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SMALLHOLDER DIARIES

Building the Evidence Base with Farming Families in Mozambique, Tanzania, and Pakistan

JAMIE ANDERSON AND WAJIHA AHMED

CGAP

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1818 H Street NW, MSN IS7-700
Washington DC 20433

Internet: www.cgap.org
Email: cgap@worldbank.org
Telephone: +1 202 473 9594

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Photo by Erin Scronce.

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Mozambique. Photo by Erin Scronce

EXECUTIVE SUMMARY

How do small-scale agricultural producers manage their money, and what do their strategies tell us about their need for financial tools? Smallholder households, cultivating approximately two hectares (five acres) or less, present one of the most challenging client segments for financial service providers (FSPs) due to three unique aspects of their financial lives: (*i*) their income from agricultural production is often erratic and infrequent; (*ii*) their required investments can be significant and must be made at specific times of the year; and (*iii*) their risks, whose incidence and covariance across the agricultural sector can be difficult to mitigate. In addition, their financial needs extend beyond agricultural production to a variety of nonagricultural, off-farm enterprises. Like any family, smallholder households also need a range of financial tools to meet regular expenses, respond to emergencies, and finance milestones such as weddings and funerals. Furthermore, improvements to the financial portfolios of smallholder households represent only one contribution to their overall well-being, and major challenges related to health, infrastructure, and education persist.[1]

CGAP launched the year-long Financial Diaries with Smallholder Families (the "Smallholder Diaries") to elucidate the financial lives of smallholder households and build the evidence base on this important client group. The study, conducted between June 2014 and July 2015, captured the financial and in-kind transactions of 270 households in impoverished northern Mozambique, the fertile farmlands of western Tanzania, and the Punjab province, the breadbasket of Pakistan. Nearly all adults in the Smallholder Diaries sample were born into farming households. They began working in agriculture at a young age and self-identified as being part of an agricultural household. When the Smallholder Diaries began, participants indicated that their agricultural activities were their most important sources of income. The data, however, told a more nuanced story.

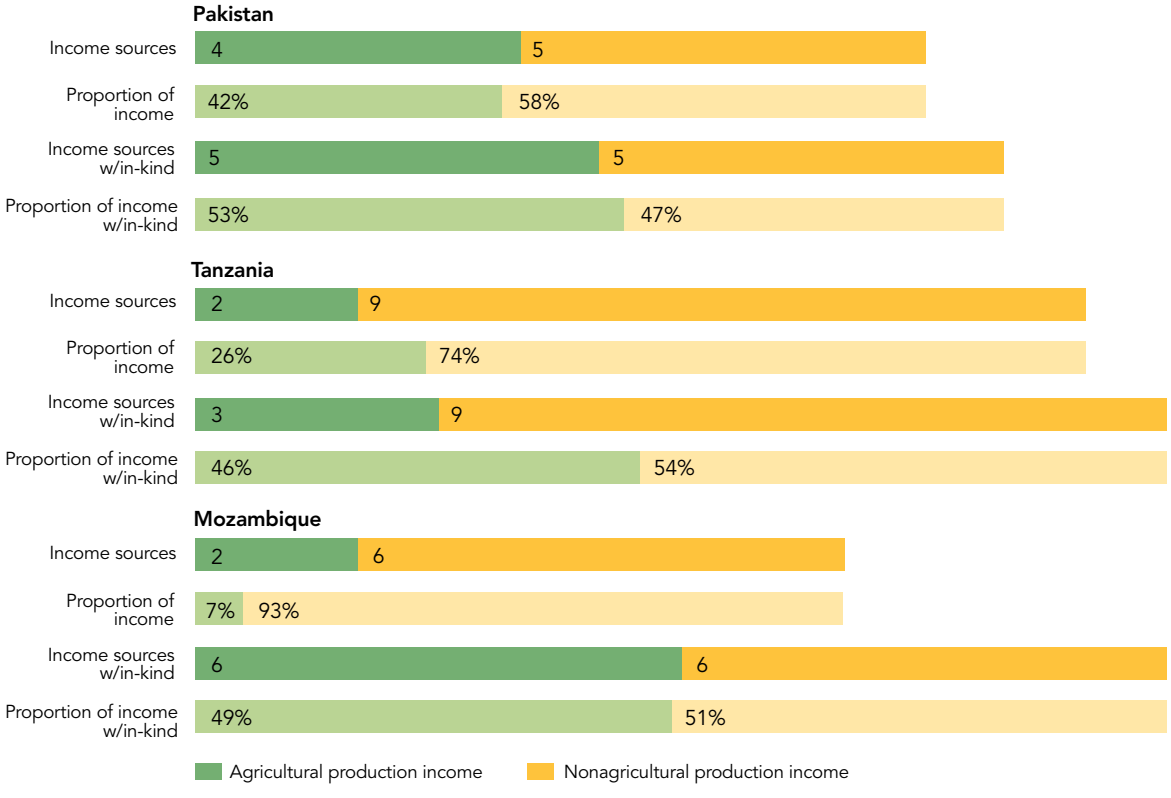
The Smallholder Diaries provide a deep view of how smallholders are affected by the agricultural cycle and manage their money in response to its ebbs and flows, as well as point to ways that FSPs might better meet smallholders' needs. While the Smallholder Diaries methodology and sample size are not statistically representative of all smallholder families in a given country, the findings from the Smallholder Diaries have global implications for the smallholder household sector. The sample of smallholder households from each study country has characteristics that are broadly representative of the types of smallholder segments identified in countries around the world, which presents an opportunity to discuss the types of financial tools that these segments demand regardless of their location.

Income sources and the role of in-kind consumption

Smallholder Diaries families had numerous sources of cash income, which tended to fall into three categories: (*i*) agricultural production, (*ii*) casual labor (often related to agriculture), and (*iii*) other off-farm, nonagricultural sources such as managing a small business, receiving remittances, or engaging in regular or waged employment. At the median, households had a total of eight income sources in Mozambique, 11 in Tanzania, and nine in Pakistan (see Figure ES-1).[2] Much of their casual labor was on neighboring farms, and thus still linked to agriculture. In the Tanzania sample, more than half of the income sources classified as casual labor was related to agriculture.

Families in the Smallholder Diaries also earned the majority of their household net cash income from their numerous nonagricultural production activities. Among the sample families, the median proportion of household cash income from nonagricultural production sources was 93 percent in Mozambique, 74 percent in Tanzania, and 58 percent in Pakistan (see Figure ES-1).

FIGURE ES-1: Smallholder Diaries: Household income from agricultural and nonagricultural production
JUNE 2014–JULY 2015



(1) Median number of household income sources
(2) Median proportion of total household net cash income
(3) Median number of household income sources, factoring in in-kind consumption
(4) Median proportion of total household income factoring in in-kind consumption

Note: Each crop or livestock byproduct (e.g., milk, eggs) that was sold at least once in the Smallholder Diaries is considered a distinct source of agricultural production income. When tracking in-kind consumption, the Smallholder Diaries recorded only activities or transactions related to crops, not livestock byproducts.

But focusing only on cash income underplays the importance of agriculture to smallholder households. The relative importance of agricultural production income increases markedly when household consumption of crops is included in the analysis (see Figure ES-1). In the sample in Tanzania and Pakistan, the median proportion of household income derived from crop production increased from 26 percent to 46 percent and 42 percent to 53 percent, respectively, when also considering in-kind consumption. But the difference is most dramatic in Mozambique, jumping from 7 percent to 49 percent.

Patterns of agricultural production and sales

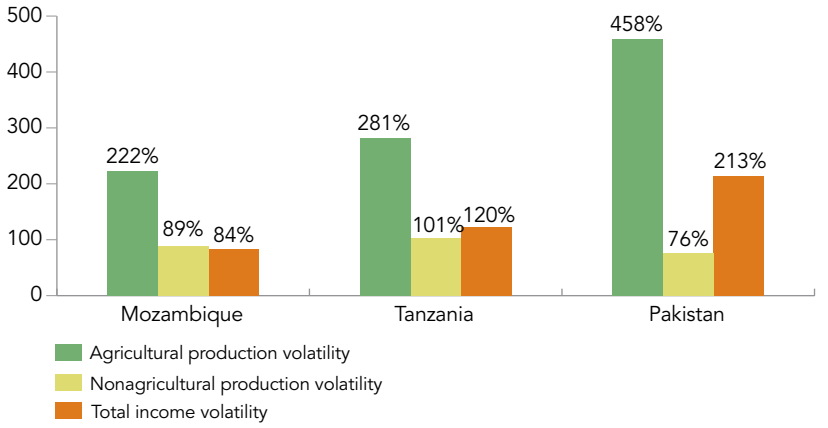
The degree to which smallholders sold their production and the pace of this monetization varies sharply across the three country samples. This echoes the segmentation framework proposed by CGAP that differentiates among (*i*) noncommercial smallholders, (*ii*) commercial smallholders in loose value chains, and (*iii*) commercial smallholders in tight value chains according to what they grow, how they engage with markets as buyers and/or sellers, and how those markets are organized (Christen and Anderson 2013). If and how smallholder households consume or sell their crops and the nature of their connections to value chains, for example, have important implications for the roles that financial tools can play in their lives and how they are tailored to household circumstances.

- **Smallholder families in the Mozambique sample were "net consumers" of their agricultural production** (i.e., they consumed more of their agricultural output than they sold). These were largely noncommercial smallholder households, with limited sales of crops and livestock. And many households did not sell anything over the entire year of data collection. They were able to consume smoothly what they produced, but they were unable to do much else with their harvest. They did not sell their crops for the cash needed to buy other foods, diversify their diet, or meet other household needs.
- **Smallholder households in the Tanzania sample were "net sellers" in loose value chains** (i.e., they sold more of their agricultural output than they consumed). These households typically had one major harvest of a cash crop (e.g., rice, potatoes) each year, which would typically be sold for cash to village-level agents and/or larger aggregating buyers. A few sold direct to market as well. Overall, sales of their agricultural production were fairly lumpy (i.e., they occurred in distinct periods over the year, not continuously) and spiked during the main harvest. Households also stored crops, consuming some proportion of some of them over time, and monetizing them when they needed cash.
- **Smallholder households in the Pakistan sample were net sellers in tight value chains,** consuming an even smaller proportion of their production than in the Tanzania sample. After each major harvest in November and in May, they were usually obliged to sell their output immediately back to the middleman to repay debts for the costly agricultural inputs they had financed.

Relationships between income volatility and agricultural production

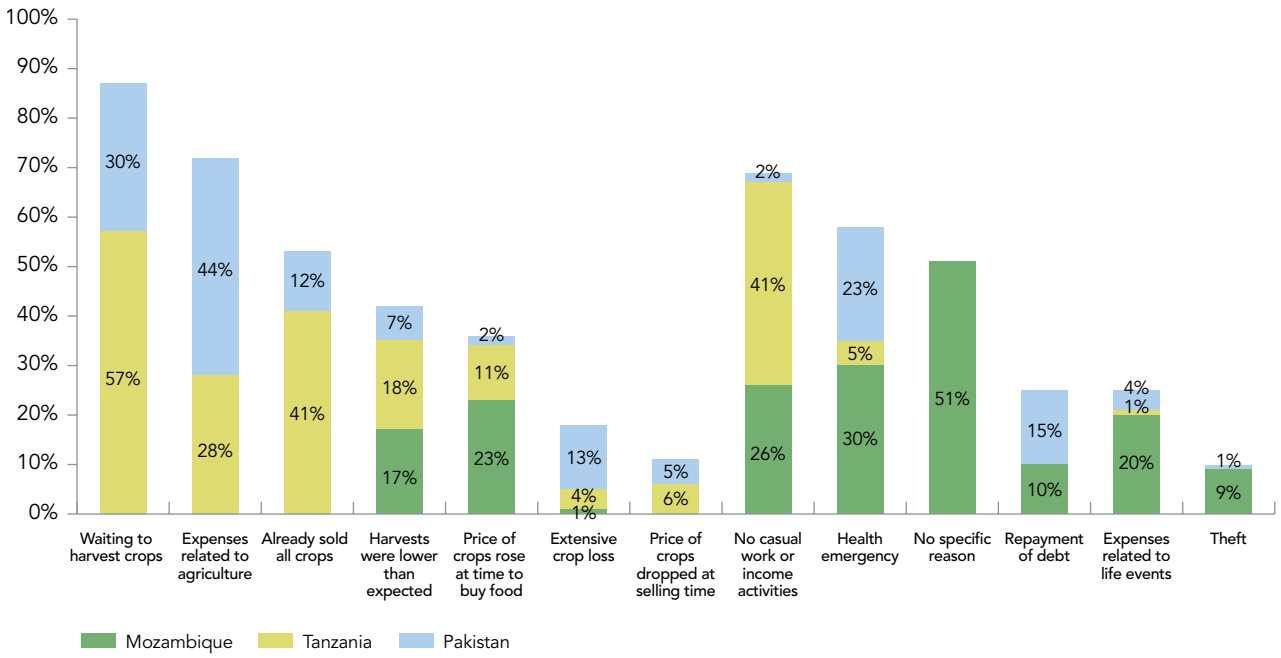
Agricultural production income was markedly more volatile than other sources of income in all three samples, and a household's overall income volatility depended on the balance between agricultural production and nonagricultural production income (see Figure ES-2). The wide range of income sources outside of crop and livestock production did dampen the effects of the agricultural cycle on the sample households, but only to a point. The volatility of agricultural production and its inherent risks still exerted a strong influence over the financial lives of smallholders. In terms of household finances and health, respondents in all three countries struggled most in the months between harvests. Furthermore, smallholders most often pointed to agriculture as causes of financial hardship, citing reasons such as "waiting to harvest crops" and "expenses related to agriculture" (see Figure ES-3).

FIGURE ES-2: Volatility of income: Median standard deviation of monthly income relative to average monthly income, JULY 2014– JUNE 2015[a]



a. Relative standard deviation of income = (Standard deviation of monthly income * 100)/ Average monthly income Standard deviation of monthly income represents the amount by which a household's income deviates from the average monthly income of that household.

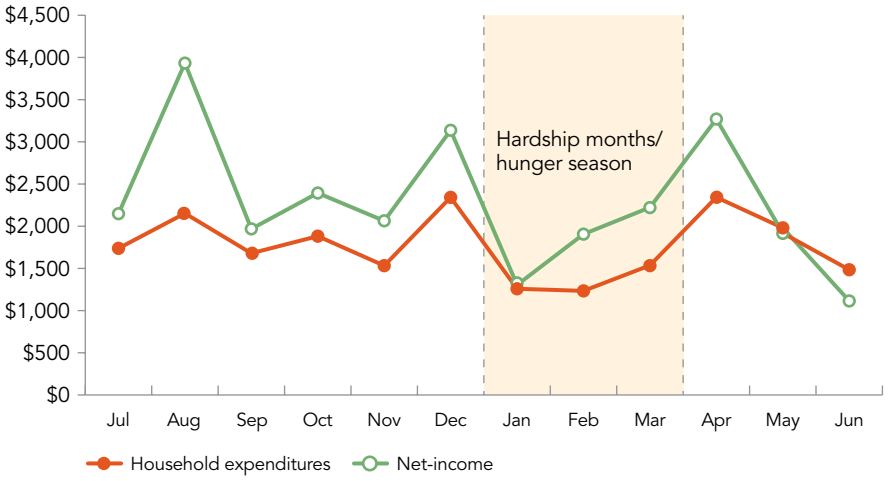
FIGURE ES-3: "[In the months when the family struggled most with money] what happened to cause this difficulty?"
Multiple responses allowed; percentage of household



For the sample in Pakistan, month-to-month net income from agricultural production was highly volatile (458 percent relative to average income). It swung from lows well below zero, when there were major expenditures on inputs, to significant highs, when they sold their output immediately after harvest. In the Mozambique sample, given the low level of crop sales and high reliance on other sources of cash income, families experienced less severe fluctuations in overall income.

