estimated value of the time savings per recipient in the treatment

²² Mbiti and Weil (2011) estimate the impact of M-Pesa on the frequency of sending and receiving remittances, household savings, employment, bank use and several other financial outcomes using panel data on 190 sub-locations (clusters of 2-3 villages). Both fixed- and random-effects estimates are obtained, and the results indicate that M-Pesa has significant positive effects on several outcomes. Jack and Suri (2011) also use panel data to estimate the impact of M-Pesa on consumption smoothing, using household proximity to the M-Pesa network as an instrument to test the robustness of their results. They conclude that access to M-Pesa increases a household's ability to smooth consumption in response to a negative income shock.

villages was \$0.91.²³ On the basis of these estimates, the “m-money” intervention was judged to be cost-effective.

Use of a mobile phone can also be a cost-effective way to obtain market information (Aker and Mbiti 2010, Aker 2011). For example, providing market information via SMS text messages in Niger has been estimated to cost less than providing the same information via an extension visit and about the same as providing it via radio (Aker 2011). However, the cost-effectiveness of mobile phone technology depends not only on the cost of alternative media but also on the capital and recurrent cost of mobile phone service. The available evidence suggests that mobile phone costs are lower in more competitive telecommunications markets (Aker and Mbiti 2010).

Sustainability

Political sustainability can be an obstacle to the introduction of new technologies that involve “creative destruction,” i.e., the replacement of existing technologies. For example, M-Pesa “m-money” transfers have effectively replaced the use of formal alternative money transfer services in Kenya (i.e., post-office, bus companies, Western Union and Moneygram). However, the response of competitors has been to lower their prices (Mbiti and Weil 2011). In one case (Western Union), the response has been to partner with M-Pesa to facilitate overseas remittances. Still, commercial banks were initially opposed to M-Pesa and lobbied the government unsuccessfully to regulate it and other “m-money” systems under the commercial banking regulations.

Conclusions

The introduction of mobile phones appears promising as an intervention to increase rural women’s labor productivity and earnings by improving access to information and by reducing the time needed to conduct financial transactions. “M-money” interventions, for example, appear to be cost-effective in areas where the necessary communications infrastructure exists and where users (or at least one household member) are literate. However, there is currently only limited information on the effectiveness, cost effectiveness and sustainability of mobile phone interventions. Accordingly, they are rated only as promising.

3.10 Improved cooking stoves

Problem

The technology used by rural women in their work, both inside the home and in the fields, is often traditional and poorly adapted to women’s needs (IFAD 1998). One important example is the widespread use of traditional cooking stoves, which expose mainly women and children to elevated levels of indoor air pollution with consequent serious health effects (Duflo, Greenstone and Hanna 2008). It has been estimated that about 2 million deaths—mostly women and children—occur annually due to exposure to indoor cooking smoke (World Bank 2011b).

²³ The study actually presents a cost-benefit analysis, with program benefits including additionally the market value (\$5) of additional okra grown in the treatment villages (without an estimate of its cost).

Description of the intervention

Tens of millions of improved cooking stoves have been distributed by governments, NGOs and donors in China, India, Bangladesh, Kenya and other countries (Duflo, Greenstone and Hanna 2008, Miller and Mobarak 2011). In September 2010 Hillary Clinton announced the formation of the Global Alliance for Clean Cookstoves, which calls for 100 million additional homes to adopt clean and efficient stoves and fuels by 2020. Improved cooking stoves are generally subsidized by governments, NGOs or donors, who typically provide assistance with installation and training in their correct use.

Expected outcomes

The main expected outcome from the use of improved cooking stoves is improved health of women and children with attendant increases in women's labor productivity or children's school attendance. Use of improved cooking stoves may also result in reduced fuel consumption (and the time required to collect it) and reduced cooking time.

Targeting

Because cooking is an activity that is typically performed by women and girls, an intervention that promotes the use of improved cooking stoves is effectively targeted to women. Because biofuels are mainly used by the rural poor for cooking, the benefits of improved cooking stoves can be expected to be received mainly by the poor. There is little concern that the benefits of these interventions can be captured by men or by upper-income groups.

Effectiveness

Although many studies have found a significant correlation between use of an improved stove and health outcomes (Duflo, Greenstone and Hanna 2008), there is very little reliable information indicating whether the provision of these stoves is a cost-effective intervention to improve women and children's health and productivity/school attendance. One exception is a randomized experiment in Orissa State of India (one of India's poorest states) to test the impact of improved stoves on human health, labor productivity and people's exposure to indoor air pollution (Hanna, Duflo and Greenstone 2012). The study tracked households for up to four years after they received an improved stove. The results indicate that there was a significant reduction in smoke inhalation in the first year but no effect in subsequent years. The reason for the difference is that households failed to use the stoves regularly or appropriately (i.e., place the pots on the openings correctly and cover the second pot opening when it is not in use), did not make the necessary investments to maintain them properly (i.e., repair cracks and remove chimney obstructions), with the result that use decreased over time.²⁴ No change was observed in lung functioning, health, or fuel consumption, although the stoves had been shown to reduce indoor air pollution and require less fuel in laboratory tests.²⁵

²⁴ In another RCT in Ghana, Burwen and Levine (2012) report that only about half of improved cooking stoves showed evidence of having been used recently after only 8 months.

²⁵ Another randomized experiment on the effect of improved cooking stoves conducted in Guatemala, i.e., the RESPIRE experiment (Smith et al. 2007), obtained more positive results for a few of the monitored health indicators. However, this experiment was conducted under conditions approaching laboratory conditions (i.e., stoves

A randomized experiment in Bangladesh sought to assess the relative importance of four barriers to the adoption of improved cooking stoves in two rural districts of Bangladesh: (1) price, (2) lack of information about the health effects of cooking with traditional stoves, (3) gender differences in preferences about alternative stoves (when women have little intra-household bargaining power), and (4) aversions to changes in traditional practices (Miller and Mobarak 2011). The experiment involved providing randomly selected women and men with information about the health effects of cooking with traditional and improved stoves. Either women or men (randomly selected—the interviews were conducted separately) were then offered two alternative improved stoves, one that was more efficient (reduced cooking time and reduced fuel consumption) and one that was healthier (equipped with a chimney) at no cost, at a heavily subsidized price or at full cost. The results indicate that when women are offered an improved stove at no cost, they are 6% more likely to accept the offer than men, and that they are also 6% more likely to choose the healthier stove over the efficient stove. However, when a price is charged for the stoves (about \$1 for the efficient stove and about \$5 for the chimney stove), women are no longer more likely to accept the offer and they are more likely than men (by about 15 percentage points) to shift away from the costlier chimney stove, indicating that women are more liquidity-constrained than men. When households were offered the stoves at full cost, demand was very low. Households were permitted to refuse their selected stoves when delivered, and many did. Households in which the offer of a free stove was made to women instead of men were 4% more likely to refuse their stove at the time of delivery. The study concludes that women and men have different preferences regarding cooking stoves, but women are unable to act on those preferences when a positive price is charged for improved stoves or when their choice can subsequently be undone by their husband.

Cost effectiveness

There are no studies of the cost effectiveness or the benefits and costs of interventions to support the use of improved cooking stoves. The main obstacle to preparing such estimates is the absence of reliable estimates of effectiveness. The Orissa study described above is the only study that provides reliable estimates of effectiveness, which are close to zero.

Sustainability

In cases where the introduction of modern technologies are expensive and/or require recurring expenditure for use or maintenance, decisions regarding the allocation of household resources become important, and particularly the perceived intra-household distribution of the benefits and costs of adopting the new technology (Miller and Mobarak 2011, Clancy, Winther, Matinga and Opraraocha 2011). Traditional aversion to change may also impede the adoption or sustainability of a new technology. Most of the improved cooking stoves that have been distributed were free or heavily subsidized. When full-cost stoves are offered, particularly in low-income rural areas, the take up is typically much lower (Okello 2005, Miller and Mobarak 2011). Even with free stoves, the take up (and use) rate is typically well below 100% (Miller and Mobarak 2011, Hanna, Duflo and Greenstone 2012). The possibility of subsidizing improved cooking stoves with carbon credits depends on whether they can be shown in actual settings to

were checked weekly to ensure that they were functioning properly and being used correctly) with a substantially more expensive stove, and follow-up was limited to 18 months. For details, see the discussion in Hanna, Duflo and Greenstone (2012).

have any effect on fuel use, which has not yet been demonstrated. The Orissa study shows the importance of examining medium- and longer-term effects, which often show a decrease over time in the use of newly introduced technologies.

Conclusions

There is currently only limited reliable information on the effectiveness of improved cooking stoves in real-world conditions. The only study that has obtained such estimates is not encouraging. However, it is limited to one geographical area, and it is unclear that the same results would be obtained in a different setting (for example, where women have more influence on intra-household decision making and where there is less resistance to change in traditional cooking methods). Accordingly, additional credible studies are needed in other geographical areas. At this point, however, the available evidence indicates that interventions to provide improved cooking stoves are of doubtful cost effectiveness.

4. Overall conclusions

4.1 What works and under what circumstances?

Table 2 lists the ten interventions reviewed in this paper, indicating whether they are rated as proven, promising, doubtful or ineffective. An intervention is rated as “proven” when it has been found to be both effective and cost-effective and sustainable in a wide range of settings and when at least some of the impact estimates are based on carefully designed, implemented and analyzed randomized field experiments. An intervention is rated as “promising” when the credible evidence is generally positive, but not yet convincing in terms of its breadth. An intervention is rated “doubtful” when the credible evidence indicates that the intervention is ineffective in most settings for which credible evidence exists, but not necessarily in all settings. An intervention would be rated “ineffective” if it were found to be ineffective, cost-ineffective and unsustainable in a wide range of settings and with at least some of the impact estimates based on carefully designed, implemented and analyzed randomized field experiments (none of the ten interventions meet these criteria). The reasons for the ratings of individual interventions are summarized in the “Conclusions” sub-section of the reviews of each intervention in Section 3.

Table 2. Which interventions are most likely to work?

