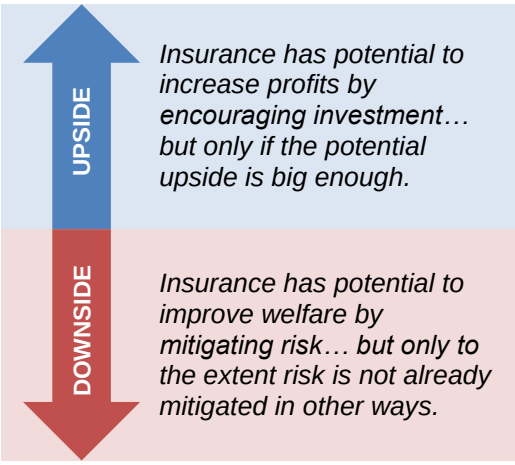
Microinsurance Learning and Knowledge

MILK Brief #34: Agricultural insurance: high potential but low demand

Ruth Vargas Hill[1], Barbara Magnoni[2] and Emily Zimmerman

Farmers everywhere face huge and varied risks, including weather uncertainty, pests, disease, and price volatility. Rural households in developing countries are especially vulnerable to these risks because they often derive a large portion of their income from agriculture. While they draw on many different tools to manage these risks, a large gap remains in their ability to do so. There is evidence that this uninsured risk has immense welfare effects and also constrains the investment low income farmers make in their farms. In this context, we would expect good agricultural insurance products to be quite valuable. They should protect assets and smooth income when a shock occurs and offer farmers the security they need to make profitable investments in inputs such as fertilizer or hybrid seeds. Good agricultural insurance products can also be useful if they encourage farmers to take "good" risks – for example by investing in more weather-sensitive but more profitable crops – and may also make lenders more willing to lend to farmers that they would otherwise consider too risky.



Despite all of these potential benefits, demand for agricultural microinsurance products remains almost universally low. This brief explores possible reasons why. We begin with a review of literature that suggests that farmers might obtain value from good agricultural microinsurance products[3] and then explore some of the possible reasons why demand for these products is still low. Low take-up may be explained by poorly designed products, potential clients' failure to understand products' value, or ineffective marketing. It might also be that the programs being studied do not have all the potential benefits that we might expect of them. Where creditors share some of the farmers' risks, farmers' "downside" risks may be capped. Likewise, where returns to available agricultural investments are quite low, the "upside" benefits of new investments may not be attractive enough for farmers to consider insuring their crops.

Welfare costs of uninsured risk

Without formal insurance, low-income households use a number of strategies to manage risk. They run down assets or borrow in bad times and save or pay loans back in good times. They ask for help from a network of friends and family members in bad years, and help out those in their network in good years (see

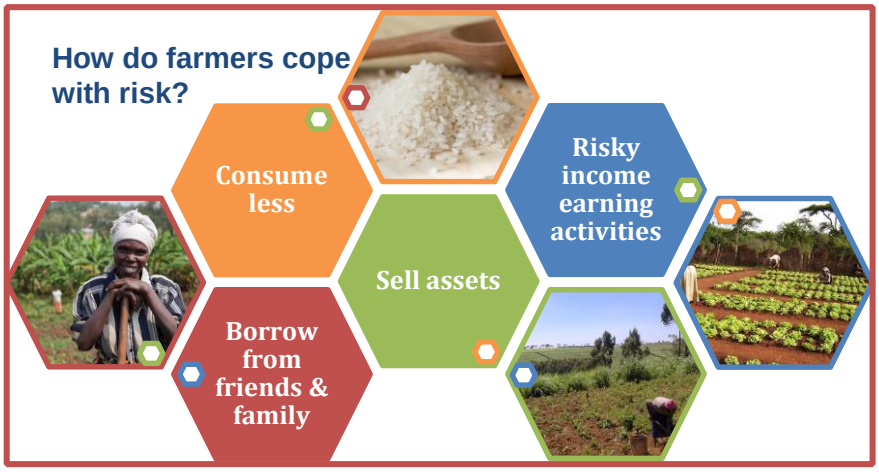
[1] International Food Policy Research Institute.