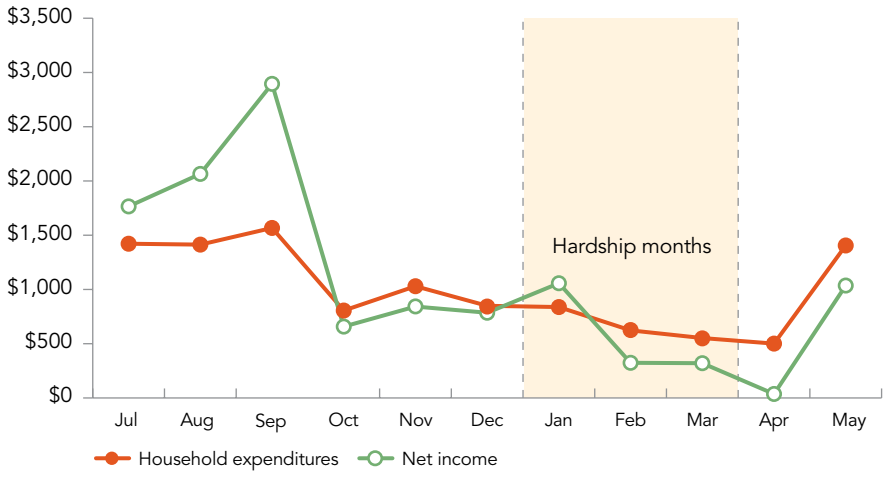
Expenses were smoother than income, but still fluctuated to some extent with income in all three samples. In Mozambique and Tanzania, sample households tended to spend money as it came in, with expenses more closely tied to cash income (i.e., a "spend-as-you-go" expenditure pattern) (see Figures ES-4 and ES-5). The Pakistan sample experienced the largest swings in income,

FIGURE ES-4: Mozambique Smallholder Diaries: Net income and household expenditures all sample level, JULY 2014–JUNE 2015 (US$)[a]



a. The green income line refers to net income. For agricultural production, and small businesses in particular, income refers to revenue less related expenditures. The red expenses line refers to operational expenses of the household separate from income or financial transactions (e.g., spending on groceries, clothes, education, transportation).

FIGURE ES-5: Tanzania Smallholder Diaries, rice production village: Net income and household expenditures all sample level, JULY 2014–MAY 2015 (US$)[a]



a. The green income line refers to net income. For agricultural production, and small businesses in particular, income refers to revenue less related expenditures. The red expenses line refers to operational expenses of the household separate from income or financial transactions (e.g., spending on groceries, clothes, education, transportation).

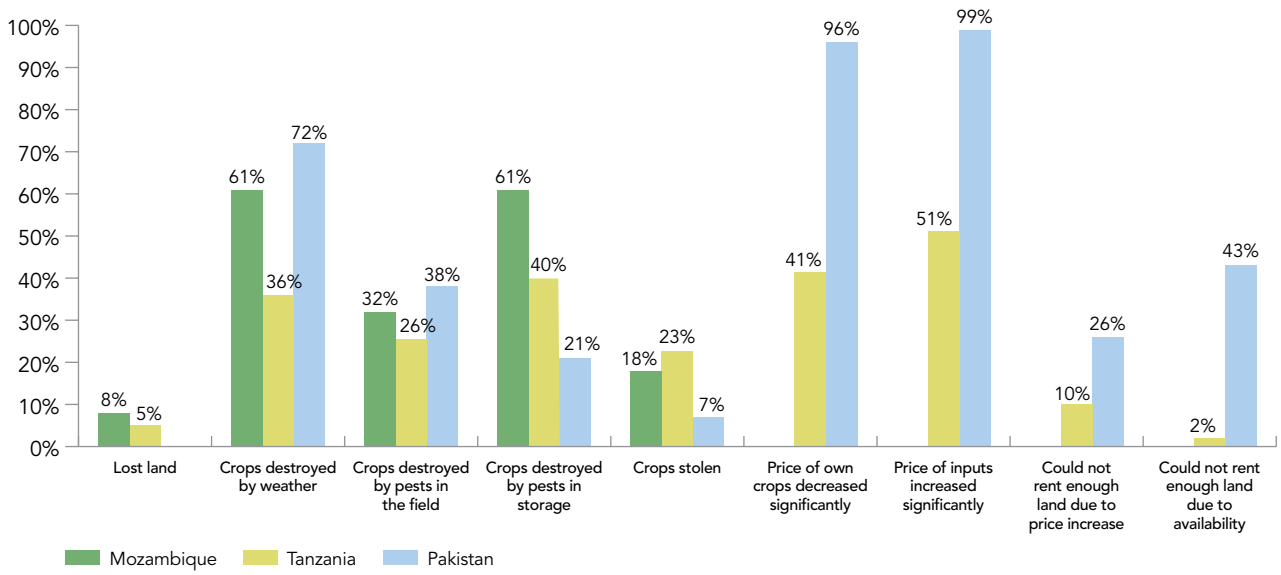
but they were able to maintain a consistent level of expenditures thanks to their greater access to credit options.

Risk mitigation and coping strategies

Less commercialized smallholders experienced more production-related shocks, such as bad weather, drought, and pests, while more commercialized households faced greater market-related ones, such as fluctuations in input and crop prices. These challenges came on top of the shocks commonly experienced by households (e.g., sickness, death of a family member, job loss).

- **In the largely noncommercial Mozambique sample, production risks were paramount, largely because the sample was not engaged in markets.** Households in the Mozambique sample needed to store their harvest for many months to cover their own food consumption and relied on bags kept in the house for crop storage. But their stored crops were vulnerable: nearly two-thirds of sample households had lost crops while in storage (see Figure ES-6). Improvements in post-harvest handling and crop storage would better preserve their agricultural production and maintain its value as both food and a form of savings.
- **The sample in Tanzania, largely commercial smallholders in loose value chains, experienced the full spectrum of agricultural shocks, both production and market related,** though at somewhat lower levels than the other two samples. Over one-third of the sample had experienced significant crop loss due to weather shocks (36 percent) and pests (40 percent) and decreases in the prices for their own agricultural production (39 percent). This range of risks calls for a variety of mitigating mechanisms, involving both agricultural techniques and financial tools.
- **For commercial smallholders in Pakistan embedded in tight value chains, market risk was more pressing than production risk.** Virtually every household was affected by increases in the price of inputs and decreases in the pur-

FIGURE ES-6: Households that experienced selected agricultural shocks at least once in the past five years, JULY 2015 (Percentage)



chase prices for their agricultural production. A wider range of potential buyers and more financial tools to mitigate these risks could be beneficial.

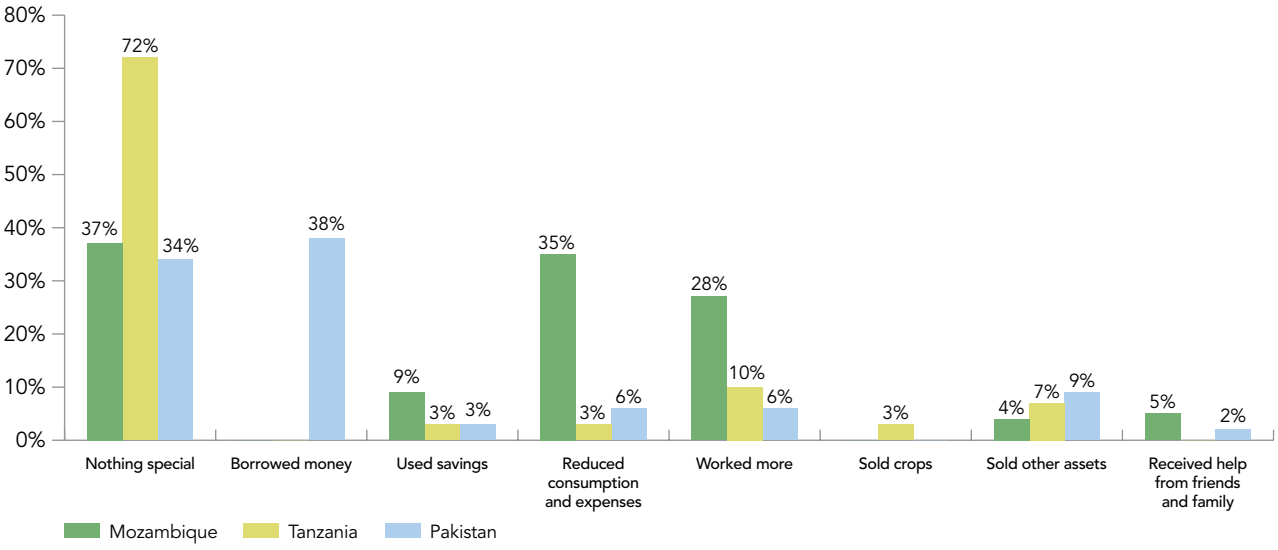
Many Smallholder Diaries households had no specific response to an agricultural shock, signaling a lack of tools with which to cope. The differences between the samples revealed varying degrees of access to financial tools and safety nets, as well as their degree of market engagement. When their crops were destroyed by weather, for example, many Tanzanian households in the Smallholder Diaries sample did nothing (72 percent), reflecting an apparent lack of perceived fallback options (see Figure ES-7). When the sample in Pakistan faced the same situation, some smallholder households borrowed money (38 percent); about one-third also had no specific coping response (34 percent).

Household financial portfolios

The degree to which Smallholder Diaries households could sustain their consumption levels and cope with shocks during lean periods between harvests depended heavily on the range of tools in their financial portfolios.[3] Most Smallholder Diaries households had access to only a thin scattering of informal financial tools—borrowing from friends and family, credit from a store or agent, saving at home or with a money guard—and each mechanism had its limitations (e.g., amount available, proximity, timing). Use of formal financial tools and digital finance remains limited. Households knew when to anticipate cash flow problems from past experience, but they lacked the financial tools to effectively and sufficiently smooth their consumption.

- **Smallholder households in the Mozambique sample used only three financial instruments at the median.** Their very narrow financial portfolio was mostly limited to savings at home and only a fraction of the Mozambique sample was engaged in informal savings and credit groups: 12 percent used rotating savings and credit associations (ROSCAs), 9 percent used accumulating savings and credit associations (ASCAs), and 5 percent used a money guard to save.[4] Though almost half had a mobile phone (45 percent) and some had

FIGURE ES-7: Households that used these coping mechanisms when crops were destroyed by weather
(Percentage; multiple answers allowed)



heard of mobile money products (21 percent), use of mobile money was nonexistent. With limited savings and credit options, sample households looked to casual labor to get through the hunger season, though the timing of this income did not always match the timing of their needs and it was insufficient to carry families through this difficult period.

- **At the median, smallholder households in the Tanzania sample used 12 different financial tools.** They relied most heavily on current income and short-term savings for both farming and nonfarming expenses. The sample also used stored crops as a kind of "term deposit": 21 percent considered crop storage their most important form of savings, with crops tending to gain "interest" as the price increases over time. Those who borrowed had a number of small loans with informal groups and from those in their social networks, and many found casual work to generate income when they needed cash. Almost everyone in the sample had heard of mobile money (98 percent), but only 19 percent had used it to store money or send and receive money. Many of the Tanzanian respondents planned strategically to make investments in their farm, but with few opportunities to borrow, most relied heavily on short-term savings, including crop storage, and earnings from casual labor to buy agricultural inputs.
- **Working with the broadest, most robust financial portfolio, the sample of smallholder households in Pakistan used 18 financial tools at the median.** Households used various forms of credit to get through the months when spending on agricultural inputs was high and revenue from farming was low. The great majority of smallholders in Pakistan had heard of mobile money (82 percent), but no families used it during the Smallholder Diaries study. However, 57 percent said they would likely use it to send or receive money, indicating an aspiration to use the service.

Access to mobile phones and use of digital financial tools

The limited capability of the Smallholder Diaries sample to send and receive SMS texts points to a crucial gap between basic access to a phone, which itself remains a barrier, and the ability to perform financial transactions with it. The majority of respondents among the sample in Pakistan and Tanzania owned a mobile phone (70 percent and 56 percent, respectively), but less than half of the respondents in Mozambique did (45 percent) (see Table ES-1). In fact, only 55 percent of the Mozambican respondents had used a phone at all in the prior year. Among the sample that had access to a mobile phone, the ability to do relatively more complex tasks was limited: 68 percent in Tanzania knew how to send and receive an SMS text (but not access the internet), but this dropped to 25 percent in Mozambique and 24 percent in Pakistan.

Use of digital financial tools in the Smallholder Diaries sample was very limited (and only in the Tanzania sample), despite varying levels of awareness of and aspiration to use these tools. General awareness of mobile money (defined in this study as a transfer of funds using a mobile wallet) as a financial tool ranged greatly across Smallholder Diaries respondents, from a low of 21 percent in the Mozambique sample to near complete awareness among the sample in Tanzania (see Table ES-1), which is expected given the strength of the

TABLE ES-1: Mobile phones and mobile money among Smallholder Diaries households (percent),[a] NOVEMBER 2014

	MOZAMBIQUE	TANZANIA	PAKISTAN
Access to mobile phones and use of mobile money			
Had a mobile phone	45	56	70
Had a SIM card	48	56	65
Other household members had a mobile phone	38	43	21
Other household members had a SIM	57	35	22
Had used a phone, even a borrowed one, in the past year	55	77	73
Had heard of mobile money	21	98	82
Selected "Mobile money" as one response when asked "What would you likely use to send or receive money?" (multiple answers allowed)	0	74	57
Had used mobile money (for transfers and transactions on a mobile wallet based on actual cash flows from June 2014 to June 2015)	0	19	0
Self-reported capability with mobile phones			
"I cannot initiate or receive a call, or send or receive an SMS."	0	3	1
"I can only receive calls."	45	9	7
"I can only dial and initiate calls."	2	0	19
"I can dial and initiate calls and receive calls."	27	15	37
"I can dial and initiate calls, receive calls, and send and receive SMS."	25	68	24
"I can dial and initiate a call, receive calls, send and receive SMS, and access the internet."	0	1	7

a. Responses are from a Smallholder Diaries module administered to the most economically active member of the sample household.