Intervention	Rating
Conditional cash transfers	Proven
Land registration	Promising
Rural electrification	Promising
Microcredit	Doubtful
Rural savings	Promising
Farmer field schools	Promising
Improved use of modern agricultural inputs	Promising
Crop insurance	Doubtful
Mobile phones	Promising
Improved cooking stoves	Doubtful

Table 3 summarizes the information based on the reviews in Section 3 on the circumstances in which the ten interventions are more likely to be workable (i.e., effective, cost-effective and sustainable).

Table 3. What are the circumstances under which the interventions are most likely to be workable?

Intervention	Circumstances
Conditional cash transfers	Good physical and social access of girls to good-quality schools; where girls' secondary schooling attainment is low due to high drop-out rates; where discount rates are relatively low (because benefits are delayed and cumulate over many years)
Land registration	Where there is a substantial risk of land expropriation; where there are attractive opportunities for land-related investments; and where land and financial markets are relatively developed.
Rural electrification	Where high percentages of households are not connected in electrified communities; where women participate in household decision-making; where households are able to purchase at least some time-saving appliances, where opportunities for work outside the home or micro-enterprise development exist.
Microcredit	Where women are active participants in household economic activities and where there are opportunities for profitable micro-enterprises; where microfinance institutions are able to operate without subsidies.
Rural savings	Where women producers are organized into groups who sell their output to a single large buyer; where social obligations to share income and wealth are important barriers to individual saving; where access to mobile phones is high
Farmer field schools	No reliable information available.
Improved use of modern agricultural inputs	Where use by women of modern inputs is low; where effective public or private extension services are available to women; where low-income women have savings or access to credit.
Crop insurance	Where there is high seasonal volatility in rainfall in areas where crops are mainly rainfed or in crop prices; where informal risk-sharing networks are relatively weak or ineffective
Mobile phones	Where the necessary communications and financial infrastructure exists; where most users (or at least one household member) are literate.
Improved cooking stoves	Where women participate in household decision-making; where resistance to change in traditional cooking methods is limited.

4.2 What are the research priorities?

Some of the paper's findings suggest some research priorities. Firstly, surprisingly few of the impact evaluations provide information on: (1) gender-specific effects, (2) high-level outcomes such as household income and gender empowerment versus intermediate outcomes such as crop yields, (3) longer-term outcomes (effectiveness is typically assessed after only one year), or on (4) economic costs. The absence of estimates of comparable gender-specific effects on higher-level outcomes (e.g., women's income, household expenditure or ownership of durables, particularly those used relatively more by women, or gender empowerment) and costs prevents the systematic use of cost-effectiveness analysis to help in identifying what works.²⁶ Clearly more high-quality randomized field experiments are needed, especially for such promising interventions as mobile phones, rural electrification, rural savings, improved use of modern agricultural inputs, as well as some widely supported interventions for which little is known about their effectiveness (e.g., farmer field schools, land registration). It would be more cost-effective at this time to invest in obtaining more information about the effectiveness, cost effectiveness and sustainability of these (and possibly other) interventions than to invest large sums in the interventions themselves. Funding to obtain such information could be leveraged effectively by targeting it to addressing the previously identified *gaps* in existing impact evaluations. Most of the good-quality impact evaluations are currently prepared by academic researchers, who often have to use multiple sources of funding to support each study. Providing additional support in return for information on the gaps discussed above would probably be welcomed by many researchers.

A second finding of this review, which is disturbing, is that there appears to be a serious disconnect between the claims made for several interventions in the broader development literature and the actual evidence of their effectiveness. It is not comforting to know that so much money has been invested (and is still planned to be invested) in interventions such as microcredit, farmer field schools, crop insurance, and improved cooking stoves in the absence of solid information about their effectiveness, cost effectiveness and sustainability. How this could happen and why is itself an important research question that could yield valuable insights.

References

- Abraham, Reuben. 2007. "Mobile phones and economic development: evidence from the fishing industry in India," *Information Technologies and International Development* 4(1):5-17.
- Agarwal, Bina. 2003. "Gender and Land Rights Revisited: Exploring New Prospects via the State, Family and Market," *Journal of Agrarian Change* 3(1-2):184-224.

²⁶ Examples of the systematic use of cost-effectiveness analysis applied to a wide range of interventions for selected outcomes (e.g., primary schooling attainment) can be found at the Abdul Latif Jameel Poverty Action Lab website (www.povertyactionlab.org).

- Aker, Jenny. 2008. "Does digital divide or provide? The impact of cell phones on grain markets in Niger." BREAD Working Paper No. 177, University of California, Berkeley (January).
- Aker, Jenny and Issac M. Mbiti. 2010. "Mobile Phones and Economic Development in Africa," *Journal of Economic Perspectives* 24(3):207-232.
- Aker, Jenny C. 2011. "Dial 'A' for Agriculture: A Review of Information and Communication Technologies for Agricultural Extension in Developing Countries." Working Paper 269, Center for Global Development (September).
- Aker, Jenny C., Rachid Boumnijel, Amanda McClelland and Niall Tierney. 2011. "Zap It to Me: The Short-Term Impacts of a Mobile Cash Transfer Program." Working Paper 268, Center for Global Development (September).
- Andrabi, Tahir, Jishnu Das and Asim Ijaz Khwaja. 2009. "Report Cards: The Impact of Providing School and Child Test-Scores on Educational Markets." Processed, Pomona College (October).
- Ahlin, C., J. Lin and M. Maio. 2010. "Where Does Microfinance Flourish? Microfinance Institution Performance in Macroeconomic Context," *Journal of Development Economics* 95(2):105-120.
- Ahuja, Amrita, Michael Kremer, and Alix Peterson Zwane. 2010. "Providing Safe Water: Evidence from Randomized Evaluations." Processed, Harvard University (April).
- Ali, Daniel Ayalew, Klaus Deininger and Markus Goldstein. 2011. "Environmental and Gender Impacts of Land Tenure Regularization in Africa: Pilot Evidence from Rwanda." Policy Research Paper 5765, Washington DC: The World Bank (August).
- Angrist, Joshua D., Eric Bettinger, Erik Bloom, Elizabeth King and Michael Kremer. 2002. "Vouchers for Private Schooling in Colombia: Evidence from a Randomized Natural Experiment," *American Economic Review* 92(5):1535-59.
- Angrist, Joshua D., Erik Bettinger, and Michael Kremer. 2006 "Long-Term Educational Consequences of Secondary School Vouchers: Evidence from Administrative Records in Colombia." *American Economic Review* 96(3):847-862.
- Aryeetey, Ernest and Christopher Udry. 2010. "Creating Property Rights: Land Banks in Ghana." Processed, Brookings Institution, Washington DC.
- Ashraf, Nava, Dean Karlan and Wesley Yin. 2006. "Household Decision Making and Savings Impacts: Further Evidence from a Commitment Savings Product in the Philippines." Center Discussion Paper No. 939. Economic Growth Center, Yale University, New Haven CT (June).
- Ashraf, Nava, Dean Karlan and Wesley Yin. 2008. "Female Empowerment: Impact of a Commitment Savings Product in the Philippines." Processed, Harvard Business School, Cambridge MA (March).
- Atkinson, Jesse, Alain de Janvry, Craig McIntosh and Elisabeth Sadoulet. 2010. "Creating incentives to save among microfinance borrowers: a behavioral experiment from Guatemala." Processed, University of California at Berkeley (December).
- Attanasio, Orazio, Adriana Kugler and Costas Meghir. 2011. "Subsidizing Vocational Training for Disadvantaged Youth in Colombia: Evidence from a Randomized Trial," *American Economic Journal: Applied Economics* 3:188-220.
- Attanasio, Orazio, Costas Meghir, and Ana Santiago. 2011. "Education Choices in Mexico: Using a Structural Model and a Randomized Experiment to Evaluate PROGRESA," *Review of Economic Studies* 79:37-66.
- Attanasio, Orazio, Britta Augsburg, Ralph De Haas, Emla Fitzsimons and Heike Harmgart. 2011. "Group lending or individual lending? Evidence from a randomized field experiment in Mongolia." Working Paper No. 136, European Bank for Reconstruction and Development, London.

- Baird, Sarah, Craig McIntosh, and Berk Özler. 2011. "Cash or Condition? Evidence from a Cash Transfer Experiment." Processed, George Washington University, Washington DC (February).
- Banerjee, Abhijit V., S. Cole, E. Duflo and L. Linden. 2007. "Remedying education: evidence from two randomized experiments in India," *Quarterly Journal of Economics* 122(3):1235-1264.
- Banerjee, Abhijit V., Esther Duflo, Rachel Glennerster, and Cynthia Kinnan. 2010. "The miracle of microfinance? Evidence from a randomized evaluation." Cambridge, MA: J-PAL and MIT (June)
- Banerjee, Abhijit V., Esther Duflo and Raghavendra Chattopadhyay. 2010. "Targeting the Hard-Core Poor: An Impact Assessment." Mimeo, Massachusetts Institute of Technology (October).
- Banerjee, Abhijit V. and Esther Duflo. 2011. *Poor Economics: A radical rethinking of the way to fight global poverty*. New York: Public Affairs.
- Barham, Bradford, Stephen Boucher, and Michael R. Carter. 2008. "Are Land Titles the Constraint to Enhance Agricultural Performance? Complementary Financial Policies to Crowd-in Credit Supply and Demand in Risk-Constrained Rural Markets." Processed, University of Wisconsin, Madison.
- Barrera-Osorio, Felipe, Marianne Bertrand, Leigh L. Linden, and Francisco Perez-Calle, "Improving the Design of Conditional Transfer Programs: Evidence from a Randomized Education Experiment in Colombia," *American Economic Journal: Applied Economics* 3:167-195.
- Bauchet, Jonathan, Cristobal Marshall, Laura Starita, Jeanette Tomas and Anna Yalouris. 2011. "Latest Findings from Randomized Evaluations of Microfinance." Access to Finance Forum, No. 2, Report to CGAP and its Partners. Washington DC: The World Bank (December).
- Beaman, Lori, Esther Duflo, Rohini Pande and Petia Topalova. 2012. "Female Leadership Raises Aspirations and Educational Attainment for Girls: A Policy Experiment in India," *Science* 335(6088):582-586.
- Behrman, Jere, Susan Parker and Petra Todd. 2009. "Schooling Impacts of Conditional Cash Transfers on Young Children: Evidence from Mexico," *Economic Development and Cultural Change* 57(3):439-478.
- Behrman, Jere, Susan Parker and Petra Todd. 2011. "Do Conditional Cash Transfers for Schooling Generate Lasting Benefits? A Five-Year Follow-Up of *PROGRESA/Oportunidades*," *Journal of Human Resources* 46(1):93-122.
- Bernard, Tanguy and Maximo Torero. 2011. "Randomizing the 'Last Mile': A Methodological Note on Using a Voucher-Based Approach to Assess the Impact of Infrastructure Projects." IFPRI Discussion Paper 01078, International Food Policy Research Institute, Washington DC (March).
- Bernard, Tanguy and Maximo Torero. 2012. "Bandwagon Effects in Poor Communities: Experimental Evidence from a Rural Electrification Program in Ethiopia." Processed, International Food Policy Research Institute (February).
- Berg, Henk van den. 2004. "IPM Farmer Field Schools: A synthesis of 25 impact evaluations." Report prepared for the Global IPM Facility, Wageningen University, Netherlands (January).
- Berlinski, Samuel, Sebastian Galiani and Patrick J. McEwan. 2008. "Preschool and Maternal Labor Market Outcomes: Evidence from a Regression Discontinuity Design." IFS Working Paper No. W09/05. Institute of Fiscal Studies (November).
- Besley, Timothy and Maitreesh Ghatak. 2010. "Property Rights and Economic Development" in Mark Rosezweig and Dani Rodrik, eds., *Handbook of Economic Development Vol 5*. Oxford and Ammerstam: Elsevier.