[2] MILK Project

[3] Most of the relatively few research studies of agricultural microinsurance to date have studied weather index products, and this research focus is reflected in the studies we cite below. The promise of microinsurance and many of the challenges it faces, however, apply more broadly to other types of microinsurance, such as crop indemnity and livestock insurance.

MILK Briefs #5 and #8).[4] However, these strategies have limited value in managing agricultural risk, which often involves severe losses, repeated losses (two bad harvests in a row) or losses that affect everyone at the same time (for example, a drought affecting a large geographic region).

Costly risk coping mechanisms are often needed to manage shocks. Farmers might reduce food consumption, take children out of school, sell off productive assets and engage in risky income-earning activities. These coping strategies have immediate and long term welfare costs. When food intake is very low there are both health costs and an effect on an individual's ability to earn (Dasgupta, 1997).[5] This is especially true when shocks impact the very young. Alderman et al. (2006) show that children in Zimbabwe exposed to the civil war preceding independence and the droughts that occurred in the early 1980s were more likely to be stunted as preschoolers, had reduced stature by late adolescence, and completed less formal schooling, resulting in a reduction in lifetime earnings of 14 percent.



When food stocks and savings have been depleted and households are unable to borrow more from friends and family, they resort to selling productive assets such as livestock and, in extreme cases, land. This is not an optimal response as it reduces the ability of households to earn income in the future. The combined effect of reduced consumption and asset losses can be large, even many years after the shock. Dercon (2004) finds that Ethiopian households that reduced consumption and sold their most valuable possessions to cope with droughts, in the mid-1980s had 16 percentage points lower growth over the period from 1989-1997 compared to those only moderately affected.[6] Other coping mechanisms may bring on new risks of their own. Risky income earning activities may help households meet immediate needs, but there may be long-run costs to health: a study on the impact of drought in sub-Saharan Africa found that in countries where the prevalence of HIV/AIDS is higher than 5%, each drought leads to a statistically significant increase in the likelihood of infection: for women, the likelihood increases by 14%, and for men it increases 11%. This is largely due to increases in sex for payments (Burke et al., 2011).

The welfare costs of this uninsured agricultural risk found in existing literature suggest that, were the right financial instruments available, farmers would be better off. Better risk management tools could help them smooth consumption and protect assets (including health, children's education, and productive physical assets). In addition to these direct welfare benefits, we expect, for reasons described below, that better risk management tools will lead to indirect welfare benefits by increasing farmers' investments in their farms.

Paying to reduce risk: Investment impacts of uninsured risk

While there is little direct evidence that having agricultural microinsurance products causes farmers to invest more in their farms, compelling evidence from literature on risk management in the absence of insurance suggests that this may be the case, and it is supported by the findings of recent studies of microinsurance

[4] MILK Brief #5: Changing role of family networks in coping with risk; MILK Brief #8: "Doing the Math" - Cashless Funeral Microinsurance in Colombia.

[5] Behavioral experiments have also shown that individuals value stability in food consumption over time (for example see Harrison, Humphrey and Verschoor, 2010).

[6] Comparing the 25th and 75th percentile of households in terms of the severity of suffering, the latter had about 16 percentage points lower growth over the period 1989-1997.

products. A large body of theoretical literature considers how risk can impact investment decisions of poor farmers. This work suggests that increases in risk will tend to reduce the scale of risky crop production[7] (see, for example, Sandmo, 1971; Fafchamps, 1992; Barrett, 1996; Kurosaki and Fafchamps, 2002). Empirical studies of risk management tools without formal insurance products have confirmed the predictions of these models: households with less risk management capability devote less land to high-yielding but volatile rice varieties and castor in India (Morduch, 1991); more land to low-risk and low-return potatoes in Tanzania (Dercon, 1996); and less labor to price-volatile coffee in Uganda (Hill, 2009).