Tanzanian digital infrastructure. This was reflected in the perception of mobile money among the sample as a financial tool relevant to their needs. When asked what financial mechanisms they might use to send or receive money, "mobile money" was selected as one answer by almost three-quarters of the sample in Tanzania and more than half of the sample in Pakistan. Yet, despite its perceived relevance, only 19 percent of Smallholder Diaries families in Tanzania used mobile money and no smallholder households in either the Mozambique or Pakistan sample used mobile money at all.

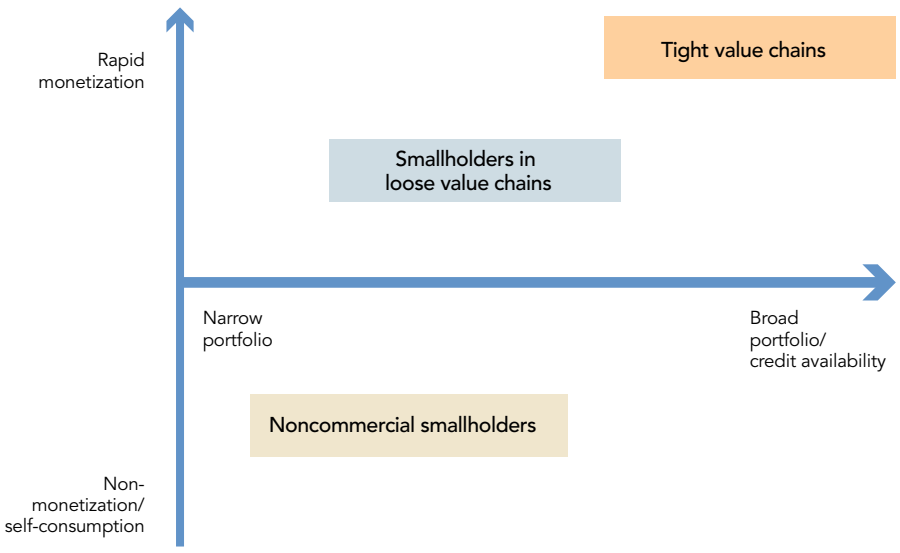
Considering the potential of digital financial services (DFS) to serve smallholder households in areas that traditional brick-and-mortar FSPs have failed to reach, DFS remain important tools to explore and expand for purposes of financial inclusion, and they must be carefully targeted to each customer profile. Digital savings and credit products could provide more compelling use cases than payments, as many households in the sample lacked access to even informal financial services such as savings groups. Additionally, some smallholders may be well-served by digital payment services that facilitate transactions such as bill payments and school fee payments (i.e., person-to-business [P2B] and person-to-government [P2G] payments), though smallholders may prefer over-the-counter (OTC) payment methods over self-initiated mobile transactions from their own wallet.

Implications for financial solutions: Translating the evidence into financial tools tailored to each smallholder household profile

The Smallholder Diaries explored the relationship between the level of agricultural commercialization and the breadth of financial portfolios in each country sample, and relevant financial tools must address the unique challenges and needs of each of these general profiles of smallholder households (see Figure ES-8).

- **Noncommercial smallholders in the Mozambique sample had a very narrow portfolio of financial tools.** Advances in their financial inclusion will likely emphasize savings and layaway products,[5] through digital channels where possible, and the better management of agricultural mechanisms of finance such as crop storage as opposed to pure, standalone credit products. Improved agronomic practices and better agricultural risk management (e.g., post-harvest storage, water catchment, drought-tolerant crop varieties) are also important. Larger buyers and agricultural processors would need to bundle a meaningful package of agronomic support with financial tools to reach more smallholders in this profile. Additional financial tools to help families store and stretch the small amounts of income earned on a daily basis would also be beneficial, especially as a type of safety net during the hunger season.
- **Smallholders in loose value chains in the Tanzania sample need greater capacity to store money across a diverse set of savings instruments, as well as access to higher levels of credit to make desired investments in agricultural production.** Overwhelmingly, the Smallholder Diaries sample in Tanzania kept its savings in-kind or under the mattress, presenting a clear opportunity for FSPs to offer more avenues to store money. A deeper under-

FIGURE ES-8: Three smallholder profiles based on degree of agricultural commercialization and breadth of financial portfolio



standing of the dynamics of household cash flows in this profile could also provide comfort to both FSPs and borrowers alike by demonstrating that certain forms of agricultural lending may not be as risky as previously perceived, or that they are at least mitigated by other less volatile sources of income outside of agricultural production. Relatively higher-income (or somewhat less poor) households like those in the Tanzania sample can also more successfully postpone crop sales to wait for a better price or purposefully use their stored crops to "save" for a lump sum of money. Closer connections to buyers and aggregators in the value chain could also benefit this profile. In a country with a robust digital infrastructure like Tanzania, these relationships and services could be enabled via digital channels. Such services could facilitate the creation of purchase agreements or formal contracts, for example, against which smallholders could borrow for fertilizer, an oft-cited need among the Tanzania sample households.

- **Smallholders in the relatively tight value chains in the Pakistan sample need financial tools that facilitate their relationships with middlemen, as well as a range of other mechanisms to reduce their dependence on them.** The sample in Pakistan faced major agricultural spending at the beginning of each season and relied on one major buyer to finance these inputs and also purchase their production. Their longstanding connection to these middlemen did facilitate a range of other financial services, including holding savings and financing family milestones and emergencies, and allowed them to refinance and bounce back after a bad harvest. But the general terms of their agreement required repayment immediately after harvest, forcing smallholders to sell when prices were lowest. In efforts to create a paper trail of transactions and purchase agreements to improve the transparency of these relationships, as well as build a credit history of interest to formal financial institutions, digital solutions could play a role. Over time, such a system could help smallholders find alternatives to middleman as sources of credit, thereby allowing them to wait longer to sell their agricultural production at higher prices. To compete, however, other service providers would need to emulate the flexibility and proximity of middlemen while offering improved terms. FSPs might also focus on middlemen as a market in need of expanded financial tools.

Mozambique. Photo by Erin Scronce.

INTRODUCTION AND METHODOLOGY

BUILDING THE EVIDENCE BASE ON SMALLHOLDER HOUSEHOLDS

The sheer numbers of smallholders (estimated at 475 million to 500 million smallholder farmers, with 1.5 billion to 2.5 billion people living in smallholder households worldwide), their significant share of the world's poor, and their role in food security in low-income countries make financial inclusion of smallholder households a development priority.[7] Limited financial inclusion among smallholder households is driven by a range of factors. These include, *inter alia,* the high transaction costs of reaching rural households; the low population density of rural areas, which makes reaching scale economies challenging; and the systemic (and perceived) risks of agricultural production that deter financial service providers (FSPs) from lending for agricultural production or otherwise engaging with farming households.[8]

Despite the renewed appreciation for the role that smallholder households can play in driving financial inclusion, little is known about this unique yet massive client group. Information about how they manage their financial lives and the financial tools they demand is even more difficult to find.

Though no financial inclusion statistics have specifically tracked smallholder households, smallholder families are likely over-represented among the financially excluded. Rural inclusion, often taken as a proxy for smallholder inclusion, is lower than urban inclusion.[9] The urban/rural disparities reported in Findex 2011 for adults holding an account in sub-Saharan Africa are 38 percent urban/21 percent rural, and for South Asia are 37 percent urban/31 percent rural.[10] Looking more closely at individual countries, estimates using Findex 2014 data for Pakistan, Tanzania, and Uganda show a similar urban/rural divide, with estimated account penetration in rural areas of Tanzania, for example, less than half of that in urban areas (see Table 1).[11]

CGAP has been working to build the evidence base on smallholder households as a first step in improving smallholders access to and uptake of a range of relevant financial tools. To address the dearth of relevant data to guide financial inclusion interventions that target smallholder households, CGAP launched two major demand-side research initiatives with smallholder households to better understand their financial lives, agricultural activities, and household livelihood strategies: (*i*) financial diaries with smallholder households ("Small-

holder Diaries")[12] and (*ii*) nationally representative household surveys and segmentations of the smallholder sector.[13]

These are two complementary research methods. The national surveys, which administer a household questionnaire to a nationally representative sample of about 3,000 smallholder households in each country, are wide, while the Smallholder Diaries are deep, with a year of very detailed data collection on all income sources, expenditures, and shocks with approximately 270 smallholder households across three countries. Together, these two lenses on smallholder households detail the granularity of the smallholder sector and identify distinct groups of agricultural households and their needs. The results also point to opportunities for service providers to improve financial tools for each segment and offer market information that informs the business case for doing so.

Opening a unique window onto the livelihoods of smallholder families and how they manage their money, this paper focuses on the Smallholder Diaries and presents its methodology and findings. This work builds on the more general findings about low-income households in other financial diaries research—

TABLE 1: Mobile phones and mobile money among smallholder diaries households (percent),[a] NOVEMBER 2014

COUNTRY	URBAN ADULTS (percent)	RURAL ADULTS (percent)
Pakistan	11	8
Tanzania	33	14
Uganda	27	19

a. The World Bank Group Global Findex database does not include Mozambique. Data from Uganda was shared to add another perspective from eastern and southern Africa and one of the countries in which CGAP is conducting national surveys of smallholder households. "The 2014 Global Findex database defines account ownership as having an account either at a financial institution or through a mobile money provider" (see Demirguc-Kunt et al. 2014).

Source: Author estimates using Global Findex database (2014) and urban/rural population shares (IFAD 2010).

BOX 1

RELEVANT FINANCIAL OR AGRICULTURAL SURVEYS OF SMALLHOLDER HOUSEHOLDS

Other survey research has included smallholder households in the sample but tends to explore either their financial or agricultural lives, but not both.

The Living Standards Measurement Study-Integrated Surveys on Agriculture (LSMS-ISA) are designed to improve the understanding of development in Africa with a particular focus on agriculture and the linkages between farm and nonfarm activities. Its design does not necessarily result in a subsample of smallholder farmers that is representative of the population of smallholder famers in a country (although most of the participants in the survey might be smallholder farmers) and though the questionnaire generally asks about access to credit, it does not provide a thorough understanding of the access to or use of a wider spectrum of financial services or delve deeply into smallholder attitudes and financial decision-making.

The FinScope consumer survey developed by FinMark Trust is designed to provide insights into how adults in a given country source income and manage their financial lives and to explore attitudes and perceptions regarding financial products and services. It is designed to be representative of the adult population of a country and does not focus only on those engaged in agriculture, thus it provides only a broad sense of the attributes of adults that generate an income through agricultural activities, and is not sufficient to facilitate targeted interventions in financing smallholder households.

The Agricultural Financial Markets Scoping (AgFiMS) diagnostic on financial services in the agricultural sector includes a comprehensive, nationally representative survey tool focusing on potentially commercially viable agricultural enterprises, including producers, processors, and service providers, which orients the survey sample toward a focus on the top-end of the agribusiness market (in terms of annual turnover) and therefore excludes the majority of smallholder farmers.

notably *Portfolios of the Poor* and the financial diaries in Kenya—with a particular focus on smallholder households.[14] The next section presents the methodology of the Smallholder Diaries, and the subsequent sections report and analyze its findings. Each section is complemented by a case study on the experiences of a family participating in the Smallholder Diaries.

SMALLHOLDER DIARIES METHODOLOGY

Launched by CGAP in 2014, the Smallholder Diaries is a research study that collected detailed financial data from approximately 270 small-scale farming households in Mozambique, Tanzania, and Pakistan over the course of a year.[15] The Diaries methodology combines in-depth quantitative and qualitative research. Research teams met participating families every two weeks to collect granular data on cash flows in and out of the household, financial tools, assets, major life events, and attitudes toward agriculture and financial services.[16]

Researchers captured the data using a tailored survey instrument. At the start, they guided households through three initial questionnaires that recorded their demographic information as well as income sources, assets, and financial tools. This baseline information then generated a tailored Smallholder Diaries questionnaire for each family (see Figure 1). In all three countries, the research teams visited the Smallholder Diaries households using tablet computers to record their financial information.

During their regular visits every two weeks, interviewers captured a complete set of individual cash flows from the preceding two-week period. Over the course of the discussion, interviewers asked household members about all of their various income sources, expense categories, financial tools, and transac-

FIGURE 1: The Smallholder Diaries process

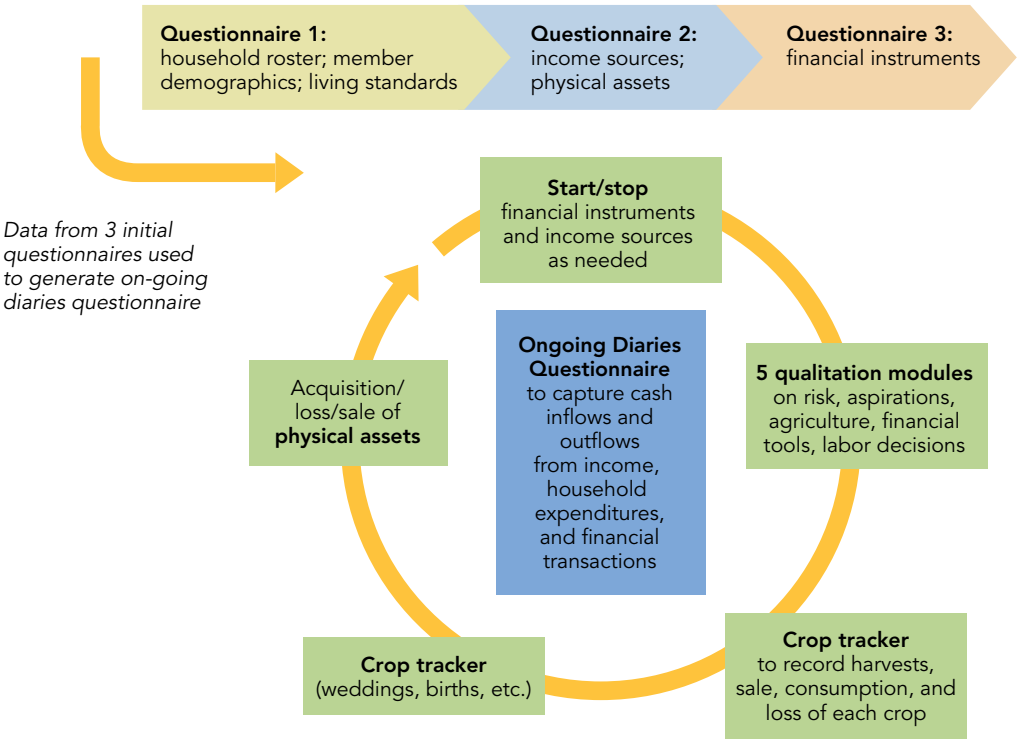


TABLE 2: Sample summary of sources and uses of income: Tanzania Smallholder Diaries household

SOURCES	USD	USES	USD
Selling beans	$5.5	Clothes and shoes	$5.8
Self-employment selling chips—income	$71.4	Housekeeping supplies	$1.2
Resources received from brother	$14.4	Posho mill/grinding machine	$3.5
Cash at home (withdrawal)	$34.5	Public TV/movies	$1.7
Supplier credit (borrowing)	$5.2	Groceries	$1.4
		Personal care	$1.2
		Prepaid phone credit	$0.3
		Self-employment selling chips—expenses	$58.7
		Cash at home (deposits)	$51.8
		Supplier credit (repayment)	$5.2
Total sources	$131	Total uses	$131

tions in the prior two weeks. One of the goals of each conversation was to balance the sources and uses of money (see Table 2). If, for example, after the interviewer had asked about the sources and uses of money, the respondent was to then mention that he or she had purchased some fertilizer, the interviewer would follow up with more questions to understand where the money had come from to make that purchase, working to bridge the gap between the uses of money and their sources. These gaps were monitored on a monthly basis, with an aim to keep them below 5 percent.