- Björkman, Martina and Jakob Svensson. 2009. "Power to the People: Evidence from a Randomized Field Experiment on Community-based Monitoring in Uganda," *Quarterly Journal of Economics* 124(2):735-769.
- Boucher, Stephen, Michael Carter and Catherine Guirking. 2008. "Risk Rationing and Wealth Effects in Credit Markets: Theory and Implication for Agricultural Development," *American Journal of Agricultural Economics* 90(2):409-423.
- Braun, Arnoud, Janice Jiggins, Niels Röling, Henk van den Berg and Paul Snijders. 2006. "A Global Survey and Review of Farmer Field School Experiences." Report prepared for the International Livestock Research Institute, Wageningen, Netherlands (June).
- Brown, Annette N.. 2011. "Systematic review of the impact of farmer field schools." International Initiative for Impact Evaluation. Presentation to the MCC Impact Evaluation Conference (January 21).
- Brune, Lasse, Xavier Giné, Jessica Goldberg and Dean Yang. 2011. "Commitments to Save: A Field Experiment in Rural Malawi." Policy Research Working Paper No. 5748. Washington DC: The World Bank (August).
- Burwen, Jason and David I. Levine. 2012. "A rapid assessment randomized-controlled trial of improved cookstoves in rural Ghana." Processed, University of California, Berkeley (May).
- Caudill, Steven B, Daniel M. Gropper and Valentina Hartarska. 2009. "Which Microfinance Institutions Are Becoming More Cost Effective with Time? Evidence from a Mixture Model," *Journal of Money, Credit and Banking* 41(4).
- Chant, Sylvia and Carolyn Pedwell. 2008. "Women, gender and the informal economy: An assessment of ILO research and suggested ways forward." Geneva: International Labour Office.
- Chattopadhyay, Raghendra and Esther Duflo. 2004. "Women as Policy Makers: Evidence from a Randomized Policy Experiment in India," *Econometrica* 72(5):1409-1443.
- Chaudhury, Nazmul and Dilip Parajuli. 2006. "Conditional Cash Transfers and Female Schooling: The Impact of the Female School Stipend Program on Public School Enrollments in Punjab, Pakistan." Impact Evaluation Series No. 9. Washington DC: The World Bank (December).
- Chowdhury, Sarahat and Sifat Adiya Chowdhury. 2011. "Microfinance and Women Empowerment: A Panel Data Analysis Using Evidence from Rural Bangladesh," *International Journal of Economics and Finance* 3(5):86-96.
- Clancy, Joy, Tanja Winther, Magi Matinga and Sheila Oparaocha. 2011. "Gender Equity in Access to and Benefits from Modern Energy and Improved Energy Technologies." ETC/ENERGIA Consortium, Netherlands (November).
- Cohen, Marc J. and Mamusha Lemma. 2011. "Agricultural Extension Services and Gender Equality: An Institutional Analysis of Four Districts in Ethiopia." Discussion Paper 01094 (June). Washington DC: International Food Policy Research Institute (IFPRI).
- Cole, Shawn, Xavier Giné, Jeremy Tobacman, Petia Topalova, Robert Townsend, and James Vickery. 2010. "Barriers to Household Risk Management: Evidence from India." Processed. Harvard Business School, Cambridge MA (November).
- Cole, Shawn, Thomas Sampson and Bilal Zia. 2011. "Prices or Knowledge? What Drives Demand for Financial Services in Emerging Markets?" *The Journal of Finance* 66(6):1933-1967.
- Coles, Christopher and Jonathan Mitchell. 2011. "Gender and Agricultural Value Chains." ESA Working Paper No. 11-05 (March). Food and Agriculture Organization of the United Nations (FAO), Rome.

- Crépon, Bruno, Florencia Devoto, Esther Duflo and William Parenté. 2011. "Impact of microcredit in rural areas of Morocco: Evidence from a randomized evaluation." Processed. Abdul Latif Jameel Poverty Action Lab.
- Cull, Robert, Asli Demirguc-Kunt and Jonathan Morduch. 2009. "Microfinance Meets the Market," *Journal of Economic Perspectives* 23(1):167-192.
- DAC Network on Gender Equality (GENDERNET). 2011. "Women's Economic Empowerment: Issues Paper." Organization for Economic Cooperation and Development (OECD), Paris.
- DANIDA. 2010. "Gender and Value Chain Development: Evaluation Study." Ministry of Foreign Affairs of Denmark, Copenhagen.
- Davis, Kristin and others. 2010. "Impact of Farmer Field Schools on Agricultural Productivity and Poverty in East Africa." Discussion Paper 00992 (June). Washington DC: International Food Policy Research Institute (IFPRI).
- Deininger, Klaus, Daniel Ayalew Ali and Tekie Alemu. 2009. "Impacts of Land Certification on Tenure, Security, Investment, and Land Markets: Evidence from Ethiopia." Environment for Development Discussion Paper 09-11 (April).
- Deininger, Klaus, Aparajita Goyal and Hari Nagarajan. 2010. "Inheritance Law Reform and Women's Access to Capital: Evidence from India's Hindu Succession Act." Policy Research Working Paper No. 5338. Washington DC: The World Bank.
- de Mel, Suresh, David McKenzie and C. Woodruff. 2007 "Who Does Microfinance Fail to Reach? Experimental Evidence on Gender and Microenterprise Returns." BREAD working paper.
- de Mel, Suresh, David McKenzie and C. Woodruff. 2008. "Returns to Capital in Microenterprises: Evidence from a Field Experiment," *Quarterly Journal of Economics* 123(4): 1329-1372.
- de Mel, Suresh, David Mckenzie and Christopher Woodruff. 2009. "Are Women More Credit Constrained? Experimental Evidence on Gender and Microenterprise Returns," *American Economic Journal: Applied Economics* 1(3):1-32.
- de Mel, Suresh, David McKenzie and Christopher Woodruff. 2010. "Wage Subsidies for Microenterprises," *American Economic Review: Papers and Proceedings* 100:614-618.
- Dhaliwal, Iqbal, Esther Duflo, Rachel Glennerster, and Caitlin Tulloch. 2011. "Comparative Cost-Effectiveness Analysis to Inform Policy in Developing Countries: A General Framework with Applications for Education." Abdul Latif Jameel Poverty Action Lab, MIT, Cambridge MA (August).
- Dinkelmann, Taryn. 2010. "The Effects of Rural Electrification on Employment: New Evidence from South Africa." Processed, Princeton University, Princeton NJ (August).
- Drexler, Alejandro, Greg Fischer and Antoinette Schoar. 2010. "Keeping it Simple: Financial Literacy and Rules of Thumb." CEPR Discussion Paper No. DP7994 (September).
- Duflo, Esther and Michael Kremer. 2005. "Use of Randomization in the Evaluation of Development Effectiveness." Chapter 3 in George Pitman, Osvaldo Feinstein and Gregory Ingram, editors, *Evaluating Development Effectiveness*. New Brunswick NJ: Transactions Publishers.
- Duflo, Esther, Rachel Glennerster and Michael Kremer. 2006. "Using Randomization in Development Economics Research: A Toolkit." Discussion Paper No. 6059, Department of Economics, Massachusetts Institute of Technology, Cambridge, MA.
- Duflo, Esther, Michael Greenstone and Rema Hanna. 2008. "Indoor Air Pollution, Health and Economic Well-being." Processed, Abdul Latif Jameel Poverty Action Lab, Cambridge MA (February).