The threat of shocks can also make households reluctant to access credit markets because they fear the consequences of an inability to repay (Carter et al., 2011). This in turn limits a household's ability to use costly inputs. In Ethiopia, households that are less able to manage income risk are less likely to apply fertilizer available on credit (Dercon and Christiaensen, 2011).

This body of work suggests that improvements in the ability to manage risks, such as those that would result from an insurance contract, will increase investments that are susceptible to weather risk. Two recent studies of microinsurance products have explored this issue, and both find that insurance does indeed help farmers reduce costly risk mitigation. In India, Cole, Giné, and Vickery (2011) provided free insurance to farmers, and found that insured farmers were more willing to invest in cash crop production. The share of households planting a cash crop (castor or groundnut) rises from 48.6% among the uninsured to 55.0% among those with insurance. Insured farmers also spent more money on inputs for cash crops and increased the area of land devoted to cash crops by 8%. This study captures the short-term average effect of providing insurance to both those that wanted it (and would have paid for it) and those who may not have been willing to pay for it. In northern Ghana, Karlan, Osei-Akoto, Osei, and Udry (2012) found that insured farmers increased expenditure on chemicals (mostly fertilizer) by 24% and increased the area of land cultivated by 17%. Farmers that had insurance also shifted a larger portion of their land to crops that were more sensitive to rainfall, increasing the share of land planted in maize by 9 percentage points. Overall, harvested value was 9% higher among insured farmers.

Although agricultural microinsurance products are often expensive in relation to farmers' incomes, there is evidence that farmers are often already paying to mitigate weather risk by reducing the area cultivated; growing low-risk, low-return crops; and refraining from input purchases. Empirical evidence suggests they may be paying quite a lot: 9% of crop value in Ghana (Karlan et al., 2010) and 25% of income in India (Walker and Ryan, 1990).

Why, then, low demand?

Given the great potential benefits, we might expect demand for formal agricultural microinsurance products to be quite high. However, demand for these products remains very low, despite many interventions designed to increase uptake. MILK Brief #7[8] explores the demand considerations that influence decisions to purchase microinsurance. Many of these are particularly relevant to agricultural products, and there are additional factors that may constrain demand for agricultural microinsurance.

Do we have good, appropriate products?

It is not clear that good insurance products for agricultural risk are available to many low income farmers. The majority of agricultural microinsurance is index-based, with payoffs tied to the performance of an index (such as the amount of rainfall measured by a rainfall gauge), rather than indemnifying farmers for crop losses actually experienced. Using indices is often the only way for insurers to offer a financially viable product because agricultural indemnity insurance is particularly subject to moral hazard, adverse selection,[9] and high costs of loss verification. However, farmers may experience a loss that is not reflected in the index,

[7] Except in the special case of output risk that is positively correlated with consumption prices, for example with rice price risk when households are net purchasers of rice (Barrett, 1996).

[8] MILK Brief #7: A Microinsurance Puzzle: How do Demand Factors link to Client Value?

[9] Moral hazard is the risk that, once insured, farmers will take less care to avoid losses because they know that those losses will be covered. Adverse selection is the tendency for higher-risk individuals to be more likely to opt into the program. Index-based products minimize these risks because the payout is determined by the index, regardless of what actual losses are.