Since in-kind transactions make meaningful contributions to smallholder household well-being, interviewers also recorded the amount of select in-kind transactions and their approximate (self-reported) value.[17] The crop tracker in the Smallholder Diaries allowed the research team to track each crop grown by the household and record what was harvested, consumed, sold, lost, and given away. This information painted a picture of crop fluctuations in households over the course of year, and clearly illuminated the extent of household dependence on the in-kind consumption of its production and the magnitude and implications of any crop loss it experienced. The crop tracker data complemented the data on sales of livestock byproducts (e.g., eggs, milk) and changes in livestock assets.

The Smallholder Diaries also tracked all separate income sources, such as "agricultural production income" and "odd job income" (also called casual income), and carefully noted their stops and starts over time. If a given income source temporarily stopped for a family, for example, and then restarted later in the year, it continued to be tracked but was not double-counted as a new income source. In addition, each different crop and type of livestock was counted and tracked as a separate source of agricultural production income, given that each may have its own distinct production costs, timing considerations (e.g., preparation, planting, harvest), markets, payment modalities, and risks.

The Smallholder Diaries also collected information on the major income, health, and other shocks that households faced, and the related strategies they used to cope with them. Over time, when households experienced change—for example in their employment, when they started using new financial tools, and when their family experienced important life events such as births and adoptions—interviewers recorded "change questionnaires." This information then

Mozambique. Photo by Erin Scronce.

updated the regular financial diaries questionnaires, which were used for that household going forward.

Building on the standard biweekly data collection, separate interview modules were used to explore key topics more thoroughly. The five topical modules explored (*i*) decision-making in income choices (e.g., agricultural production versus nonagricultural production); (*ii*) the aspirations of smallholder households, including both farmers' aspirations and their hopes for their children; (*iii*) the use of and preference for various financial tools (based on knowledge of each household's financial portfolio); (*iv*) decision-making in agricultural production (e.g., why smallholders grow some crops and not others, how and when they decide to sell); and (*v*) risks, including how they are perceived and prioritized and how families coped with the shocks they experienced.

The methodology and sample size of the Smallholder Diaries were designed to generate a rich pool of detailed information and insights on a targeted population.[18] The Smallholder Diaries are not statistically representative of smallholder families in participating countries. Instead, through intensive, biweekly interviews about the sources and uses of household income and life events over the course of a year, the Smallholder Diaries paint a rich picture of the financial lives of a specific group of smallholder households in Mozambique, Tanzania, and Pakistan. Elucidating these differences is an important step in better understanding the financial management challenges facing smallholder households.

SMALLHOLDER DIARIES SITE AND HOUSEHOLD SELECTION

CGAP chose to implement the Smallholder Diaries in Mozambique, Tanzania, and Pakistan because of the variation in their agricultural sectors and the potential to work with smallholder households with different mixes of crops and livestock, degrees of engagement in agriculture, and market relationships, all within the varied mobile financial services ecosystems across the three countries. When selecting the specific research sites in each of the three Smallholder Diaries countries, the goal was to locate at least two villages no more than 40 kilometers apart. The villages needed to be accessible by a passable road so researchers could reach them throughout the year, and they also needed to present distinctions in at least a few important aspects, such as prevalent varieties of crops and livestock, access to irrigation, and average household income levels.

- In Mozambique, three villages in Rapale district of northern Nampula Province were selected based on strong recommendations from local stakeholders. While some large companies buy cash crops in the province, smallholders tend to practice the subsistence, rain-fed agriculture that is more commonly found throughout Mozambique.
- In Tanzania, the Smallholder Diaries sites included two villages located in the region of Mbeya, home to one of the largest farming populations in Tanzania. Mbeya sits within the Southern Agricultural Growth Corridor of Tanzania (SAGCOT), a region known for a productive agroecological climate and an array of crops and livestock. Farmers in the region most commonly produce maize, as well as coffee and tea, rice, potatoes, pyrethrum, and cassava. To explore the diversity within this region, Smallholder Diaries sites were selected in two different districts. The two selected villages exhibit important differences in available economic activities, climate, harvest seasons, crops, and use of agricultural inputs.
- In Pakistan, the Smallholder Diaries were conducted in southern Punjab, within the country's breadbasket. Rice, wheat, and cotton are commonly grown and typically sold through a network of local commission agents (known as arthis) and village traders. Given the dominance of agricultural middlemen in Pakistan, two villages in the district of Bahawalnagar were selected as representative of an area with relatively looser connections to agricultural value chains and middlemen.

Once the villages for the Smallholder Diaries were selected, the research teams used a screening process to help identify a range of families with diverse income sources, access to agricultural inputs, wealth levels, crops, and livestock to participate in the research.[19]

- In Tanzania and Mozambique, households were selected using a participatory rural appraisal wealth-ranking technique. Working with committees of village representatives, the research teams conducted wealth-ranking exercises to assess the relative wealth of households in village hamlets or subareas. Using the wealth ranking, eligible households were selected based on their landholdings, number of crops and harvests per year, use of inputs, and integration with local markets.

- In Pakistan, the sample was selected using a traditional screener survey with questions related to household demographics, crops and livestock, main income sources, and wealth indicators. As a supplement to this process, village leaders and community representatives were consulted to help ensure local ownership and eliminate households with large landholdings.

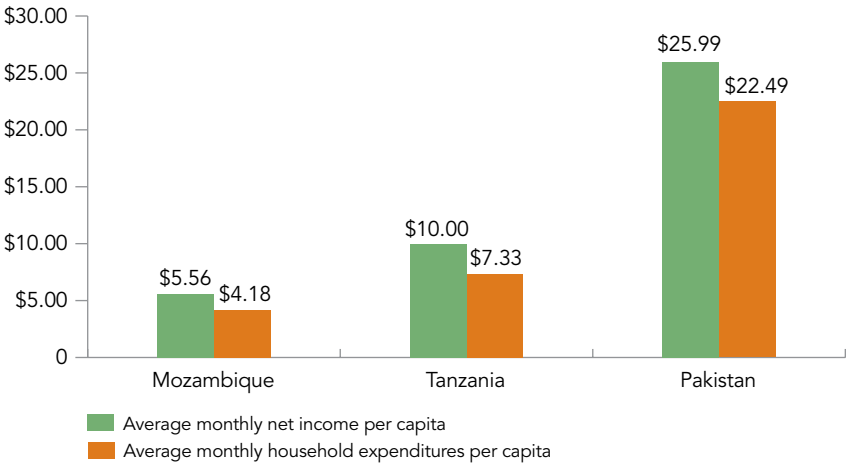
The specific sites selected for the Smallholder Diaries within each country also broadly reflect CGAP's global segmentation of smallholder households: noncommercial smallholders, commercial smallholders in loose value chains, and commercial smallholders in tight value chains. CGAP's focus is primarily on the lower-income, more vulnerable groups of farming families (i.e., noncommercial smallholders and commercial smallholders in loose value chains), as the relatively smaller percentage of commercial smallholders in tight value chains are likely to benefit from a number of interventions and developments in value chain finance. Nampula Province in Mozambique is the least developed of the three regions in terms of agriculture, with almost no use of agricultural inputs and limited access to irrigation and markets, unlike the Mbeya region in Tanzania. Southern Punjab, Pakistan, has the most robust agricultural market, even in the relatively less-developed (compared with North of the province) Smallholder Diaries site.

Tanzania. Photo by Erin Scronce.

SAMPLE DEMOGRAPHICS AND AGRICULTURAL CHARACTERISTICS

This section provides more detail on the demographics and agricultural characteristics of each Smallholder Diaries sample, setting the stage for the results that follow. In terms of income, smallholder households across the samples in Mozambique, Tanzania, and Pakistan reported average monthly per capita income of US$5.56, US$10, and US$25.99, respectively (see Figure 2), with added income diversity within each country sample. Characteristics of agricultural production also varied across the samples in the three countries, with marked differences in input use, access to irrigation, and crop and livestock mix (see Table 3), as well as their physical assets and financial net worth (see Figure 3).

FIGURE 2: Average monthly income and consumption (operational expenditures)[a] per capita (US$)[b]



a. Consumption here includes all operational expenses. It does not include stock purchases for self-owned businesses or farming expenses related to agricultural production. Consumption here does not include in-kind consumption of production from their own farms (these data are covered later in the report). Per capita calculations were derived by dividing by the number of people in the household.

b. The timeframes for observations are not exactly the same for every sample and household. In some areas and with some households, the Smallholder Diaries started slightly earlier than others.

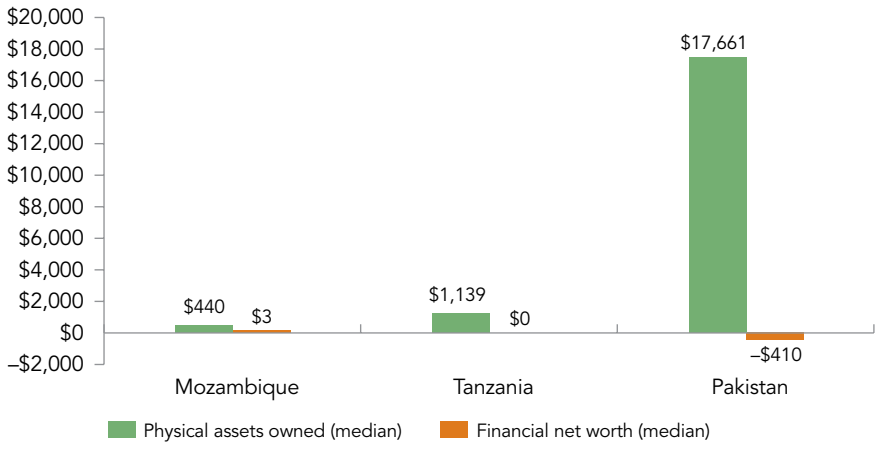
TABLE 3: Agricultural profile of households in the Smallholder Diaries

	MOZAMBIQUE SAMPLE—NAMPULA PROVINCE (North)	TANZANIA SAMPLE—MBEYA REGION (West)	PAKISTAN SAMPLE—BAHAWALPUR DISTRICT (Central)
National GDP per capita (US$) (2014)[a]	602	998	1,334
Monthly per capita net income in sample (US$)	5.56	10.00	25.99
Total number of households in sample	93	86	94
Average number of household members in sample	6	5	7
Female-headed households in sample (%)	17	29	1
Agricultural indicators			
Average land holdings (hectares)	1.31	0.8	1.18
Use pesticides (%)	13	47	100
Use fertilizer (%)	4	64	100
Use irrigation (%)	2	27	53 (canal)
Use diesel tube wells[b] (%)	—	—	83
Sample households growing various crops (Percent)			
Cotton	0	0	37
Wheat	0	7	100
Rice	49	35	96
Peanuts	96	0	0
Potatoes	0	73	0
Maize	65	100	0
Cassava	100	6	0
Beans	97	43	0
Other vegetables	41	15	12
Sample households raising various livestock (Percent)			
Poultry	53	64	33
Goats	10	26	55
Pigs	3	12	0
Buffalo	0	0	89
Cattle	0	21	39
Donkeys	0	5	26

a. World Bank (2014).

b. A tube well is a type of well with a wide tube or pipe a few inches long that provides water from an aquifer.

FIGURE 3: : Median physical assets and financial net worth of the Smallholder Diaries samples (US$)



MOZAMBIQUE SAMPLE

Of the three samples in the Smallholder Diaries, the one in Mozambique includes the most vulnerable population, where respondents identified a clear "hunger season" between late December and March. In the field site of Rapale district in northern Mozambique, the Smallholder Diaries sample included 93 households across three villages, with an average family size of six members (see Table 3). The household head had an average of five years of schooling and 17 percent of households were female-headed. The median value of all physical assets owned was US$440 (see Figure 3).[20] The main receptacles of physical asset wealth were vehicles, such as motorbikes, and land (see Annex 1).

Crop production was notably diverse among the Mozambique sample, but the use of agricultural inputs was limited. Sample households grew maize, cassava, peanuts, beans, rice, and a range of vegetables, and they consumed a significant proportion of their production at home. Livestock holdings were mostly limited to poultry, and occasionally goats and pigs. Some families channeled water from the river to their plots via informal irrigation schemes, but most depended entirely on rainfall.

Households in the Mozambique Diaries tended to exhibit some matriarchal tendencies, reflecting traits of the Makua culture, the largest ethnic group in Mozambique. Notably, women can inherit land, and women and men often come to a marriage each with their own plots. In many cases, each is responsible for farming their own small area. In most households in the Mozambique sample, the male household head made most decisions regarding agriculture and his wife followed his lead. Women generally cultivated food crops and men cash crops (though these were very limited in the sample). In addition to any agricultural activities, women were solely responsible for cooking, obtaining and preparing food, and raising the children. Women also organized funerals and other cultural events in the community, and the few respondents that participated in accumulating savings and credit associations (ASCAs) were women. Some men in the sample did not disclose their entire income to their wives, in some cases due to polygamous marriages or other relationships.

TANZANIA SAMPLE

The Smallholder Diaries sample in Mbeya, Tanzania, was comprised of 86 households, with an average family size of five members. Women headed about a third of sample households (29 percent) and levels of education were modest: 24 percent of household heads had no formal schooling and 69 percent had only completed up to primary school. The median asset portfolio of households in the sample reached US$1,139, and emphasized the primary residence and farmland, with notable holdings of other property and livestock (see Figure 3 and Annex 1).

The sample in Tanzania was located in two villages, each in a different district: One-third of families came from the Rujewa district, where rice is the main cash crop, and two-thirds were drawn from the Mbeya Rural district, where potato is the dominant cash crop. The village in Rujewa district sits at a lower elevation and has access to irrigation, unlike the village in Mbeya Rural

Tanzania. Photo by Erin Scronce.

district, which is located eight kilometers down a gravel road branching off the paved road that leads to Malawi. Families typically sold potatoes to independent agents who visit the village. The two villages have different agricultural cycles, so data related to harvests are presented by village in this report.