- Duflo, Esther, Michael Kremer and Jonathan Robinson. 2008. "How High Are Rates of Return to Fertilizer? Evidence from Field Experiments in Kenya," *American Economic Review: Papers and Proceedings* 98(2):482-488.
- Duflo, Esther, Michael Kremer and Jonathan Robinson. 2009. "Nudging Farmers to Use Fertilizer: Theory and Experimental Evidence from Kenya," Working Papers No. 15131, National Bureau of Economic Research, Cambridge, MA (July).
- Duflo, Esther and Rohini Pande. 2007. "Dams," *Quarterly Journal of Economics* 122(2):601-646.
- Duncombe, Richard and Richard Boateng. 2009. "Mobile Phones and Financial Services in Developing Countries: A Review of Concepts, Methods, Issues, Evidence and Future Research Directions." Working Paper No. 37, Centre for Development Informatics, University of Manchester, UK.
- Duncombe, Richard. 2009. "Assessing Impact of Mobile Phones on Development: Concepts, Methods and Lessons for Practice." Working Paper No. 39, Centre for Development Informatics, University of Manchester, UK.
- Dupas, Pascaline and Jonathan Robinson. 2012. "Why Don't the Poor Save More? Evidence from Health Savings Experiments." Processed, Department of Economics, Stanford University (February).
- Dupas, Pascaline and Jonathan Robinson. 2009. "Savings Constraints and Microenterprise Development: Evidence from a Field Experiment in Kenya." Working Papers No. 14693, National Bureau of Economic Research, Cambridge, MA.
- Dupas, Pascaline, Sarah Green, Anthony Keats and Jonathan Robinson. 2012. "Challenges in Banking the Rural Poor: Evidence from Kenya's Western Province." Working Paper 17851, National Bureau of Economic Research, Cambridge MA (February).
- Duvendack, Maren, Richard Palmer-Jones, James G. Copestake, Lee Hooper, Yoon Loke and Nitya Rao. 2011. "What is the evidence of the impact of microfinance on the well-being of poor people?" EPPI-Centre, Social Science Research Unit, Institute of Education, University of London (August).
- Dzene, Richman and Aseidu K. Fred. 2010. "Gender Composition, Competition and Sustainability of Micro Finance in Africa: Evidence from Ghana's Microfinance Industry." Processed. Ghana Institute of Management and Public Administration (May).
- FAO. 2011. *The State of Food and Agriculture 2010-11: Women in Agriculture: Closing the Gender Gap for Development*. Food and Agriculture Organization of the United Nations (FAO), Rome.
- Feder, Gershon, Rinku Murgai, and Jaime B. Quizon. 2004. "The Acquisition and Diffusion of Knowledge: The Case of Pest Management Training in Farmer Field Schools, Indonesia," *Journal of Agricultural Economics* 55(2):221-243.
- Feder, Gershon, Jock R. Anderson, Regina Birner and Klaus Deininger. 2010. "Promises and Realities of Community-Based Agricultural Extension." IFPRI Discussion Paper 00959, International Food Policy Research Institute, Washington, DC (March).
- Field, Erica, Seema Jayachandran and Rohini Pande. 2010. "Do Traditional Institutions Constrain Female Entrepreneurship? A Field Experiment on Business Training in India." Processed (May).
- Field, Erica, Rohini Pande, John Papp, and Natalia Rigol. 2011. "Term Structure of Debt and Entrepreneurial Behavior: Experimental Evidence from Microfinance." Working Paper, Department of Economics, Harvard University.
- Fiszbein, Ariel and Norbert Schady. 2009. *Conditional Cash Transfers: Reducing Present and Future Poverty*. Washington DC: The World Bank.

- Fletschner, Diana and Lisa Kenney. 2009. "Rural women's access to financial services: credit, savings and insurance." Background paper prepared for *The State of Food and Agriculture 2010-2011*. Food and Agriculture Organization of the United Nations (FAO), Rome (March).
- Gachassin, Marie, Boris Najman and Gaël Raballand. 2010. "The Impact of Rural Roads on Poverty Reduction: A Case Study of Cameroon." Policy Research Paper No. 5209. Washington DC: The World Bank (February).
- Galasso, Emanuela, Martin Ravallion and Agustin Salvia. 2001. "Assisting the Transition from Workfare to Work: Argentina's Proempleo Experiment." Processed. The World Bank (September).
- Garikipati, S. 2008. The impact of lending to women on household vulnerability and women's empowerment: evidence from India," *World Development* (36(12):2620-2642.
- Gaurav, Sarthak, Shawn Cole and Jeremy Tobacman. 2011. "Marketing Complex Financial Products in Emerging Markets: Evidence from Rainfall Insurance in India," *Journal of Marketing Research* 48(SPL)S150-S162.
- Gelbach, Jonathan B. and Lant H. Pritchett. 1997. "More for the Poor is Less for the Poor: The Politics of Targeting." Policy Research Working Paper 1799. Washington DC: The World Bank (February).
- Gertler, Paul J., Sebastian W. Martinez and Marta Rubio-Codina. 2012. "Investing Cash Transfers to Raise Long-Term Living Standards," *American Economic Journal: Applied Economics* 4(1):1-32.
- Giné, Xavier and Dean Yang. 2009. "Insurance, credit and technology adoption: Field experimental evidence from Malawi," *Journal of Development Economics* 89:1-11.
- Giné, Xavier, Jessica Goldberg and Dean Yang. 2001. "Credit Market Consequences of Improved Personal Identification: Field Experimental Evidence from Malawi." Working Paper No. 17449, National Bureau of Economic Research, Cambridge, MA.
- Giné, Xavier and Dean Karlan. 2011. "Group versus Individual Liability: Short and Long Term Evidence from Philippine Microcredit Lending Groups." Working Paper, Yale University (June).
- Gitter, Seth R. and Bradford L. Barham. 2008. "Women's Power, Conditional Cash Transfers, and Schooling in Nicaragua," *The World Bank Economic Review* 22(2):271-290.
- Glennerster, Rachel and Kudzai Takavarasha. 2010. "Empowering young women: What do we know?" Report prepared for the Nike Foundation, The Abdul Latif Jameel Poverty Action Lab, Cambridge MA (May).
- Goldstein, Markus and Christopher Udry. 2008. "The Profits of Power: Land Rights and Agricultural Investment in Ghana." *Journal of Political Economy* 116(6):981-1022.
- Goetze, Marie A. and R. Sengupta. 1996. "Who takes the credit? Gender, power, and control over loan use in rural credit programs in Bangladesh," *World Development* 24(1):45-63
- Grogan, Louise and Asha Sadanand. 2011. "Electrification and Labour Supply in Poor Households: Evidence from Nicaragua." Processed. Department of Economics, University of Guelph, Canada.
- Hanna, Rema, Esther Duflo and Michael Greenstone. 2012. "Up in Smoke: The Influence of Household Behavior on the Long-Run Impact of Improved Cooking Stoves." Working Paper 12-10, Department of Economics, Massachusetts Institute of Technology, Cambridge MA (April).
- Hashemi, Syed, Sidney Ruth Schuler and Ann Riley. 1996. "Who Takes the Credit? Gender, Power, and Control over Loan Use in Rural Credit Programs in Bangladesh," *World Development* 24(4):635-653.
- Horowitz, Leah. 2009. "Getting Good Government for Women: A Literature Review." Agriculture and Rural Development Discussion Paper 43. Washington DC: The World Bank.

- International Fund for Agricultural Development (IFAD). 1998. *Agricultural Implements Used by Women Farmers in Africa*. Rome: IFAD (April).
- Jack, William and Tavneet Suri. 2011. "Risk Sharing and Transactions Costs: Evidence from Kenya's Mobile Money Revolution." Working Paper, Consortium on Financial Systems and Poverty.
- Jacoby, Hanan and Bart Minten. 2007. "Is Land Titling in Sub-Saharan Africa Cost-Effective? Evidence from Madagascar." *World Bank Economic Review* 21(3):461-485.
- Jensen, Robert. 2007. "The digital divide: information (technology), market performance, and welfare in the South Indian fisheries sector," *The Quarterly Journal of Economics* 122(3):879-924.
- Jensen, Robert. 2010. "Economic Opportunities and Gender Differences in Human Capital: Experimental Evidence for India." Working Papers No. 16021, National Bureau of Economic Research, Cambridge, MA.
- Jensen, Robert. 2010. "The (Perceived) Returns to Education and the Demand for Schooling," *The Quarterly Journal of Economics* 125(2):515-548.
- Karlan, Dean and Martin Valdivia. 2011. "Teaching Entrepreneurship: Impact of Business Training on Microfinance Clients and Institutions," *The Review of Economics and Statistics* 93(2):510-527
- Karlan, Dean, Ed Kutsoati, Margaret McMillan and Chris Udry. 2011. "Crop Price Indemnified Loans for Farmers: A Pilot Experiment in Rural Ghana," *The Journal of Risk and Insurance* 78(1):37-55.
- Karlan, Dean and Jonathan Zinman. 2008, "Credit Elasticities in Less-Developed Economies: Implications for Microfinance," *American Economic Review* 98(3):1040-1068.
- Karlan, Dean and Jonathan Zinman. 2010. "Expanding Credit Access: Using Randomized Supply Decisions to Estimate the Impacts." *Review of Financial Studies* 23(1):433-464
- Karlan, Dean and Jonathan Zinman. 2012. "List randomization for sensitive behavior: An application for measuring use of loan proceeds," *Journal of Development Economics* 98(1):71-75.
- Karlan, Dean, Margaret McConnell, Sendhil Mullainathan and Jonathan Zinman. 2011. "Getting to the Top of Mind: How Reminders Increase Saving." Working Papers No. 16205, National Bureau of Economic Research, Cambridge, MA (July).
- Kast, Felipe, Stephan Meier and Dina Pomeranz. 2012. "Under-Savers Anonymous: Evidence on Self-Help Groups and Peer Pressure as a Savings Commitment Device." Working Paper 12-060, Harvard Business School, Cambridge MA (January).
- Khandker, Shaidur. 1998. *Fighting poverty with microcredit: experience from Bangladesh*. New York: Oxford University Press for the World Bank.
- Khandker, Shaidur, Zaid Bakht and Gayatri B. Koolwal. 2006. "The Poverty Impact of Rural Roads: Evidence from Bangladesh." Policy Research Working Paper No. 3875. Washington DC: The World Bank (April).
- Klonner, Stefan and Patrick Nolen. 2008. "Does ICT Benefit the Poor? Evidence from South Africa." Processed. Goethe University, Frankfurt, Germany (May).
- Knowles, James C. and Jere R. Behrman. 2004. "A Practical Guide to Economic Analysis of Youth Projects." Health, Nutrition and Population (HNP) Discussion Paper. Washington DC: The World Bank (November).
- Köhlin, Gunnar, Erin O. Sills, Subhrendu K Pattanayak and Christopher Wilfong. 2011. "Energy, Gender and Development: What are the Linkages? Where is the Evidence?" Policy Research Paper No. 5800. Washington DC: The World Bank (September).
- Koolwal, Gayatri and Dominique van de Walle. 2010. "Access to Water, Women's Work and Child Outcomes." Policy Research Working Paper No. 5302. Washington DC: The World Bank (May).