and as a result receive no payout. This "**basis risk**" can be quite large[10] and may act as a major deterrent to demand (Clarke, 2011; Mobarak & Rosenzweig, 2012).[11] Clarke finds that for the levels of basis risk found in some index products sold in a developing country in 2009, the optimal level of coverage is 9.6% of agricultural wealth when the product is actuarially fairly priced.[12] This study likely overstates the impact of basis risk because it assumes that there is no positive benefit to incomes as a result of holding insurance, but even when income benefits are taken into account the impact of basis risk on demand remains large for risk-averse farmers. Mobarak and Rosenzweig find in India that, while basis risk (measured by the perceived distance to the nearest rainfall station), is a significant impediment to take-up of index insurance, its effects vary widely with the farmers' risk-sharing arrangements. Farmers in Ethiopia stated that an incidence of basis risk would reduce demand by 30 percentage points (Hill et al., 2011). When insurance was sold to groups encouraged to mitigate basis risk by sharing payouts, demand increased by 50% (Dercon et al., 2012). When new weather stations were installed closer to insured villages in India (reducing perceived and possibly actual basis risk), demand increased by 17% for each kilometer the distance was reduced (Hill et al., 2011).

Even when products are "good" (effective in covering the risks they are intended to cover), they may fail to address some other risks that are critical to farmers, such as price volatility. This may also limit demand, if farmers are unwilling to pay for insurance coverage that fails to mitigate these critical risks. These remaining risks may also prevent farmers from taking on the additional risk of increased investment or a loan, and may similarly limit the willingness of lenders to offer loans.

Are products affordable?

Like other microinsurance products, agricultural microinsurance products are often expensive in relation to their potential payout; they have a **high loading factor** due to substantial distribution costs, low sales volumes, and high per-unit reinsurance costs. Cole et al. (2010) indicate that loading multiples for weather index products have been quite high (between 1.75 and 3.03). Because low-income farmers tend to be very price-sensitive, such high loading factors can be a substantial force in keeping demand low. A number of studies have randomly allocated discount vouchers to small-holder farmers, and in all cases demand has increased quite substantially with reductions in price (see, e.g., Cole et al., 2010; Hill et al., 2011). Similarly, Karlan et al. (2012) finds strong demand for index insurance (between 40% and 50% of farmers purchased insurance at an actuarially fair price), but great price sensitivity.

Liquidity constraints affect demand for all microinsurance products, but can be even more of a problem for agriculture when premiums must be paid at the same time other inputs are bought, a number of months after the last harvest when money is already tight. Combining insurance with agricultural loans allows the premium to be paid after harvest, and in some cases increases demand, though it may also in some cases generate a significant risk that the premium will not be paid. Syngenta has found that demand for products with this feature (their combined insurance-input loan) is quite considerable. More flexible premium payment schedules or offering insurance for the next season at harvest time when more cash is available[13] may also help to overcome some of these liquidity constraints.

Is perceived value low?

Financial literacy is often very low in rural areas, and is often combined with limited experience and **trust** in formal financial institutions, both of which can keep demand low if farmers do not understand how

[10] While we have little information about the magnitude of the size of basis risk for specific index products, it is likely to be quite large. Variance of yields within one location is often great, leaving large amounts of risk uninsured by the most accurate area-yield index, and even more poorly insured by an index that focuses only on weather data (as in most index insurance pilots).

[11] While an index should be closely correlated to actual losses, there will always be some variance between the index and individual losses. This potential mismatch is known as *basis risk*. Basis risk occurs when an insured experiences a loss but does not receive a payment because the index threshold value is not met, or conversely, when an insured receives a payment but localized conditions may not have resulted in a loss or as severe a loss as the index value indicates. (Skees et al., 2007)

[12] The paper develops a model for the optimal level of coverage for an actuarially fairly priced index product with basis risk. It then applies this model to an example of yields and weather index claim payouts for maize crops in a developing country in 2009, finding that rational, risk-averse farmers in this country would maximize their expected utility by covering only 9.6% of their agricultural wealth with these products.

[13] This has proven successful for fertilizer adoption (Duflo et al., 2010).

insurance works and/or do not trust insurers to make payments. Training on risk management and insurance products has been shown to increase demand in some cases. Receiving intensive financial training as opposed to basic training increased insurance purchases by 43% in China (Cai, 2012) and by 84% in India (Hill et al., 2011). Increasing trust through endorsement of a product by a trusted third party has also been shown to increase demand. In India, demand was found to be 36% higher when insurance was offered by someone known and trusted by the household (Cole et al., 2011).