In the Tanzania sample, men are typically the household head and the final decision-makers. Women were generally in charge of household activities (e.g., cooking, cleaning, caring for children) and contributed to household decision-making. Women and men both shared farming responsibilities, but it was more common for women to work on other farms than men, and for less money. Over the course of the Smallholder Diaries, women from 46 different households worked as casual laborers on neighboring farms on 809 occasions, earning an average of US$2.67 each time. Men from 24 households, in contrast, worked as casual laborers on farms 268 times and earned an average of US$5.39 each time.[21]

PAKISTAN SAMPLE

The research team selected two villages about 25 kilometers apart, both growing rice as the main cash crop. In the first, semi-perennial irrigation canals provided water about six months out of the year, while in the second, smallholders did not have access to the canal and instead depended on tube well irrigation (see Table 3). Some families in the first village used tube well irrigation as well to supplement water from the canal. The use of chemical pesticides and fertilizers was universal among the Pakistan sample and almost all households were connected to the national power grid, though electricity may be available for only a few hours each day.

The Pakistan sample universally grew wheat, and fodder to feed livestock. A smaller percentage of households (12 percent) also grew vegetables, such as green chilies and okra. Most families cultivated rice (96 percent) and about a third (37 percent) grew cotton. Most families had buffalos (89 percent) and more than half also raised goats (55 percent). The median physical asset value in the Pakistan sample was significant: US$17,661. However, financial net worth was negative: -US$410 at the median (the credit-heavy portfolio in the Pakistan sample is discussed more in Section 5). Farmland was the major household asset, followed by the primary residence and livestock, which was significant and formed an important part of household livelihood strategies (see Figure 3 and Annex 1).

The family size was the largest across the three samples, with an average of seven members per household. Sixty-one percent of the household heads had no formal education, and 28 percent completed primary school. Men were generally the household head and women were in charge of household chores. In the Pakistan Smallholder Diaries sample, men headed all but one of the 94 households. In the Pakistan sample, most husbands and wives tended to make farming decisions together, but the husband had the final say. In some cases, the household head was the husband, and the wife operated her own side business. The husband made decisions regarding farming, but the wife operated her business independently.

The women in the Pakistan Smallholder Diaries sample generally played a major role in all aspects of agricultural production, from cultivation to harvest, and were primarily responsible for looking after livestock, which could be quite numerous. Women conducted the majority of harvesting and cleaning related to cotton picking, rice planting, and wheat cutting, and generally make up the hired labor force for these tasks in the region. Most women in both villages also engaged in casual labor on farms doing similar tasks, though earnings from temporary agricultural labor were very low; at most, women earn US$2 to US$3 per day.

ATTITUDES ABOUT AGRICULTURE IN THE SMALLHOLDER DIARIES SAMPLE

Born and raised in agriculture, most adults in the Smallholder Diaries sample believed that they would continue to farm, and in many cases would continue to supplement agriculture with other income sources. Nearly all adults in the sample were born into agricultural households—97 percent in each of Mozambique and Tanzania, and 100 percent in Pakistan—and began working in agriculture at a young age.

Among the Smallholder Diaries participants in Mozambique, their two most important aspirations were building a sturdy house out of quality materials (66 percent) and improving their farm (57 percent); providing an education for their children was a relatively low priority. The more commercially active smallholders in the Tanzania and Pakistan samples viewed expanding or improving their farm as a top life goal (74 percent and 69 percent,

Photo by Mwangi Kiribi.

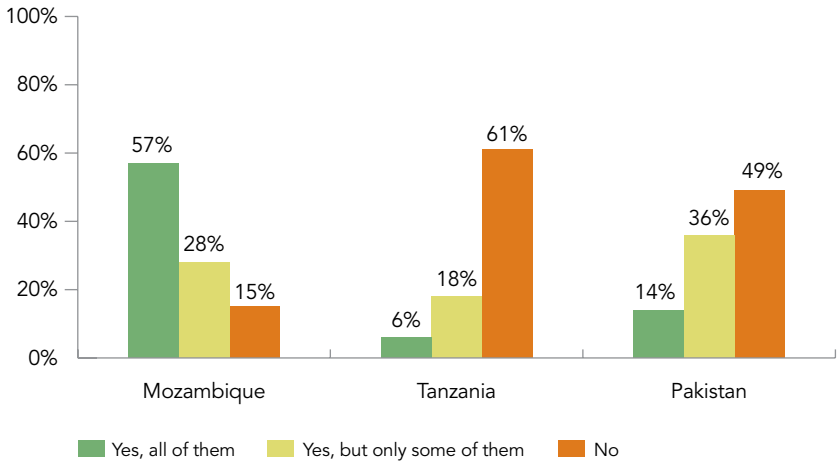
respectively). Many households in both countries also wanted to purchase their own farm equipment (55 percent and 30 percent in Pakistan and Tanzania, respectively), educate their children (45 percent and 44 percent in Pakistan and Tanzania, respectively), and support their children in achieving their future goals (45 percent and 16 percent in Pakistan and Tanzania, respectively), which speaks to the multiple objectives and trade-offs facing smallholder households.

Few respondents from the Mozambique sample could envision a life outside of agriculture in the next few years (5 percent) or were attracted to the possibility of migrating to the city (35 percent). The largely noncommercial smallholders in the Mozambique sample voiced concern with meeting their most basic needs—food and shelter—and considered the main advantage of working in agriculture the guarantee of providing at least a minimum level of food for their family. The thought of not being able to make this contribution to their survival worried them. The Smallholder Diaries sample in Mozambique may have been less attracted to migration out of agriculture due to limited alternatives to earn income, modest levels of education, and few social connections outside the village.

Respondents in the Tanzania and Pakistan samples also had limited desire to leave agriculture. Only 7 percent and 9 percent, respectively, envisioned themselves working primarily outside of agriculture within the next five to 10 years, and 23 percent and 38 percent, respectively, would move to urban areas if financial constraints were not an issue. Families in the Tanzania and Pakistan Smallholder Diaries shared a range of reasons why they stayed in agriculture and remained in rural areas. The sample of smallholders in Tanzania felt that people in urban areas had access to everything, such as health care, education, and very important social services, but they viewed life in the city as full of "bad influences." In the rural areas, it was also "easier to get food" and "everything is cheaper." In addition, rural areas were "all I know" for many respondents. In Pakistan, one smallholder in the sample explained that nonfarming jobs were not guaranteed: "Whether you have a job or not, whether you have a business or not, you can make do with the land." Another explained that he doesn't have the skills required for other jobs. "We don't have other options. I have been doing this work my whole life. I am an expert in farming."

Looking to the future, not everyone wanted their children to follow their footsteps into agriculture, despite their own desire to keep working in agricultural production. The majority of the Mozambique sample wanted all or some of their children to continue farming (85 percent), while a smaller proportion of the Tanzania and Pakistan samples did so (24 percent and 50 percent, respectively) (see Figure 4). Families that wanted their children to pursue other activities emphasized that nonfarming jobs could provide a steadier or higher income source, which also reflected that households were relying on multiple sources of income and not only on their agricultural production.

FIGURE 4: "If you have children, do you want them to continue farming"
MAY 2015



Sample size per country includes only households with children: Mozambique n=61; Tanzania n=62; Pakistan n=80.

Smallholder Diaries interview, Mozambique. Photo by Erin Scronce.

1.

INCOME SOURCES AND THE ROLE OF IN-KIND CONSUMPTION

Agricultural production was just one source of cash income for Smallholder Diaries households. But their numerous nonagricultural production activities provided the majority of household net cash income at the median. When in-kind consumption of crops produced at home was factored into total household income, agricultural production income did increase markedly and provided approximately half of total household income at the median. Casual labor was also an important source of income for smallholder families, and in many cases it, too, involved tasks related to agriculture.

When the Smallholder Diaries began, all respondents in the sample indicated that agriculture was their primary source of income, cash or in-kind, though they were balancing a range of income sources in and out of the agricultural sector. They made it a priority to earn money from a range of sources due to the irregularity of their agricultural income and relatively more stable nonfarm income. But they still self-identified as agricultural households and indicated that this was their most significant source of income. The data, however, showed a more nuanced picture.

Smallholder families in the sample had numerous sources of cash income, tending to fall into three categories: (*i*) agricultural production, (*ii*) casual labor, and (*iii*) other off-farm, nonagricultural sources such as managing a small business, receiving remittances, or engaging in wage labor.[22] At the median, households had a total of eight income sources in Mozambique, 11 in Tanzania, and nine in Pakistan.[23] Sample households in Mozambique and Tanzania had far more sources of nonfarming income, independent of their own agricultural production. In the Tanzania sample, for example, at the median, households had two sources of income in agricultural production and nine related to other, off-farm activities (see Figure 5 and Case 1).

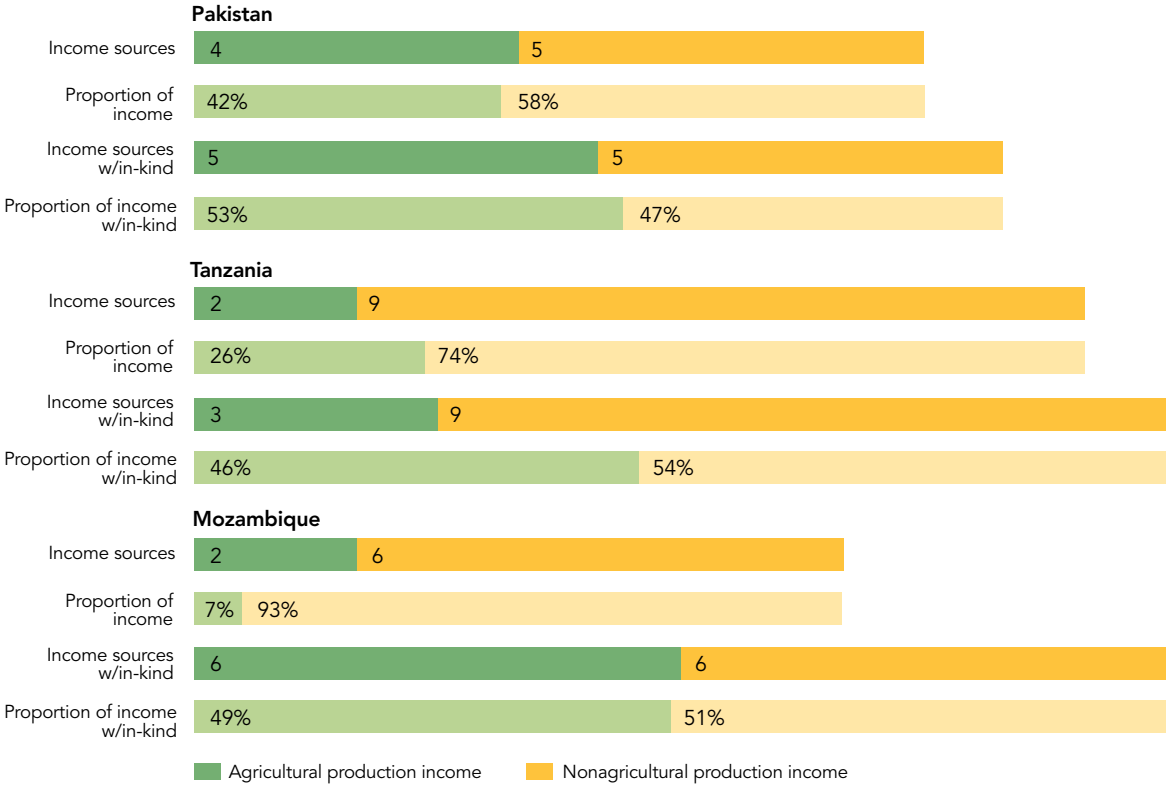
Families in the Smallholder Diaries also earned the majority of their household net cash income from their numerous nonagricultural production activities. Among the sample families, the median proportion of household net cash income (i.e., revenue less any associated expenses, such as stock purchases for side businesses) from nonagricultural production sources was 93 percent in Mozambique, 74 percent in Tanzania, and 58 percent in Pakistan (see Figure 5).[24]

But focusing only on cash income underplays the importance of agriculture to smallholder households. The relative importance of agricultural production income increases markedly when household consumption of crops is

included in the analysis.[25] In the sample in Tanzania and Pakistan, the median proportion of household income derived from crop production increased from 26 percent to 46 percent and 42 percent to 53 percent, respectively, when also considering in-kind consumption. But the change was most dramatic in Mozambique, jumping from 7 percent to 49 percent.

Looking more closely at the sample in Mozambique, the 93 percent figure for total household net cash income from nonagricultural production income sources may seem high, especially among a sample that self-identifies as farming households. But consider that the sample in Mozambique was comprised largely of noncommercial smallholders: they generated little surplus to sell (i.e., revenue) and purchased very little fertilizer or pesticide (i.e., spending on agricultural inputs), and thus reported very low incomes related to their agricultural production. They instead relied largely on other income sources for cash (see Box 2). But these households were heavily involved in agriculture, producing a wide variety of crops, consuming them at home, and trading it with friends and family, outside the cash economy.

FIGURE 5: Smallholder Diaries: Household income from agricultural and nonagricultural production
JUNE 2014–JULY 2015



(1) Median number of household income sources
(2) Median proportion of total household net cash income
(3) Median number of household income sources, factoring in in-kind consumption
(4) Median proportion of total household income factoring in in-kind consumption

Note: Each crop or livestock byproduct (e.g., milk, eggs) that was sold at least once in the Smallholder Diaries is considered a distinct source of agricultural production income. When tracking in-kind consumption, the Smallholder Diaries recorded only activities or transactions related to crops, not livestock byproducts.

BOX 2

ACTIVE IN AGRICULTURE, BUT EARNING CASH OFF THE FARM: THE NTHIAS (MOZAMBIQUE)[a]

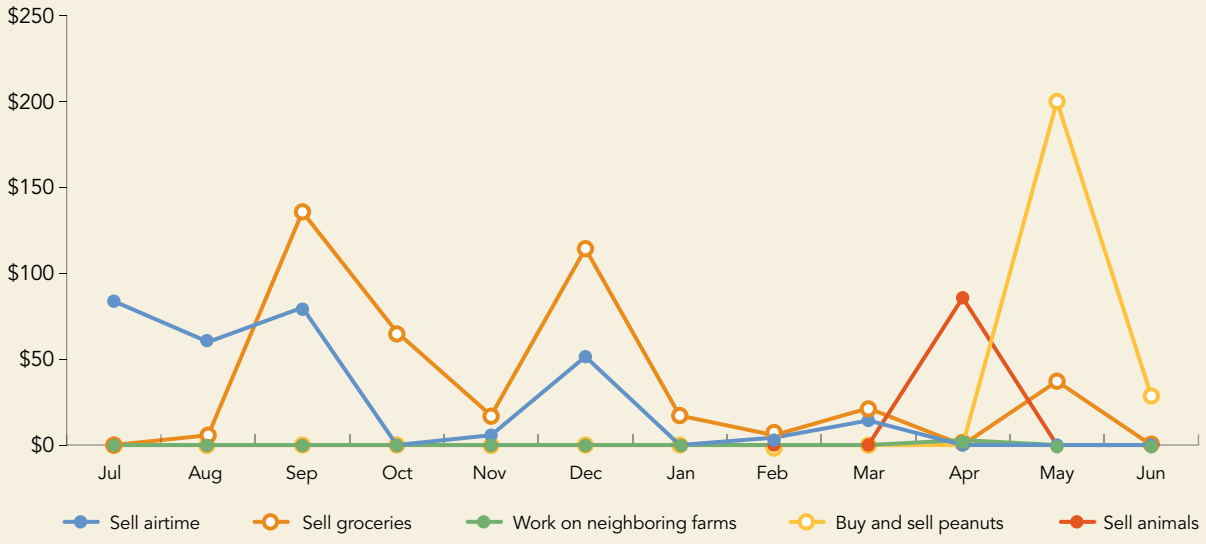
José and Thalia Nthia, a family in the Smallholder Diaries sample in Mozambique, lived with their two daughters, aged four and one, in a brick house on a very small plot of land. José, 21, had studied until the ninth grade and Thalia, 19, did not finish primary school. They used half of the area around their house to plant crops and raise livestock, including goats. The Nthias also cultivated another larger plot of land, which they considered their main farm, on a hectare close to a neighboring village. Thalia maintained the family farm, while managing all household tasks and caring for the children. In this area of Mozambique, it was typical for husbands and wives to each maintain their own macshamba, or farming plot, and for women to do much of the daily farm labor.