- Kondo, Toshio, Aniceto Orbeta, Jr., Clarence Dingcong and Christine Infantado. 2008. "Impact of Microfinance on Rural Households in the Philippines." Working Paper No. 4, Network of Networks on Impact Evaluation (NONIE) (January).
- Kremer, Michael, Edward Miguel and Rebecca Thornton. 2009. "Incentives to Learn," *The Review of Economics and Statistics* 91(3):437-456.
- Kremer, Michael, Jessica Leino, Edward Miguel and Alix Peterson Zwane. 2011. "Spring Cleaning: Rural Water Impacts, Valuation, and Property Rights Institutions." *Quarterly Journal of Economics* 126(1):145-205.
- Macours, Karen, Patrick Premand and Renos Vakis. 2012. "Transfers, Diversification and Household Risk Strategies: Experimental evidence with lessons for climate change adaptation." Policy Research Working Paper No. 6053. Washington DC: The World Bank (April).
- Mbiti, Isaac and David N. Weil. 2011. "Mobile Banking: The Impact of M-Pesa in Kenya." Working Paper No. 17129. National Bureau of Economic Research, Cambridge, MA (June).
- Miller, Grant and A. Mushfiq Mobarak. 2011. "Intra-household Externalities and Low Demand for a New Technology: Experimental Evidence on Improved Cookstoves." Processed, Stanford University (November).
- Mobarak, A. Mushfiq and Mark Rosenzweig. 2012. "Selling Formal Insurance to the Informally Insured." Discussion Paper No. 1007, Economic Growth Center, Yale University, New Haven CT (February).
- Morduch, J.. 1999. "The Role of Subsidies in Microfinance: Evidence from the Grameen Bank," *Journal of Development Economics* 60:229-248.
- Mosley, P. 2001. "Microfinance and Poverty in Bolivia," *Journal of Development Studies* 37(4):101-132.
- Muto, M. and T. Yamano. 2008. "The impact of mobile phone coverage expansion on market participation: panel data evidence from Uganda." Working Paper. Japan International Cooperation Agency Research Institute, Tokyo.
- Ngo, Thi Minh-Phuong and Zaki Wahhaj. 2009. "Microfinance and Gender Empowerment." Processed, School of Oriental and African Studies, University of London (April).
- Odell, Kathleen. 2010. "Measuring the Impact of Microfinance: Taking Another Look." Grameen Foundation.
- Okello, Vincent. 2005. "The Upesi rural stoves project." *Boiling Point* 51:2-5.
- Pande, Rohini and Deanna Ford. 2011. "Gender Quotas and Female Leadership." Background paper for *World Development Report 2012: Gender Equality and Development*. Washington DC: The World Bank.
- Peterman, Amber, Julia Behrman and Agnes Quisumbing. 2011. "A review of empirical evidence on gender differences in non-land agricultural inputs, technology, and services in developing countries." ESA Working Paper No. 11-11 (March). Rome: Food and Agriculture Organization of the United Nations (FAO).
- Pitt, Mark M. and S.R. Khandker. 1998. "The impact of group-based credit programs on poor households in Bangladesh: Does the gender of participants matter?" *Journal of Political Economy* 106(5):958-996.
- Pitt, Mark M., S.R. Khandker and J. Cartwright. 2006. "Empowering Women with Micro Finance: Evidence from Bangladesh," *Economic Development and Cultural Change* 54(4):791-831.

- Prina, Silvia. 2012. "Do basic savings accounts help the poor to save? Evidence from a field experiment in Nepal." Processed (preliminary and incomplete), Case Western Reserve University, Cleveland OH (March).
- Quisumbing, Agnes and Lauren Pandolfelli. 2008. "Promising Approaches to Address the Needs of Poor Female Farmers." IFPRI Note 13. Washington DC: International Food Policy Research Institute (IFPRI).
- Roodman, D. and J. Morduch. 2009. "The impact of microcredit on the poor in Bangladesh: revisiting the evidence." Working Paper No. 174, Center for Global Development (June).
- Roy, Sanchari. 2012. "Empowering Women: Inheritance Rights and Female Education in India." Processed, Department of Economics, Warwick University, UK (February).
- Schreiner, Mark. 2003. "A Cost-Effectiveness Analysis of the Grameen Bank of Bangladesh." Processed. Center for Social Development, Washington University, St. Louis MO.
- Schultz, T. Paul. 2004. "School subsidies for the poor: evaluating a Mexican strategy for reducing poverty," *Journal of Development Economics* 74(1):199-250.
- Smith, Kirk R., John P. McCracken, Lisa Thompson, Rufus Edwards, Kyra N. Shields, Eduardo Canuz and Nigel Bruce. 2010. "Personal Child and Mother Carbon Monoxide Exposures and Kitchen Levels: Methods and Results from a Randomized Trial of Woodfired Chimney Cookstoves in Guatemala (RESPIRE)," *Journal of Exposure Science and Environmental Epidemiology* 20:406-416.
- Thomas, Duncan, Elizabeth Frankenberg, Jed Friedman, Jean-Pierre Habicht et al. 2003. "Iron deficiency and the well-being of older adults: Early results from a randomized nutrition intervention." Paper presented at the Population Association of America Annual Meetings, Minneapolis (April).
- USAID. 2009. *Promoting Gender Equitable Opportunities in Agricultural Value Chains*. United States Agency for International Development, Washington DC (November).
- Vasilaky, Kathryn. 2010. "Randomizing Social Networks in Rural Uganda: New Links Improve Outcomes." Processed.
- Weiss, John and Heather Montgomery. 2004. "Great Expectations: Microfinance and Poverty Reduction in Asia and Latin America." ADB Institute Discussion Paper No. 15. Manila: Asian Development Bank (September).
- White, Howard, Shampa Sinha and Ann Flanagan. 2006. "A Review of the State of Impact Evaluation." Independent Evaluation Group. Washington DC: The World Bank.
- World Bank. 2005. "Implementation Completion Report for the Southern Provinces Rural Electrification Project in the Lao People's Democratic Republic." Report No. 32004, Washington DC (June).
- World Bank. 2008. *The Welfare Impact of Rural Electrification: A Reassessment of the Costs and Benefits*. Independent Evaluation Group. Washington DC: The World Bank.
- World Bank. 2011a. *World Development Report 2012: Gender Equality and Development*. Washington DC: The World Bank.
- World Bank. 2011b. *Household Cookstoves, Environment, Health and Climate Change*. Washington DC: The World Bank
- World Bank, FAO and IFAD. 2009. *Gender in Agriculture Sourcebook*. Washington DC: The World Bank
- Zuger, Regula. 2004. "Impact Assessment of Farmer Field Schools in Cajamarca, Peru: An Economic Evaluation." Social Sciences Working Paper No. 2004-1, International Potato Center, Lima (March).

Appendix 1. Preliminary review of interventions to increase the productivity and earnings of rural females

Main outcome	Interventions	Rationale/other outcomes	Comments
ACCESS TO ASSETS			
Women's human capital			
Female education	Conditional cash transfers (CCTs) and other incentives (e.g., merit scholarships) targeted to adolescent girls	Girls often drop out of school at an early age, which reduces their productivity and earnings and exposes them to early marriage, with attendant health risks. When women have significantly less education than their husbands, they typically exercise less influence on intra-household decisions. Better educated mothers also improve the education, health and nutritional status of their children.	Randomized evaluations have been conducted in several countries to assess the effects of CCTs and related interventions.
	Providing information to adolescent girls on the economic returns to additional schooling	Some studies have found that adolescents significantly underestimate the economic returns to additional schooling. Simply providing information on the true returns can improve educational outcomes, with all the attendant benefits noted above.	There is limited information on the effectiveness of this intervention. However, one randomized evaluation has been conducted for adolescent boys in the Dominican Republic.
	Vouchers to finance family planning and reproductive health services for adolescents	Protecting adolescent girls from becoming pregnant makes it possible for them to stay in school longer and reduces the excess maternal mortality and morbidity associated with teen pregnancies.	There are some completed and ongoing randomized evaluations of the effects of vouchers and related reproductive health interventions targeted to adolescent girls.

Main outcome	Interventions	Rationale/other outcomes	Comments
	Vouchers and cash incentives to support girls who have dropped out of school to return to school or to receive vocational training, sometimes in combination with literacy and life skills training	These interventions are expected to increase educational attainment, literacy and life skills among adolescent girls who have dropped out of school.	There is only limited evidence on the effectiveness and cost effectiveness of these interventions.
	Providing information to communities on the effectiveness of individual schools	This intervention can improve learning and reduce the cost of schooling by stimulating competition among schools.	There is only limited evidence on the effectiveness of this intervention in developing countries. However, one randomized evaluation has been conducted in Pakistan.
	Gender quotas for political office holders	An increase in the number of female political leaders (including at the village level) can have a positive effect on the aspirations and educational attainment of girls. Female leaders may also alter government priorities toward investments that are more valued by women (e.g., education or access to water)	There is limited information on the effectiveness of this intervention. However, there is one completed randomized evaluation from India.
Women's health	Cash payments to adolescents who, when tested periodically, are free of STIs	This intervention is designed to protect adolescent girls from STIs and HIV/AIDS. Providing information alone (behavior change interventions) has not been shown to be effective in preventing STIs and HIV/AIDS among adolescent girls	There is at least one completed randomized evaluation of the effects of this intervention. Otherwise, information on effectiveness is limited.
	Vouchers/health insurance for pregnant women	Demand-side financing can increase the utilization of safe motherhood services, which reduce maternal mortality and morbidity	There is only limited information on the effectiveness of this intervention. Moreover, effectiveness in rural areas requires the availability of effective safe motherhood services.