Do other behavioral influences keep demand low?

Ambiguity aversion, people's tendency to prefer certainty, can reduce demand for any insurance products because the premium payment is a known, thus a certain loss while the benefit is uncertain and for that reason is discounted. Its effect is often particularly strong for index products, where farmers' losses are not always mirrored by the payout determined by an index (Bryan, 2010). Carter (2011) suggests that this can be overcome by rethinking the timing of premium payments or incorporating a certain refund into insurance products if the index is not triggered.

Agriculture is often rooted in tradition, and farmers can be resistant to new practices with uncertain outcomes. **Status quo bias**, the tendency to maintain current or previous decisions, may also keep demand low where farmers have never used insurance. A similar influence is our tendency to **conform** to the decisions of those around us, even in cases where those decisions are obviously wrong. In areas where microinsurance takeup is low and its value is difficult to assess, these influences may be quite strong. MILK Brief #7 provides a more detailed description of behavioral and other influences on demand.

Is the potential "downside" or "upside" of products limited?

In some cases the benefits of insurance products may be limited. The evidence presented above suggests the potential benefits of agricultural insurance are large, but in some cases the insurance products offered may address downside risks that are already well-managed, or they may target investments that farmers believe offer little upside return.

Business Implications of Lending to Riskier Borrowers

A crucial component of the value of agricultural insurance is its potential to improve access to credit among low income farmers. We do not explore in this brief the business implications of the incentives insurance may create for lenders, but note that they may be significant. If insurance encourages lenders to lend to riskier borrowers than they otherwise would have, it may create a temptation to lend to those who are "too risky." Mishra (1994) suggests that this may have happened to both commercial and cooperative lenders in India. By shifting their credit risk to an insurer, lenders may be tempted towards moral hazard where they lend even in cases where they know or could anticipate that crops are likely to fail.

To the extent that insurance may in some cases lead lenders to over-lend and insurers are unable to anticipate or restrain this activity, the business case for the provision of these products may be weakened as a result their longer term incentives to provide microinsurance products. Product design and delivery channel choices that take these considerations into account may strengthen both the business case and the long term value proposition of agricultural insurance.

Financial institutions may restructure or even write off agricultural loans when farmers are struck with severe droughts, floods or other disasters, or when the government provides a bailout to the financial institution. **Debt relief** can have strong effects on the expectations of farmers, with implications for the way they view future debt obligations (Kanz, 2011). Specifically, debt relief can cap the perceived "downside" to farmers losing their crops by reducing or eliminating their debt burden. Giné and Yang (2009) found that take-up of a loan product bundled with insurance (at an actuarially fair price) was lower than take-up of the loan offered on its own. The authors suggest that this may be due to the inherent limited liability of the loan product; if farmers know that lenders will not pursue them for nonpayment if the growing season is bad, the insurance product becomes redundant. In these settings, index insurance is beneficial when it lowers interest rates faced by insured farmers, or when it is used by rural banks to manage risk allowing lending to farmers to expand (Collier and Skees 2012).

Although, as noted above, they are rarely sufficient to fully manage agricultural risks, strong **informal risk management** tools, or the perception or expectation of them, may also limit demand for microinsurance. Mobarak and Rosenzweig (2012) find that farmers in networks with strong informal risk sharing that already protects them against aggregate weather shocks[14] purchase less insurance than other farmers.

It is also possible that the potential "**upside**" of agricultural insurance products is limited. Farmers may not always have access to the high yielding inputs for the crops for which insurance is designed, and this limits the potential benefit of having insurance. Stefan Dercon, Chief Economist at the Department for International Development, once commented that it "does not make sense to offer insurance for fertilizer adoption in Africa where the returns are relatively low and the risks and complexities are high."