José and Thalia were active in agricultural production, but they typically did not sell any of their livestock or the five crops they grew. The household viewed their crops and livestock primarily as sources of food for their own consumption, not monetary income. They earned their cash income from work away from their own farm. A small stall in the village market where José sold groceries and airtime provided their main source of income, though this fluctuated over the year (see Figure B2-1).

The Nthias faced a major income shock in April. Thieves broke into the area where José had stored his stock of groceries and stole everything. To make up for the cash shortfall, he sold one of his goats (see the red line in Figure B2-1). José then identified another source of income: buying peanuts from his neighbors to sell in Nampula, the regional urban center, at a higher price.

After the theft, Thalia also looked for additional work to supplement their income. She started weeding on a neighbor's farm, but this was short-lived. She was injured and, as she recovered, Thalia struggled to keep up with the work at the neighbor's on top of the demands of their own farm and family. Finally the Nthias decided that Thalia would stop working for their neighbor, ending this source of income from casual farm labor, and focus on the needs of their family and its agricultural activities.

FIGURE B2-1: The Nthias various income sources over time (US$)
JULY 2014–JUNE 2015



a. The names of all respondents have been changed to protect their privacy.

Casual labor was an important source of income for smallholder families, and much of it was related to agriculture.[26] In all three samples, casual labor was an important source of cash income (see Figure 6). Among the dominant sources of net cash income, 30 percent, 19 percent, and 14 percent of total net cash income came from casual labor in Mozambique, Tanzania, and Pakistan, respectively. A significant proportion of opportunities for casual labor was related to agriculture, including tasks such as planting and harvesting crops. In terms of its relative value, casual labor income from work related to agriculture

was 25 percent in Mozambique, 52 percent in Tanzania, and 36 percent in Pakistan of total income from casual labor.

A significant proportion of households in all three samples gave and received resources among family and friends, in both cash and in-kind. The Smallholder Diaries tracked both cash or in-kind contributions to income from friends or family (i.e., "resources received"), as well as the payments that respondents made to family and friends outside the household in their wider social network (i.e., "resources given") (see Figure 7). Among the Smallholder Diaries sample in Mozambique, 75 percent of households received resources, 83 percent of which was in cash; 74 percent of households also gave resources to family and friends, 40 percent of which was in-kind (see Figure 7). In the Tanzania sample, 93 percent received and 89 percent gave resources (see Box 3),

FIGURE 6: Mean proportion of income from various sources
Percentage of Value at the Sample Level

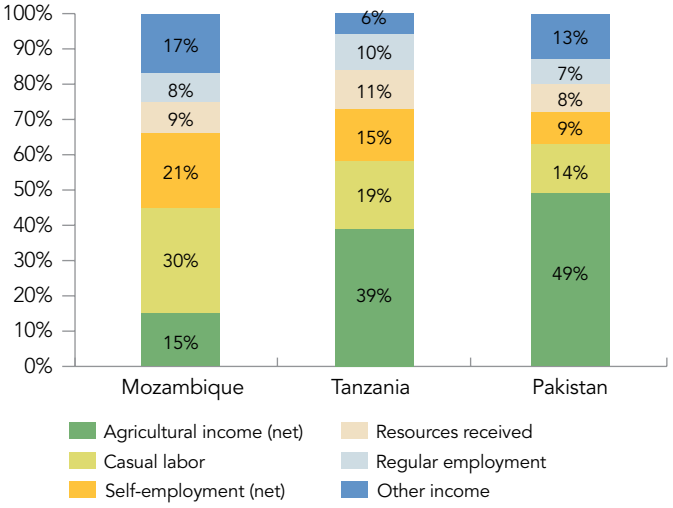
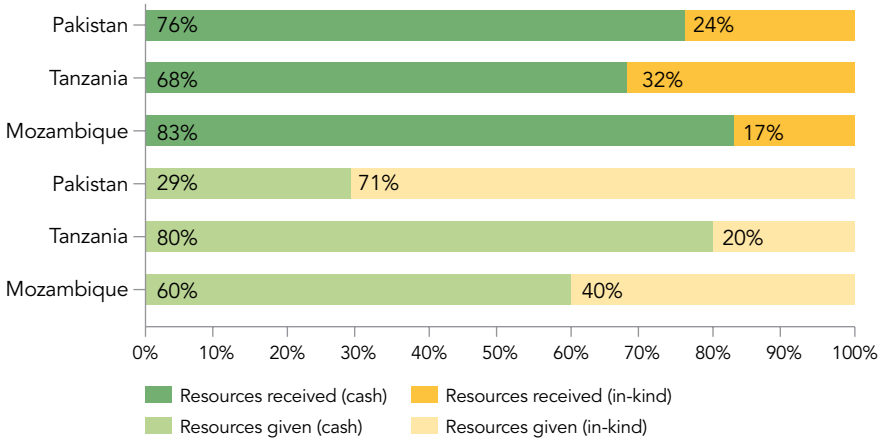


FIGURE 7: Proportions of total resources received and resources given in cash and in-kind (percentage)



BOX 3

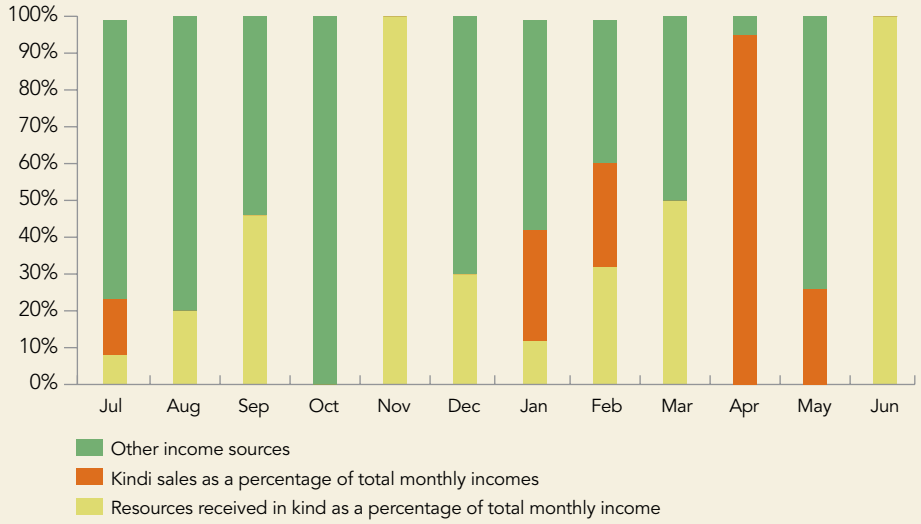
THE MANY ROLES OF KINDI IN HOUSEHOLD CASH FLOWS: RACHEL (TANZANIA)

In the village focused on potato production in Tanzania, the local beer made from maize, kindi, played a significant role in household cash flows in the Smallholder Diaries sample. Households bought and sold it, and also gave and received it as donations or gifts. At the aggregate, kindi accounted for 31 percent of the total value of in-kind resources received over the course of the Smallholder Diaries in Tanzania. The experience of Rachel's household over the year demonstrates the different ways that kindi was used.

Rachel, 61, lived with her six grandchildren, ranging in age from six to 18. She grew potatoes and maize, and considered herself a farmer. She struggled with pain in her legs and could not work on her farm or walk for a long time, which led her to minimize her investment in farming. As a result, her yields suffered and she earned less from her agricultural production than her neighbors. Informal savings and credit groups were concerned that she could not repay, and she was typically unable to borrow from them. Thus, to make extra money and generate "quick cash," Rachel relied on selling kindi.

Sales of kindi made up 95 percent of her total income in April, and approximately 30 percent of her income in January, February, and May (see Figure B3-1). A significant portion of Rachel's monthly income came from resources received in-kind (i.e., monetary or in-kind contributions provided to respondents through their social networks), including kindi. In November and June, for example, resources received in-kind were her only source of income; in March, resources received in cash and in-kind made up her total income. Rachel also bought kindi for herself and sometimes received it as a gift. Over the course of the year, Rachel's spending on kindi for her own consumption varied, falling in periods when she received it as a gift, such as March and April.

FIGURE B3-1: Total net income by type: Rachel (TANZANIA)
JULY 2014–JUNE 2015 (PERCENTAGE)



while in Pakistan, 49 percent received resources and 36 percent offered them, more than 71 percent of which was in-kind. In the Tanzania sample, most of the total amount of both resources received and given circulated within the community (76 percent, or 73 percent by volume), while the Pakistan sample received and sent the most long-distance remittances (85 percent, or 56 percent by volume).

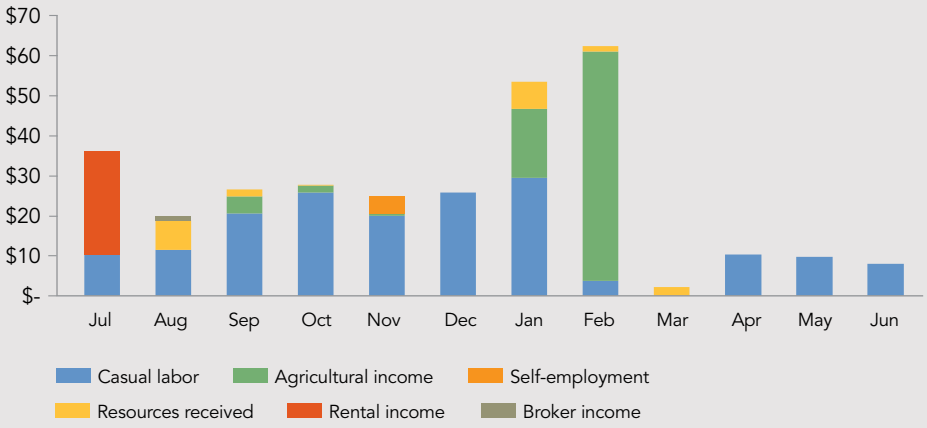
CASE 1

JUGGLING MULTIPLE INCOME SOURCES TO REPAY DEBTS: BERTHA (TANZANIA)

Bertha took part in the Smallholder Diaries in Tanzania. She lived close to the main road in her village. Her husband died, leaving her to raise their five children, ranging in age from four to 20 years old, by herself. Bertha was known as a good neighbor and always helped those who came to her with a problem. She worked hard to provide for her family, leaving her house early in the morning and returning late at night. She focused on agricultural production and relied primarily on selling potatoes, eggs, and sometimes maize. She also had a number of other income sources. Bertha collected and sold grasses and timber in the neighborhood, provided casual labor on other farms, and from time to time she received money from relatives outside her household (i.e., "resources received") (see Figure 8).

In addition to providing for her family, Bertha was also motivated to take on a number of jobs because she had several outstanding debts with different groups. These came about in 2014 when her sister-in-law needed an operation during childbirth and her brother borrowed a large amount (US$343) to pay for it. Unfortunately, soon after taking this loan, Bertha's brother fell ill and stopped making payments on it. The lender wanted to sue him and seize his assets to recover the debt, but Bertha stepped in to help her brother. She started borrowing from four informal groups, two local shops, and four other family members and friends to help repay the loan.

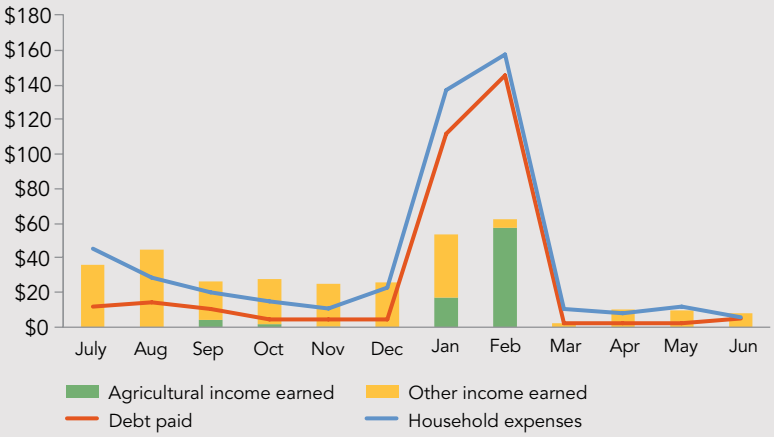
FIGURE 8: Income from multiple sources: Bertha (TANZANIA) (US$)



Through just one informal group, Bertha was able to cover the interest payments over the course of the year. But only after she sold her potatoes could she repay the principal in February. When Bertha could not cover the interest payments for the loans from her regular income sources, she took on additional casual work to earn money. Her income barely covered her debts plus her household expenses (see Figure 9). In February, when she earned the most from selling potatoes, all of her income was dedicated to loan repayments. She felt obligated to engage in numerous types of work, without regard to the job or its location, to cover her household expenses, her children's basic needs, and her debts to the groups.

Some of Bertha's income from selling potatoes was never actually received. In February, she sold potatoes to an agent and earned a lump sum of US$57. In February she sold an additional US$86 of potatoes to another agent, with the agreement that he would pay her later, after his buyer paid him. Unfortunately as of June, the second agent had never returned with her payment, and Bertha had given up on this payment. Since Bertha earned $80 in agricultural income in total that year, this means that she lost more than half of her potential annual agricultural income in a single bad transaction. Her experience highlights the vulnerability of commercial smallholders in loose value chains.

FIGURE 9: Income barely covers debts and household expenses: Bertha (TANZANIA) (US$)



Farmers working with Wasil Foundation, Pakistan. Photo by Ayesha Vellani.

2.