Main outcome	Interventions	Rationale/other outcomes	Comments
	CCTs to use pre-birthing hostels for rural women in remote locations.	Financial incentives are often needed to overcome cultural resistance to the use of these services, which can reduce maternal mortality and morbidity in the presence of effective obstetric services.	There is only limited information on the effectiveness of this intervention.
	Incentives to save for future health expenditure	Barriers to savings may be a significant obstacle to investing in health.	There is only limited information on the effectiveness of this intervention. However, there are a few randomized evaluations of interventions designed to increase saving, including one focused on saving for future health expenditure.
	Treatment of water or spring protection to prevent diarrheal diseases	Reduces diarrheal diseases, particularly among children, thereby improving their survival and nutritional status	There are several randomized evaluations of the effectiveness of water treatment and spring protection in reducing diarrheal disease.
	Fuel-efficient cooking stoves to reduce indoor air pollution	Indoor air pollution is believed to be an important cause of respiratory disease in some settings, reducing school attendance and labor productivity. Fuel-efficient stoves may also save women's time spent in collecting firewood.	There are some completed and ongoing randomized evaluations of the effectiveness of cooking stoves in reducing female morbidity due to respiratory disease.
	Community monitoring of health services	Community monitoring of public health services can improve the performance of public health providers, leading to improvements in women's health.	There is limited information on the effectiveness of this intervention. However, one randomized evaluation has been completed in Uganda.
Women's nutritional status	Micronutrient supplements administered to pregnant women and infants	These interventions can increase children's nutritional status, thereby contributing to improved educational outcomes, adult health and labor productivity over the long term.	There is a substantial literature on the effectiveness of these interventions. However, outcomes are obtained only after a considerable time lag.

Main outcome	Interventions	Rationale/other outcomes	Comments
	De-worming of school children	School-age children are often infected with worms in rural areas with poor sanitation. Worm burdens can have a negative effect on health and nutritional status (e.g, anemia).	There is some credible evidence that de-worming can improve health and nutritional status, including one randomized evaluation in Kenya that obtained positive long-term effects on schooling and labor productivity.
	Iron fortification or iron supplements for adolescent girls and adult women	Iron supplements are believed to increase physical activity, wellness and labor productivity in iron-deficient populations. Iron fortification of flour or other foods is a cost-effective intervention.	There is some credible evidence on effectiveness, including one carefully designed randomized evaluation in Indonesia on the effects of iron supplementation on adults.
Women's access to land			
	Land titling	Secure titles can increase access to credit and stimulate investment in agriculture. Joint titles for spouses may increase women's influence within the household.	There are several careful evaluations of the effects of land titling. However, most have been done in urban areas.
	Legal reform	Inheritance, divorce, common property, and marriage laws affect women's access to land and influence within the household. Reconciling formal and customary or religious legal systems can also be important.	There are some careful studies of the effects of changes in inheritance laws in India. However, there is only limited evidence of the effects of this intervention.
Women's access to financial assets			
	Asset transfer	Either cash (conditional or unconditional) or productive assets. Usually targeted to the very poor, sometimes to prepare them to participate in microfinance schemes.	There are some completed and ongoing randomized evaluations of these interventions in rural areas.

Main outcome	Interventions	Rationale/other outcomes	Comments
	Commitment savings accounts	Designed to increase the savings of the poor. These interventions can be based in formal savings institutions or micro-savings organizations. Usually involves a commitment to save a target amount or to save for a target period, sometimes in combination with the use of lock boxes and periodic reminders (see below).	There are some completed and ongoing randomized evaluations of these interventions in rural areas.
	Incentives to open savings accounts (e.g., waiving account fees or subsidizing the interest rate)	Designed to increase the savings of the poor. These interventions can be based in formal savings institutions or micro-savings organizations.	There are some completed and ongoing randomized evaluations of these interventions in rural areas.
	Facilitating deposits into savings accounts (e.g., periodic reminders, use of lock boxes or mobile phones)	Limited attention models predict that reminders may increase saving. Lock boxes can be used to store savings until they can be deposited in a bank. Mobile phones can be used in some areas to make deposits.	There is limited information on the effectiveness of these interventions. However, there are a few randomized evaluations on the effectiveness of periodic reminders and use of lock boxes.
	Microcredit	Usually targeted to women (in groups or individually) in the expectation that the proceeds will be used more productively and will empower women. Increasingly combined with financial literacy or entrepreneurship training and/or with cash grants.	There is a large and growing literature on gender-specific effects, including several completed and ongoing randomized evaluations in rural areas.
	Establishment of village savings and loan associations (VLSAs)	Few microfinance institutions are willing to operate in rural areas. VLSAs can be a more flexible substitute for traditional informal savings mechanisms (e.g., rotating savings and credit associations)	There is very little information on the effectiveness of these interventions. However, one randomized evaluation is ongoing in Ghana.
Women's access to infrastructure			

Main outcome	Interventions	Rationale/other outcomes	Comments
	Construction of rural roads	Reduces time spent in transportation (e.g., to markets). Increases employment and business opportunities.	There is limited credible information on the effectiveness of this intervention.
	Rural electrification	Reduces time spent by women and children gathering firewood. Also supports schooling and can stimulate new business opportunities.	There is limited credible information on the effectiveness of this intervention
	Expanding access to water in rural areas	Saves time mainly of women and children in collecting water.	Most feasible in densely populated areas. There are some randomized evaluations of this intervention.
	Public works (e.g., maintenance of rural roads)	Contributes to the development and maintenance of infrastructure and provides income support in times of crisis. Good gender balance in participation is possible, but access to childcare can be an important constraint to women's participation. Low administrative cost. Politically acceptable since beneficiaries must work and benefits are self-targeted.	There is limited information on the effectiveness of this intervention.
	Using gender quotas to increase women's voice in infrastructure investments	Women are not often consulted on decisions about infrastructure investments. Women's influence in this area can be increased through gender quotas applied to decision-making bodies.	There is some credible evidence of the effectiveness of these interventions in India.
PRODUCTIVITY AND EARNINGS			
Female labor productivity and earnings in agriculture			
Non-land inputs	Use of credit, subsidies, and advance purchase arrangements to increase the use of non-land inputs, such as fertilizer and improved seeds	Many farmers in developing countries (and particularly women) use less than optimal quantities of fertilizer, improved seeds and other non-land inputs	There is a growing literature on the effects of interventions designed to increase the utilization of key non-land inputs, including some completed and several ongoing randomized evaluations.

Main outcome	Interventions	Rationale/other outcomes	Comments
Risk management	Crop price and rainfall insurance, often in combination with savings and microcredit schemes or cash grants	Risk has been identified as an important barrier to agricultural investment.	There is a growing literature on the effects of rainfall and crop price insurance on agricultural investment, including some completed and several ongoing randomized evaluations.
Knowledge	Female-friendly agricultural extension services (often in combination with the use of social networks to diffuse information).	Women farmers are often neglected by agricultural extension agents.	There is a growing literature on interventions designed to improve the effectiveness of agricultural extension, including some completed and several ongoing randomized evaluations
	Farmer field schools targeted to female farmers and sometimes targeted to “female” crops	This is a popular intervention to diffuse information on new agricultural technologies to farmers. High levels of participation of women in farmer field schools is easier to achieve when meetings are scheduled around women’s time constraints.	There is a large evaluation literature, much of it focused on pest control initiatives, but there are no randomized evaluations. Some evaluations have expressed concerns about the cost and sustainability of farmer field schools.
	Use of social networks to diffuse agronomic information	The expansion of social networks can increase farmers’ productivity. This intervention is often combined with extension services.	The information on the effectiveness of social networks in diffusing agronomic information is limited.
Female labor productivity and earnings in non-agricultural activities			
Skills	Short-term job training targeted to adolescents	Can help to smooth transition from school to employment. Can reduce youth unemployment and boost earnings. May be targeted to youth who have dropped out of school. Interventions are usually short-term (e.g., 6 months) and may combine job training with life skills training or wage subsidies.	Some completed and ongoing randomized evaluations. However, most are in urban areas where open unemployment among youth is a particularly important problem.

Main outcome	Interventions	Rationale/other outcomes	Comments
	Subsidies for technical and vocational training	Vouchers are typically used to provide scholarships. Usually in urban areas, but may also be done in rural areas if there are village polytechnics and a sufficient number of primary school leavers available.	Some ongoing randomized studies. However, there is limited information available on the impact of VTEC in developing countries.
Labor supply	Subsidized childcare/public pre-schools	These interventions are designed to increase female labor supply by freeing up time from childcare.	Limited information on the effectiveness of these interventions, most of which are in urban areas.
Labor markets	Wage subsidies	Can be used to stimulate hiring. Most interventions target formal sector employment, but some have targeted microenterprises.	Some completed and ongoing randomized evaluations. However, most are in urban areas.
	Affirmative action	Successfully used in India and Malaysia to address ethnic/caste imbalances in labor markets. Less successful in Nigeria. Can be used exclusively in the public sector (India) or in both the public and private sectors (Malaysia)	Main impact is in urban areas. Limited country experience, and usually focused on achieving ethnic and/or religious balance. Effectiveness is usually measured by trend analysis.
	Cash incentives to stimulate temporary rural to urban migration	Incentives are designed to overcome barriers to temporary migration, such as the risk of not finding a job or poor access to credit.	There is limited evidence of the effectiveness of these interventions. However, one randomized evaluation has been completed in Bangladesh.
Self-employment	Entrepreneurship training	Many women are self-employed and can presumably benefit from business training. Entrepreneurship training is often combined with microfinance or asset transfer.	Most interventions have been conducted in urban areas. However, there are a few completed or ongoing randomized evaluations in rural areas.