Conclusion

The demonstrated gap in poor farmers' ability to manage agricultural risk effectively, combined with the demonstrated impacts of uninsured risk on agricultural investment, point to great potential value of formal microinsurance products. There are some cases where the potential benefit is not as large as expected, perhaps because farmers already have effective tools to mitigate agricultural risks or because high-return investments are not widely available. Nevertheless, in general a large gap remains between potential value of these products and their demand. Much like with other microinsurance products, **price sensitivity, liquidity constraints, and mistrust** can be large obstacles to demand for agricultural insurance. However, these are exacerbated when poor value products are being offered, and many of the studies cited in this report suggest that **product flaws** inherent to index insurance products (such as basis risk) inhibit demand. As we work to understand the links between value and demand for agricultural insurance, it is also important to keep in mind the potential for tension between the insurer's business proposition and the incentives that insurance may create for lenders.

Further work is also needed to understand how to use indices to design insurance products of real value to low-income farmers. Combining index insurance with savings or group risk-sharing to help manage basis risk may be worth exploring. Innovations around how indices are used can also help. For example, indices could be used to inform when and where loss-assessment should occur rather than to determine payouts.

The studies cited in this brief represent much of the existing literature in agricultural microinsurance impact and demand. This body of work is small and has been mostly published since 2010. Already, this literature has begun to offer critical insights as to why a gap remains between value and demand for agricultural microinsurance. Interest in this field has been escalating and a number of new and potentially insightful studies are underway.[15] The MicroInsurance Centre's MILK Project expects these research initiatives to help speed the pace of innovation in coming years.

References

Alderman, H., Hoddinott, J., Kinsey, B. H. (2006). Long term consequences of early childhood malnutrition. *Oxford Economic Papers. 58,* 450-74.

Barrett, C. (1996). On price risk and the inverse farm size-productivity relationship. *Journal of Development Economics, 51,* 193-215.

Burke, M., Gong. E., & Jones, K. (2011). Income shocks and HIV in Sub-Saharan Africa. International Food Policy Research Discussion Paper 1146.

Bryan, G. (2010). Ambiguity and insurance. Mimeo. New Haven, CT: Yale University.

Cai, J. (2011). Social networks and the decision to insure: Evidence from randomized experiments in China. Berkeley, CA: University of California, Berkeley. Mimeo.

Carter, M. R., Cheng, L., & Sarris, A. (2011). The impact of interlinked insurance and credit on financial market deepening and small farm productivity. UC Davis. Mimeo.

Carter, M. (2011). Innovative design challenges. Presentation at the I4-CCAFS Workshop: Index Insurance for Managing Climate-Related Agricultural Risk: Toward a Strategic Research Agenda. IFPRI, Washington, DC, October 27-28.

Clarke, D. (2011). A theory of rational demand for index insurance. Department of Economics Discussion Paper. Oxford, UK: University of Oxford.

[14] The networks studied are Indian sub-castes (*jati*) which are geographically dispersed across districts and thus have the potential to protect against aggregate risk, as not all members experience weather shocks at the same time.

[15] By, among others, the Index Insurance Innovation Initiative (I4), International Food Policy Research Institute (IFPRI), Innovations for Poverty Action (IPA), the Microinsurance Innovation Facility, and the MicroInsurance Centre's MILK project.

Cole, S. A., Giné, X., Tobacman, J., Topalova, P. B., Townsend, R. M., & Vickery, J. I. (2009). Barriers to household risk management: Evidence from India. Harvard Business School Finance Working Paper No. 09-116. Cambridge, MA, US: Harvard Business School.

Cole, S. A., Giné, X., & Vickery, J. I. (2011). How does risk management influence production decisions? Evidence from a field experiment.