PATTERNS OF AGRICULTURAL PRODUCTION AND SALES

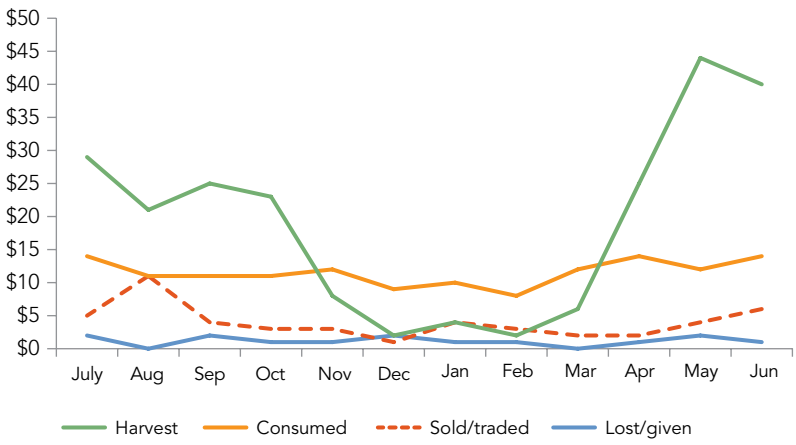
Income from agricultural production in the Smallholder Diaries sample showed three distinct patterns of harvest, sales, and consumption: (1) two major annual harvests but very limited or nonexistent sales; (2) one major annual harvest, with varied sales into loose value chains; and (3) two major annual harvests, with immediate sale into tight value chains. If and how smallholder households consume or sell their crops and the nature of their connections to value chains, for example, have important implications for the roles that financial tools can play in their lives and how they are tailored to household circumstances.

MOZAMBIQUE SMALLHOLDER DIARIES: TWO MAJOR ANNUAL HARVESTS, BUT VERY LIMITED OR NONEXISTENT SALES

Smallholder families in the Mozambique sample were "net consumers" of their agricultural production (i.e., they consumed more of their agricultural output than they sold). Households harvested continually between April and September (see Figure 10, green line), with the two major harvests in May/June (cassava) and August/September (maize, vegetables, other grains). Families maintained a relatively smooth level of consumption throughout the year (orange line). They generally stored their harvests in bags and traditional bamboo silos in the house.

Sales of crops and livestock were limited among Smallholder Diaries families in Mozambique. Largely noncommercial smallholder households, many families in the sample did not sell anything over the entire year of data collection (see dotted red line). They were able to consume smoothly what they produced, but they were unable to do much else with their harvest. They did not sell their crops for the cash needed to buy other foods, diversify their diet, or meet other household needs.

FIGURE 10: Mozambique Smallholder Diaries: Monthly average value of crops (self-reported), JULY 2014–JUNE 2015 (US$)

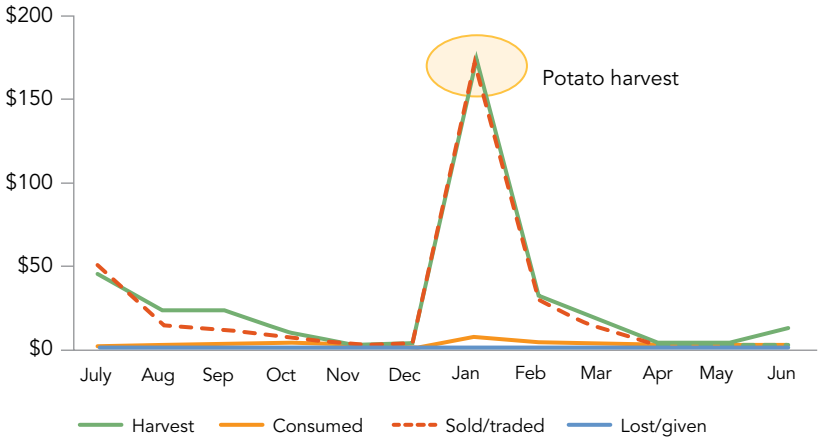


Green "Harvest" line: Self-reported value of harvested crops.
Dotted red "Sold/Traded" line: Self-reported value of crops that were sold or traded.
Orange "Consumed" line: Self-reported value of crop production that was consumed at home.
Blue "Lost/Given" line: Self-reported value of any crop amounts that were lost (due to weather, pests, theft, etc.), given away, or traded. Value of crops stored not included.

TANZANIA SMALLHOLDER DIARIES: ONE MAJOR ANNUAL HARVEST, VARIED SALES INTO LOOSE VALUE CHAINS

Smallholder households in the Tanzania sample were "net sellers" in loose value chains (i.e., they generally sold more of their agricultural output than they consumed). These households typically had one major harvest of a cash crop (e.g., rice, potatoes) each year, which would be sold for cash and, to some degree, consumed at home (see Figure 11 for the sample producing potatoes). Overall, sales of their agricultural production were fairly lumpy (i.e., they occurred in distinct periods over the year, not continuously) and reflected the timing of the main harvest. Almost all of these respondents sold directly to village-level agents and/or larger aggregating buyers further along the value chain, while those with the means also transported their production directly to market (see Box 4).[27]

FIGURE 11: Tanzania Smallholder Diaries: Monthly average value of crops (self-reported): Potato production village, JULY 2014–JUNE 2015 (US$)



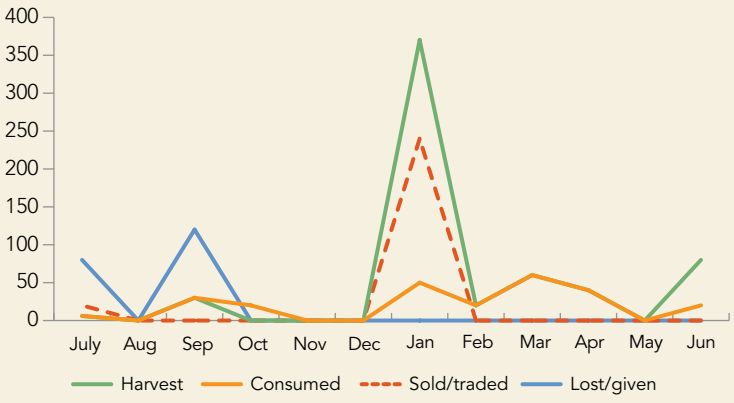
Green "Harvest" line: Self-reported value of harvested crops.
Dotted red "Sold/Traded" line: Self-reported value of crops that were sold or traded.
Orange "Consumed" line: Self-reported value of crop production that was consumed at home.
Blue "Lost/Given" line: Self-reported value of any crop amounts that were lost (due to weather, pests, theft, etc.), given away, or traded. Value of crops stored not included.

BOX 4

HARVEST AND CONSUMPTION OVER THE YEAR: THE LUHENDES (TANZANIA)

The experience of Mathias and Zaituni Luhende offers a good representation of the sample in the village focused on potato production. The Luhendes sold most of their potatoes in January soon after the harvest (see Figure B4-1, dotted red line). They consumed some of their production during the year (orange line); their maize was destroyed by livestock in September (blue line).

FIGURE B4-1: Aggregate harvest and consumption of agricultural production for the Luhendes (self-reported) (TANZANIA), JULY 2014–JUNE 2015 (KG)



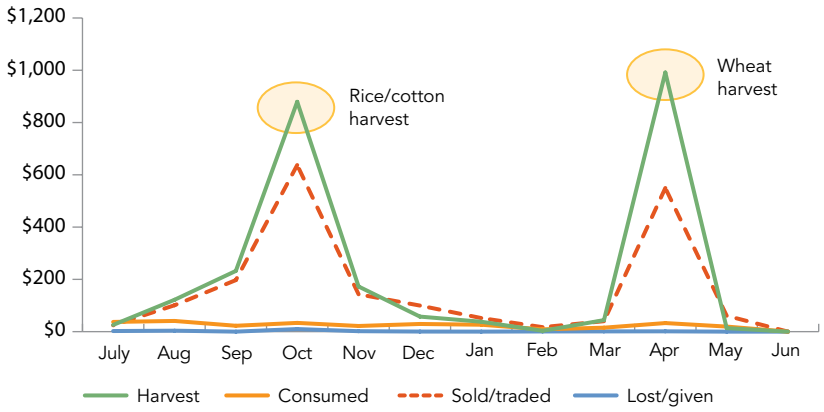
PAKISTAN SMALLHOLDER DIARIES: TWO MAJOR ANNUAL HARVESTS, IMMEDIATE SALE INTO TIGHT VALUE CHAINS

Smallholder households in the Pakistan sample were net sellers in tight value chains, consuming an even smaller proportion of their production than in the Tanzania sample.[28] After each major harvest in October (cotton and rice) and in May (wheat), they were usually obligated to sell their output immediately back to middlemen to repay debts for the costly agricultural inputs they had financed (see Figure 12, dotted red line, and Box 5). This resulted in large spikes of sales from agricultural production over the year.

The sample in Pakistan sold into a complex value chain. Working directly with the smallholders are the beoparis, local villagers who buy crops directly from farmers and do not provide agricultural credit or inputs. They offer farmers a lower price than katcha (informal) arthis, the next step in this value chain, but they could pay farmers more quickly. Nevertheless, the majority of the sample sold directly to arthis, and in many cases to a specific arthi family that had been working with their family for generations. The arthi also held a good portion of their cash savings and provided pesticides and fertilizer on credit. Moving up the value chain, katcha arthis then sell to the pukka (formal) arthis, who in turn sell to factories and mills or brokers.

Tanzania. Photo by Erin Scronce.

FIGURE 12: Pakistan Smallholder Diaries: Average value of crops (self-reported), JULY 2014–JUNE 2015 (US$)



Green "Harvest" line: Self-reported value of harvested crops.
Dotted red "Sold/Traded" line: Self-reported value of crops that were sold or traded.
Orange "Consumed" line: Self-reported value of crop production that was consumed at home.
Blue "Lost/Given" line: Self-reported value of any crop amounts that were lost (due to weather, pests, theft, etc.), given away, or traded. Value of crops stored not included.

BOX 5

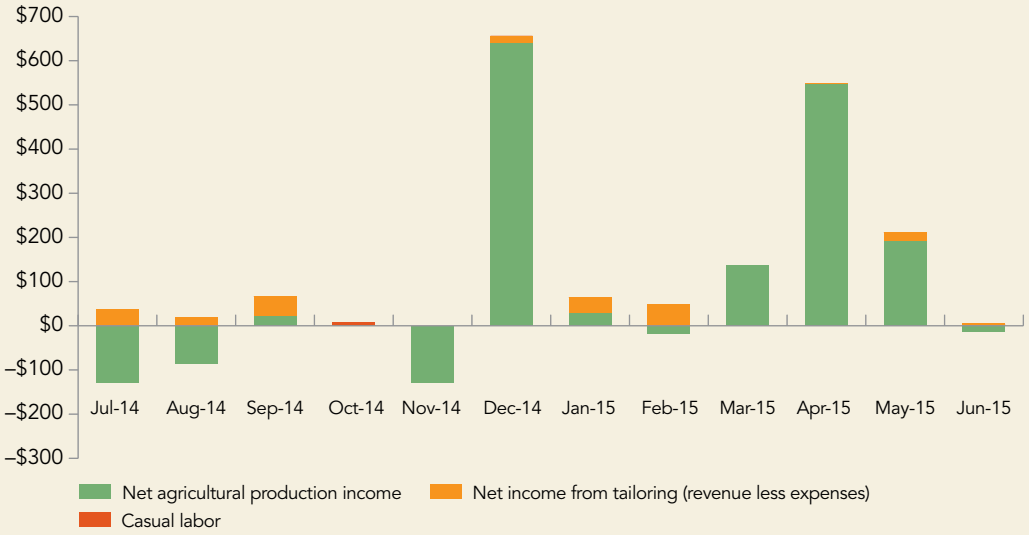
WAITING TO SELL UNTIL PRICES INCREASED: SAMIR AND ZAINAB

Samir and Zainab, participants in the Smallholder Diaries in Pakistan, grew rice, wheat, and fodder and sold milk. Zainab also generated income for the household from casual labor (see Figure B5-1). In June 2014, right before the research began, heavy rains destroyed the rice they had planted. The family replanted rice, spending money on additional agricultural inputs; July and August were difficult for the family. In this period, and in the winter months, when the household was under intense seasonal pressure to invest in their agricultural production, Samir and Zainab spent much of their money on agricultural inputs. Agriculture was such a high priority and related expenses were so high that they could not afford to buy a school uniform for one of their sons and he was sent home from school for a few days.

In September, Samir earned some cash from his work as a tailor and that helped improve the household's financial situation. Finally, in November, Samir harvested the rice, but the prices in the market were very low. If he had sold the rice at that time, then he would have suffered a financial loss on his investment. Instead he stored some of the rice to sell later in December after the price increased.

After their harvests were cut and sold, Samir continued working as a tailor and Zainab did casual labor. Samir said the family needed to do this additional work. "When we don't have crops, we make ends meet with credit [from local stores]. There is no other source where we can get additional income. That's why we have to rely on credit."

FIGURE B5-1: Sources of household income: Samir and Zainab (PAKISTAN) (US$)



CASE 2

THE BENEFITS AND BURDENS OF A TIGHT VALUE CHAIN: THE MALIKS (PAKISTAN)

Saif Malik, a participant in the Smallholder Diaries in Pakistan, earned agricultural production income from selling milk from his cows and growing wheat and rice, which he sold to three arthis (see Figure 13). Whenever he needed funds, he could borrow from any of the arthis, but he kept multiple relationships going with arthis in the event that one of them would not allow him to borrow the amount he needed.

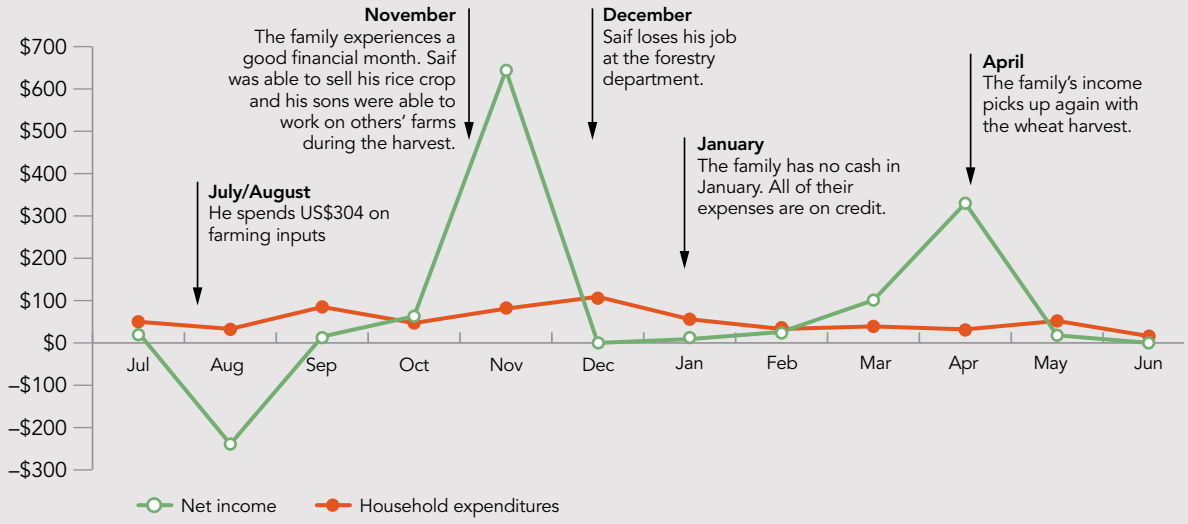
Saif also looked for off-farm work to supplement his income from agricultural production. "The money we make from our crops alone is not enough," he explained. "That's why we work on other farms. Our crops do suffer a little bit, since we aren't able to give them our full time." What other sources of income he could find were unstable. Saif was the main breadwinner, and the family worried about their economic condition.