Appendix 2. Summaries of studies included in in-depth reviews

Study	Country & setting	Methodology	Sample & sample size	Intervention(s)	Findings
Conditional cash transfers					
Aker and others (2011)	See under “Mobile phones” below				
Baird, McIntosh and Özler (2011)	Malawi (mostly rural, Zomba district)	RCT	2,907 schoolgirls in 176 enumeration areas.	Conditional cash transfers (CCT) and unconditional cash transfers (UCT)	Decrease in the drop-out rate in the UCT group only 43% as large as that in the CCT group.
Barrera-Osorio, Bertrand, Linden and Perez-Calle (2011)	Colombia (urban, Bogota)	RCT	7,569 students in 68 schools	Postponing part of the monthly transfers until students have to re-enroll in school and payments for attendance with incentives to graduate and enroll in a tertiary institution	Both non-standard variants increase enrollment rates at the secondary and tertiary levels without reducing attendance
Berhman, Parker and Todd (2011)	Mexico (PROGRESA, rural areas in 7 states)	RCT (with estimates of longer-term exposure obtained using a matched comparison group)	Baseline (1997) and follow-up (2003) data from 506 communities (with about 14% sample attrition) on 14,485 children aged 9-15 in 1997 (and 15 to 21 in 2003).	Conditional cash transfers provided to children in 320 randomly selected communities for 1.5 years, after which they were also provided to children in the 186 control communities	Estimated impact of 1.5 years longer exposure to the program (i.e., 5.5 years versus 4 years) is +2.4% for boys and +2.7% for girls (and +4.4% for boys and +6.8% for girls who had completed 7 or more grades pre-program). Estimates of the impact of 5.5 years of exposure to the program, obtained by using data from a matched comparison group from 152 additional communities, indicate that completed years of schooling increased by 12-15% among boys and 9-10% among girls, depending on the age group.

Study	Country & setting	Methodology	Sample & sample size	Intervention(s)	Findings
Kremer, Miguel and Thornton (2009)	Kenya (rural, Busia and Teso districts)	RCT	7,401 students completing both baseline questionnaire and follow-up examination (with almost 40% sample attrition)	Merit scholarships awarded to 6 th grade girls	Test scores increased by 0.19 standard deviations and teacher attendance increased by 4.8 percentage points (by 7.6 percentage points in the 6 th grade)
Gertler, Martinez and Rubio-Codina (2012)	Mexico (PROGRESA, rural areas of 7 states)	RCT	12,302 households from 506 communities (with about 10% sample attrition)	Conditional cash transfers	CCTs used in part to finance productive investments. Per capita consumption is 5.6% higher in treatment households even 4 years after transfers to control households were initiated.
Land registration					
Ali, Deininger and Goldstein (2011)	Rwanda (3 rural and 1 peri-urban location)	Regression discontinuity design with spatial fixed effects	3,513 households drawn from both sides of the boundaries of four pilot cells	Land titling pilot covering 14,908 parcels with 3,448 hectares owned by 3,513 households	No effect on the perceived risk of expropriation but investment in soil conservation measures approximately doubled, with the estimated effect almost twice as high for plots owned by female-headed households.
Deininger, Ali and Alemu (2009)	Ethiopia (East Gojjam zone of the Amhara region)	Difference in differences estimation using four rounds of panel survey data spanning 8 years	4,000+ plots owned by 900 randomly sampled households from 7 villages in 3 districts	Low-cost land registration scheme covering 20 million plots over 5 years	Significant positive effect on the three outcomes examined, i.e., perceived tenure security, land-related investments and participation in land rental markets.
Goldstein and Udry (2008)	Ghana (rural, Akwapim South District, Eastern Region)	Household-level fixed-effects estimation	519 plots in 4 village clusters owned by 240 married couples. Each couple was interviewed 15 times during a two-year period.	None	Security of tenure has an important effect on land productivity (via investments in soil fertility) and security of tenure is related to an individual's position in the political and social hierarchy, with most women relatively disadvantaged

Study	Country & setting	Methodology	Sample & sample size	Intervention(s)	Findings
Jacoby and Minten (2007)	Madagascar (rural, Lac Alaotra region)	Household-level fixed effects estimation using cross-section data on multiple plots per household	2,652 owner-cultivated rice plots owned by 1,700 households in 38 communes	Land titling	Land titling has no significant effect on land-related investment or productivity and only a modest (+6%) effect on land values
Rural electrification					
Bernard and Torero (2011, 2012)	Ethiopia (rural)	RCT	566 households from 8 village communities	Randomly allocated vouchers providing discounts in the cost of connecting to an existing grid	Vouchers have a positive effect on the likelihood of connecting to the grid. Electricity use mainly for lighting. No significant effect on time devoted to specific activities. No gender-specific effects reported.
Dinkelman (2010)	South Africa (rural Kwa-Zulu Natal province)	(1) Instrumental variable (IV) estimation using community-level data (2) Fixed-effects (FE) estimation using panel data	(1) 1996 and 2001 Census data aggregated to 1,816 communities (2) Cross-section data from 4 household surveys conducted in 1995, 1997, 1999 and 2001 collapsed to 38 magisterial district aggregates	Rural electrification	IV estimates indicate that the female employment-to-population ratio increased significantly by 9.5 percentage points (i.e., by 30-35% compared to the baseline), compared to an insignificant 3.5 percentage points among males. FE estimates are broadly consistent.
Grogan and Sadanand (2011)	Nicaragua (rural)	Instrumental variable estimation	6,882 households from the 2005 nationally representative LSMS household survey	Extending the grid from urban to rural areas of a municipality	Female propensity to work outside the home increased by 23% without any effect on male labor supply. Increased household use of modern cooking fuels such as gas.
Microcredit					

Study	Country & setting	Methodology	Sample & sample size	Intervention(s)	Findings
Attanasio and others (2011)	Mongolia (rural)	RCT	1,148 poor women from 40 rural communities across Mongolia (with 86% of the sample re-interviewed 1.5 years later)	One treatment group was offered a group lending product, while the other was offered an individual lending product. Randomization was done at the village level.	Significant increase in business ownership (+10 percentage points) and food consumption (+17 percentage points) and asset ownership among those offered a group lending product, with no effect among those offered an individual lending product. No significant effect on household income and no difference in repayment rates between the two treatment groups.
Banerjee, Duflo, Glennerster and Kinnan (2010)	India (urban slums, Hyderabad)	RCT	2,800 households with at least one woman aged 18-55.	MFI branches were opened in 52 randomly selected urban slums	No effect on household expenditure per equivalent adult or women's decision-making role within the household after 15-18 months, but expenditure on durable goods and the number of new businesses increased significantly in treated areas

Study	Country & setting	Methodology	Sample & sample size	Intervention(s)	Findings
Crepon and others (2011)	Morocco (rural)	RCT	4,495 households in 80 pairs of villages. An endline survey of 5,551 households (including 1,400 new households) was conducted in 81 pairs of villages (including 5 replacement villages)	A randomly selected half of 82 paired villages in the catchment areas of newly opened microfinance branches with no previous access to microcredit were offered microcredit (group-liability loans), with the remaining villages receiving the same offer two years later	13 percentage point increase in households having a microfinance loan in the treatment villages. Both livestock and non-livestock agricultural activities expanded in the treatment villages (limited to households with a business activity pre-intervention). No effect on average household consumption, poverty or on other outcomes such as health and education. The majority of borrowers were men, and there was no measurable effect on women's empowerment.
de Mel, McKenzie and Woodruff (2009)	Sri Lanka	RCT	387 firms in 25 Census divisions, 197 run by males and 190 run by females (jointly run businesses were excluded from the sample). Sample attrition at the end of three years was about 14%, with 365 firms reporting at least three waves of profit data.	Provided randomly timed and sized unconditional cash or equipment grants to microenterprise owners	After three years, the grants had led to large increases in profits for male owners, but not for female owners, suggesting that women microenterprise owners are either less credit constrained by men or unable to benefit from the grants due to intra-household transfers.
Rural savings					

Study	Country & setting	Methodology	Sample & sample size	Intervention(s)	Findings
Ashraf, Karlan and Yin (2006, 2008)	Philippines (greater Butuan City)	RCT	1,777 Green Bank clients with savings accounts in two branches with identifiable addresses were administered a baseline and a follow-up survey after one year (with 92% re-interviewed)	Commitment savings intervention, i.e., treatment group received a lock box for their savings that they were not allowed to open until they had met their savings goals.	Household savings increased by 81% after one year (without crowding out other savings) and the decision-making power also increased significantly in the treatment group (especially among married women with below-median decision-making power pre-intervention). After 32 months, administrative data indicate that the effect on household savings was no longer significant.
Atkinson, de Janvry, McIntosh and Sadoulet (2010)	Guatemala (locations unspecified)	RCT	1,375 borrowers from 20 microfinance branches of Guatemala's largest public sector bank	New commercial savings products were offered to participants, with no financial incentives or penalties involved in the treatments	Prompting for savings at the time of loan payments doubles savings, while suggesting a savings deposit equal to 10% of the loan repayment causes savings to double again. Women are significantly more likely to take up the offer of a savings account. However, women's accumulated net savings are significantly lower overall.