Collier, B. & Skees, J. (2012). Increasing the resilience of financial intermediaries through portfolio-level Insurance against natural disasters. Selected Paper prepared for presentation at the International Association of Agricultural Economists (IAAE) Triennial Conference, Foz do Iguaçu, Brazil, 18-24 August, 2012.

Dasgupta, P. (1997). Nutritional status, the capacity for work, and poverty traps. *Journal of Econometrics, 77,* 5-37.

Dercon, S. (2004). Growth and shocks: Evidence from rural Ethiopia. *Journal of Development Economics, 74,* 309–329.

Dercon, S. (1996). Risk, crop choice and savings: Evidence from Tanzania. *Economic Development and Cultural Change, 44*, 385-514.

Dercon, S., & Christiaensen, L. (2011). Consumption risk, technology adoption, and poverty traps: Evidence from Ethiopia. *Journal of Development Economics, 96,* 159–173.

Dercon, S., Hill, R. V., Clarke, D. Outes-Leon, I., & Seyoum Taffesse, A. (2012). Rainfall insurance and informal groups: Evidence from a field experiment with funeral societies in Ethiopia.

Duflo, E., Kremer, M., & Robinson, J. (2010). Nudging farmers to use fertilizer: Theory and experimental evidence from Kenya.

Fafchamps, M. (1992). Cash crop production, food price volatility, and rural market integration in the Third World. *American Journal of Agricultural Economics, 74,* 90–99.

Giné, X., & Yang, D. (2009). Insurance, credit, and technology adoption: Field experimental evidence from Malawi. *Journal of Development Economics, 89,* 1–11.

Harrison, G., Humphrey, S., & Verschoor, A. (2010). Choice under uncertainty: Evidence from Ethiopia, India and Uganda. *Economic Journal, 120,* 80–104.

Hill, R. V. (2009). Using stated preferences and beliefs to identify the impact of risk on poor households. *Journal of Development Studies, 45,* 151–171.

Hill, R.V., Ouzounov, P., Robles, M., Chatterjee, T., Isaacs, M. & Shankar, A. (2011). Report on insurance take-up analysis submitted to 3ie.

Kanz, M. (2011). What does debt relief do for development? Evidence from a large-scale policy experiment. Washington, DC: World Bank.

Karlan, D., Osei, R., Osei Akoto, I., & Udry, C. (2012). Agricultural decisions after relaxing credit and risk constraints. Research paper no. 23. Geneva: International Labour Organization.

Kurosaki, T., & Fafchamps, M. (2002). Insurance market efficiency and crop choices in Pakistan. *Journal of Development Economics, 67,* 419–453.

Mishra, P. K. (1994). Crop insurance and crop credit: Impact of the comprehensive crop insurance scheme on cooperative credit in Gujarat. *Journal of International Development, 6,* 529-568.

Mobarak, A. M., & Rosenzweig, M. (2012). Selling formal insurance to the informally insured. Yale University Economics Department Working Paper No. 97, Economic Growth Center Discussion Paper No. 1007. New Haven, CT: Yale University.

Morduch, J. (1991). Risk and welfare in developing countries. PhD Thesis. Cambridge, MA: Harvard University.

Sandmo, A. (1971). On the theory of the competitive firm under price uncertainty. *American Economic Review, 611,* 65–73.

Skees, J., Murphy, A., Collier, B., McCord, M.J., & Roth J. (2007). Scaling Up Index Insurance: What is needed for the next big step forward? Appleton WI, MicroInsurance Centre, p. 4.

Walker, T. & Ryan, J. (1990). *Village and household economies in India's semi-arid tropics*. Baltimore, MD: Johns Hopkins University Press.

Photo credits:

Microinsurance Learning and Knowledge (MILK) is a project of the MicroInsurance Centre that is working collaboratively to understand client value and business case in microinsurance. Barbara Magnoni leads the client value effort and Rick Koven leads the effort on the business case. Contact Michael J. McCord (mjmccord@microinsurancecentre.org), who directs the project, for more information.