Study	Country & setting	Methodology	Sample & sample size	Intervention(s)	Findings
Bruné, Giné, Goldberg and Yang (2011)	Malawi (rural)	RCT	3,150 farmers in 299 clubs at baseline, and 2,835 farmers from 298 clubs at endline (10% attrition).	Provided either an ordinary savings account to rural smallholders with direct deposits of sales revenue from participating agri-businesses or both an ordinary savings account and a “commitment” savings account	The group receiving commitment saving accounts had significantly higher outcomes than the control group, including 9.8% more land under cultivation, use of 26.2 % more agricultural inputs, 22.0% higher crop sales from the subsequent harvest, and 17.4% higher household expenditure during the post-harvest period. No gender-specific effects are reported.
Dupas and Robinson (2012)	Kenya (rural)	RCT	Follow-up surveys at 6 and 12 months of 771 members of 113 rotating savings clubs (ROSCAs) with 74% female members in one administrative division of Western Kenya. 92% of the baseline sample was re-interviewed after 12 months.	Providing a safe place (metal box) to save money with randomly varying levels of commitment to save	Preventive health investments increased by 68%. The share of households achieving their savings goals increased by 13 percentage points (compared to 34% in the control group). Three years later 39% of those who received metal boxes were still using them for saving. Larger effects found among married than among unmarried females. The results also suggest that savings programs that do not restrict liquidity are most effective.
Karlan, McConnell, Mullainathan and Zinman (2011)	(1) Philippines (peri-urban, Western Mindanao) (2) Bolivia (unspecified location) (3) Peru (unspecified location)	RCT	14,168 customers of the savings banks participating in the experiment: Peru (n=2,968), Bolivia (n=9,653) and Philippines (n=1,547)	Sending monthly reminders by text message or by letter to remind individuals who had opened savings accounts and established savings goals	Overall, savings were 6% higher in banks sending monthly reminders

Study	Country & setting	Methodology	Sample & sample size	Intervention(s)	Findings
Kast, Meier and Pomeranz (2012)	Chile (location unspecified)	RCT	Baseline and follow-up surveys of 2,687 low-income micro-enterprise owners in 196 micro-finance groups with savings accounts in the participating bank	Peer group pressure versus increase in the real interest rate. Text message reminders one year after accounts offered.	Individuals in the peer group pressure treatment group saved 3.5 times more often and had more than twice the level of accumulated savings after one year. In contrast, a higher interest rate had almost no effect on savings. The text messages alone had almost as large an effect as peer group pressure. No gender specific effects are reported.
Prina (2012)	Nepal (peri-urban, Pokhara)	RCT	1,236 female-headed households in 19 slums. Endline survey after 12 months re-interviewed 91% of the baseline sample.	Flexible savings accounts were provided with no opening, deposit or withdrawal fees to female-headed households	Total household assets increased in the treatment group (including an increase of 50% in monetary assets) after one year, with larger effects observed in lower and middle pre-intervention asset groups
Farmer Field Schools					
Davis and others (2010)	Kenya, Tanzania and Uganda	Difference in differences estimation with propensity score matching	1,126 randomly selected households from villages with and without farmer field schools	Farmer field schools with 50% female participation	FFS increase the value of crops grown and agricultural income per capita, especially among women. Income increased by 61% in the pooled sample.

Study	Country & setting	Methodology	Sample & sample size	Intervention(s)	Findings
Feder, Murgai and Quizon (2004)	Indonesia (Java)	Difference in differences estimation	Panel data collected from 320 households in 1991 (baseline) and 1999 (follow-up). Baseline data were collected only in villages that had not yet been exposed to farmer field schools. Four of the sample villages (52 households) that had not been served by a FFS by 1999 serve as a control group.	Farmer field schools	Modest effect of FFS on knowledge of participants and no effect on the knowledge of their neighbors
Improved use of modern agricultural inputs					
Duflo, Kremer and Robinson (2008)	Kenya (rural, Busia district)	RCT	673 farmers randomly selected from lists of parents of children enrolled in local schools	Free fertilizer and hybrid seeds provided to randomly selected farmers, together with assistance in applying the inputs correctly and harvesting the crops	Median increases in yields of from 9% to 49% (depending on the fertilizer treatment). However, median rates of return were positive for only one of the treatments.
Duflo, Kremer and Robinson (2009)	Kenya (rural, Busia district)	RCT	924 farmers randomly selected from lists of parents of children enrolled in 16 local schools (9% sample attrition between baseline and follow-up).	Farmers randomly offered one of the following: the chance to purchase a voucher immediately after the harvest, at a time of their choosing, fertilizer at the regular price with free delivery 2-4 months after harvest or fertilizer at a 50% subsidy with free delivery 2-4 months after harvest	Fertilizer use increased in every group (from 14-22 percentage points on a base of 23 percentage points), except the group allowed to purchase fertilizer at the regular price.
Giné and Yang (2009)	Malawi (rural, Central Malawi)	RCT	800 maize and groundnut farmers in 32 localities	Farmers offered either credit to purchase high-yielding hybrid seeds or credit plus a requirement to purchase rainfall insurance at an actuarially fair price.	Take up was 33% in the first group and 13% lower in the second group.
Crop insurance					

Study	Country & setting	Methodology	Sample & sample size	Intervention(s)	Findings
Cole and others (2010)	India (rural Andhra Pradesh and Gujarat)	RCT	1,047 randomly selected land-owning households from 37 villages (Andhra Pradesh). 1,500 households from 100 villages in which the participating NGO marketing the rainfall insurance operated and located within 30 kilometers of a rainfall station (Gujarat).	Rainfall insurance offered to farmers at different discounted prices	Take up strongly related to price, with estimated price elasticities ranging from -0.66 to -0.88. However, take-up was low (less than 50%) even when the price was heavily discounted. Demand appears to be constrained by liquidity.
Gaurav, Cole and Tobacman (2011)	India (rural, Gujarat)	RCT	600 small-scale land-owning predominantly male farmers from 15-rainfed villages in three coastal districts. Two-thirds of the sample own less than 4 hectares of land.	Farmers offered rainfall insurance, with some offered a money-back guarantee (equivalent to a 60% price discount). Half of the treatment group was also given financial literacy training in two 3-hour sessions.	The training increased the take up by 8.1 percentage points (compared to a base take-up rate of 8%), while the 60% price discount increases the base take-up rate by 6.9 percentage points.
Giné and Yang (2009)	See under “Improved use of modern inputs” below				
Karlan, Kutsoati, McMillan and Udry (2011)	Ghana (rural, Eastern)	RCT	169 farmers responding to a baseline survey, 126 of whom responded to a follow-up about one year later. Evidence of attrition bias.	Farmers offered loans with or without crop price insurance and financial literacy training	Take up rates were high (92% of farmers offered loans and crop price insurance, 86% of farmers offered loans only). Gender did not have a significant effect on take up.
Mobarak and Rosezweig (2012)	India (rural, Andhra Pradesh, Uttar Pradesh and Tamil Nadu)	RCT	4,667 cultivator households from 42 villages randomly selected for a large previous rural survey	Rainfall insurance offered to farmers at actuarially fair or discounted prices	Take up rate very low (about 40% overall). However, additional follow-up data collected in Tamil Nadu indicate that households offered rainfall insurance at discounted prices tended to plant more higher yielding and less drought-resistant varieties.
Mobile phones					

Study	Country & setting	Methodology	Sample & sample size	Intervention(s)	Findings
Aker (2008)	Niger (rural)	Difference in differences estimation	Panel data on 395 traders and 205 farmers located in 35 markets across six geographic regions.	Extension of mobile phone coverage	Reduced grain price dispersion, especially in areas where travel costs are higher
Aker and others (2011)	Niger (rural, Tahoua region)	RCT	Baseline and follow-up data were collected from 1,200 recipient households in 96 villages (with 98% of baseline households re-interviewed)	Use of mobile phones to distribute unconditional cash transfers in targeted villages	Mobile phone distribution reduced both the variable costs of distributing the transfers (by 30%) and program recipients' costs of obtaining the transfer (by about 75%)
Jack and Suri (2011)	Kenya (national)	Difference in differences and instrumental variable estimation using panel data	Panel data were collected from 3,000 randomly selected households from 102 locations in areas accounting for 92% of Kenya's population. Sample attrition was about 24% between baseline and endline surveys.	Extension of M-Pesa mobile money agent coverage	Access to M-Pesa increases a household's ability to smooth consumption in response to a negative income shock.
Klonner and Nolen (2008)	South Africa (rural)	Instrumental variable estimation	Data from two nationally representative household surveys	Extension of mobile phone network	Employment increases by 15 percentage points, with most of the effect concentrated in females. No effect on average household income or moderate poverty, but a positive effect on household income among households with no children and a negative effect on severe poverty.
Mbiti and Weil (2011)	Kenya (national)	Fixed and random effects estimation using panel data	Aggregated household data from two nationally representative surveys conducted in 190 sublocations (i.e., clusters of 2-3 villages)	Extension of mobile phone network	M-Pesa network has a significant effect on several outcomes, including the probability of being banked (positive), use of traditional savings networks (negative), and the cost of competing money transfer services (negative)

Study	Country & setting	Methodology	Sample & sample size	Intervention(s)	Findings
Muto and Yamano (2008)	Uganda (rural)	Fixed-effects instrumental variable estimation	Data collected from 856 households in 94 communities in baseline and follow-up surveys (940 households were interviewed in the baseline survey)	Expansion of mobile phone coverage	Participation of farmers in marketing bananas (a perishable crop) increased from 50 to 69% in communities more than 20 kilometers from district centers, without any effect on participation of maize marketing (a less perishable crop)
Improved cooking stoves					
Burwen and Levine (2012)	Ghana (Sissala West district of Upper West Region)	RCT	768 households in 8 villages (only 64% of households completed the survey, 53% of treatment households and 73% of controls)	Provision of stove materials and training to randomly selected women identified as the main food preparers in their households	Modest reduction (12%) in wood use. No effect on time spent gathering wood or carbon monoxide exposure. After 8 months, half of the stoves appeared to have been used recently.
Hanna, Duflo and Greenstone (2012)	India (rural Orissa)	RCT	Panel data on 2,651 households from 44 villages (no evidence of attrition bias)	Households randomly selected to receive an improved cooking stove	Significant reduction in smoke inhalation in the first year, but no effect in years 2-4. No effect was observed in lung functioning, health, productivity or exposure to indoor air pollution. Households failed to use the stoves regularly or appropriately and did not maintain them properly.

Study	Country & setting	Methodology	Sample & sample size	Intervention(s)	Findings
Miller and Mobarak (2011)	Bangladesh (rural, Jamalpur and Hatia districts)	RCT	3,079 households from 58 villages	Treatment group provided with information about the health effects of cooking with traditional and improved stoves. Either women or men were randomly offered two alternative improved stoves, one that was more efficient and one that was healthier at no cost, at a heavily subsidized cost or at full cost.	When offered an improved stove at no cost, women were 6% more likely to accept the offer (and 6% more likely to choose the healthier stove). However, when a price is charged, women were no more likely to accept the offer and were less likely than men to choose the more expensive healthier stove. When households were offered the stoves at full cost, take up was very low.
Smith and others (2007)	Guatemala (rural, western highlands)	RCT	534 households (97% of whom participated in the data collection)	Improved cooking stoves were distributed to treatment group and stoves were checked weekly to ensure that they were functioning and being use correctly	52.3% of women in the treatment group reported that their health had improved after a mean of 16.3 months, compared to 23.5% in the control group.