The most difficult periods for the Maliks were in July and August and the winter months, the stretches between harvests. During these periods, they spent whatever they had on agricultural production. Saif spent a total of US$304 on fertilizer, pesticides, and seed in this period. Overall the family earned negative income (i.e., spending on farming inputs exceeded revenue from farm sales) during those months, due to these significant expenditures on fertilizer and pesticides. To make ends meet, the family relied on credit and sale of milk.

Pests destroyed much of their rice crop in October, but November was the best month for the family. November is an important time to harvest in the area, and his sons were able to work on other farms to help make up for the loss in October.

January was again difficult as the family had no cash. Saif had been earning money almost every month by cutting trees for the forest department. But at the end of December, the forest department told him it did not need him anymore and that it would call him again only if work was available. All household expenses were purchased on credit.

FIGURE 13: Main financial transactions of the Maliks (PAKISTAN), JULY 2014–JUNE 2015 (US$)



Pakistan. Photo by Erin Scronce.

3.

RELATIONSHIPS BETWEEN INCOME VOLATILITY AND AGRICULTURAL PRODUCTION

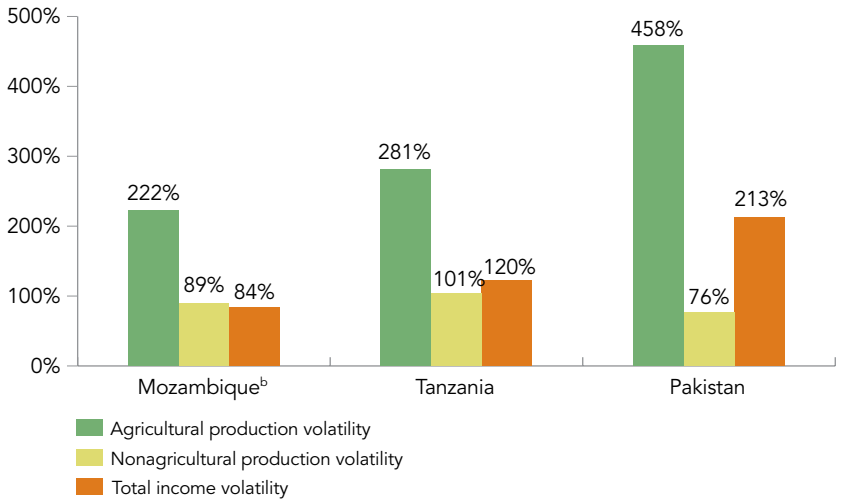
Agricultural production income was markedly more volatile than other sources of income across the Smallholder Diaries sample, and overall household income volatility depended on the balance between the two. Expenditures fluctuated considerably as well, due to major household shocks or events, or regular, significant expenses such as school fees. Despite income diversification outside of agricultural production and smoothing strategies, the agricultural cycle still exerted a strong influence over the financial lives of smallholders and most financial hardships were related to agriculture. Smallholder households in the sample knew from past experience what financial problems to anticipate, but they lacked the financial tools to mitigate them or meet their needs.

Agricultural production income was markedly more volatile than other sources of income in all three samples, and a household's overall income volatility depended on the balance between agricultural production and nonagricultural production income (see Figure 14). The wide range of income sources outside of crop and livestock production did dampen the effects of the agricultural cycle on sample households, but only to a point. It was not eliminated entirely. Respondents in all three countries struggled the most, with their finances and nutrition, in the months between harvests. In the Mozambique sample, with very limited crop sales and reliance on other sources of cash income, families experienced less severe fluctuations in overall income, but their paucity of financial tools presented other challenges.

For the sample in Pakistan, month-to-month agricultural production income was highly volatile (458 percent relative to average income). It swung from lows well below zero, when there were major expenditures on inputs, to significant highs, when immediately after harvest they sold their output (see Figure 15). (Since these expenses are related to agriculture income, they are embedded in the green income line.) The involvement of households in other sources of income was relatively more stable, peaking in March when farming activity quiets down. Importantly, though these other sources of income do not generate periods of large negative income (i.e., deficit periods where expenses related to agricultural production or running a business exceeded revenue), total income volatility (red line) still tracks agricultural production income volatility (see Figure 15 and Box 6).

Expenses were smoother than income, but still fluctuated to some extent with income in all three samples. At the median, expenditures per month varied 68 percent in Mozambique, 80 percent in Tanzania, and 59 percent in Pakistan among Smallholder Diaries samples. But this volatility of expenditures

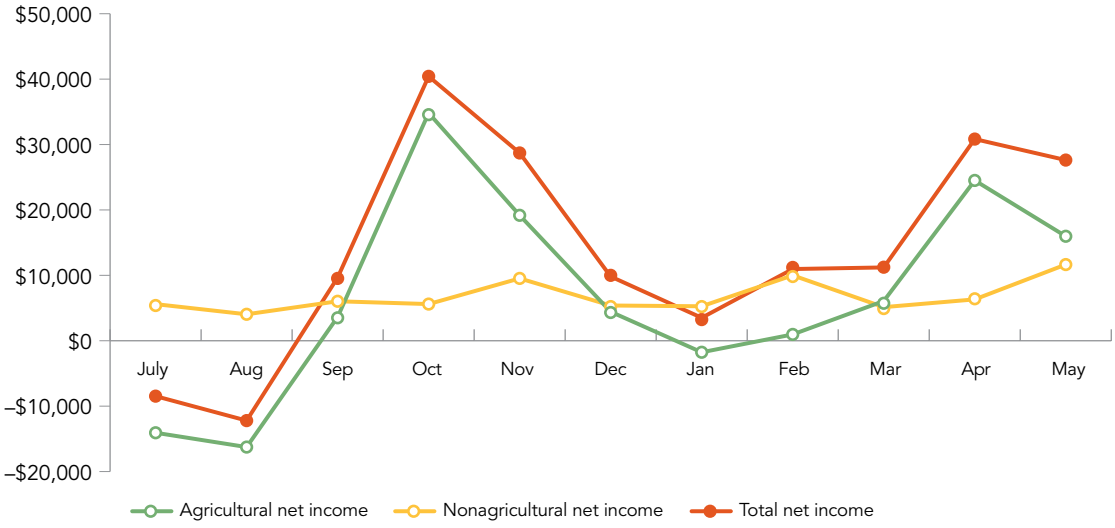
FIGURE 14: Volatility of income: Median standard deviation of monthly income relative to average monthly income, JULY 2014–JUNE 2015[a]



a. Relative standard deviation of income = (Standard deviation of monthly income * 100)/ Average monthly income. Standard deviation of monthly income represents the amount by which a household's income deviates from the average monthly income of that household.

b. In the Mozambique sample, agricultural production income and nonagricultural production income have an inverse relationship, so much so that the medians of the two cancel each other out a bit. Thus total median income volatility is lower than the two parts that compose it.

FIGURE 15: Pakistan Smallholder Diaries: Value of agricultural and nonagricultural production income at the sample level, JULY 2014–MAY 2015 (US$)



should not necessarily always be considered negative. In certain months people have major expenses such as school fees or may choose to spend more for expensive items.

That said, data on spending across the samples showed that basic expenditures, such as food, public transportation, clothing, and education, accounted for the largest share of household budgets at the median (see Figure 16). Household budgets are tight, leaving little room to pay for other lump-sum or unexpected needs. In its extreme form, the inability to smooth expenses can translate into the inability to cover some basic needs. Over the course of the year, notable

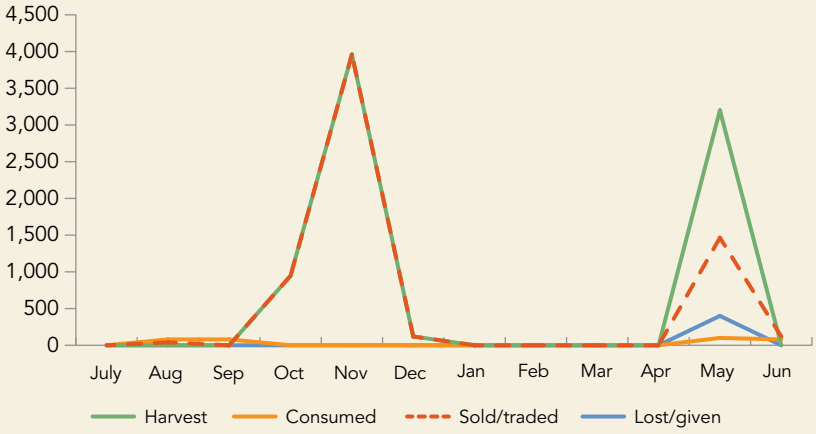
BOX 6

SEASONALITY OF AGRICULTURAL PRODUCTION FOR THE MALIKS (PAKISTAN)

The pattern of agricultural production that Adil Malik followed was typical of the sample of Smallholder Diaries households in Pakistan. Adil grew fodder, rice, and wheat and sold buffalo milk. His sister did casual work, and his mother did embroidery. Adil also took care of his two sisters, one divorced and one widowed, and their three children.

In June 2014, before data collection for the Smallholder Diaries began, part of the Malik's wheat crop was destroyed in a hail storm. From September to October, the family did well, thanks to the sale of the cotton crop (see Figure B6-1). The family's second major annual harvest, wheat, occurred in May. Most of the wheat was sold, but they also consumed some and gave some away.

FIGURE B6-1: The Malik's aggregate harvest and consumption over time (self-reported), JULY 2014–JUNE 2015 (KG)



Green "Harvest" line: Self-reported value of harvested crops.
Dotted red "Sold/Traded" line: Self-reported value of crops that were sold or traded.
Orange "Consumed" line: Self-reported value of crop production that was consumed at home.
Blue "Lost/Given" line: Self-reported value of any crop amounts that were lost (due to weather, pests, theft, etc.), given away, or traded. Value of crops stored not included.

percentages of households in each sample sacrificed visiting a doctor or buying medicine when needed (see Figure 17).

Despite income diversification and smoothing strategies, the agricultural cycle still exerted a strong influence over the financial lives of smallholders. Smallholders were asked, "In the past 12 months, during which months did your family struggle the most with money?" to identify the typical "hardship months." Notably, most of the reasons cited for financial hardships were tied to the agricultural cycle, such as "waiting to harvest crops," "expenses related to agriculture," and "already sold all crops" (see Figure 18). Respondents identified similar reasons when asked why they had cut down on food consumption or worried about food during certain months.

Farmers in the Smallholder Diaries knew from past experience what money problems to anticipate, but they still lacked the tools to smooth consumption. In all three samples, household operational expenses were smoother than

FIGURE 16: Median share of consumption expenditures on various household needs
(Percentage)

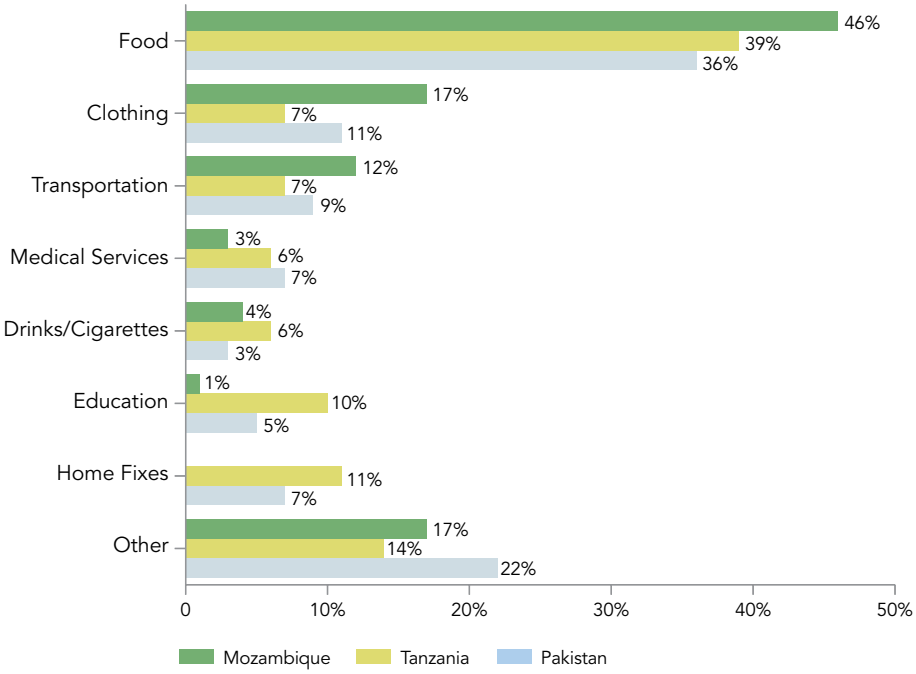
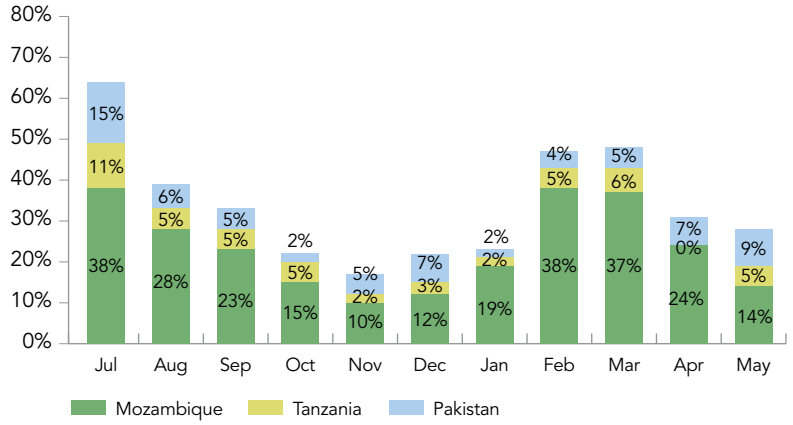


FIGURE 17: Share of households forced to forgo medical care during the study
JULY 2014–MAY 2015 (Percentage)



income, but expenditures still fluctuated to a degree with income. The samples in both Mozambique and Tanzania most strongly exhibited a "spend-as-you-go" expenditure pattern (see Figures 19 and 20).[29] In Mozambique, income and expenditures dropped to the lowest during the lean hunger season. And in the Tanzania sample in the village focused on rice production, income and expenses dipped to their lowest point between February and April, the months that respondents had earlier identified as their most difficult, when crop stocks and income opportunities related to farming typically dwindle (see Box 7).

The Pakistan sample experienced the largest swings in income across the three countries in the Smallholder Diaries, but these households maintained relatively smoother levels of household expenditures. They had access to more

FIGURE 18: "[In the months when the family struggled most with money] what happened to cause this difficulty?"
(Multiple responses allowed; percentage of households)

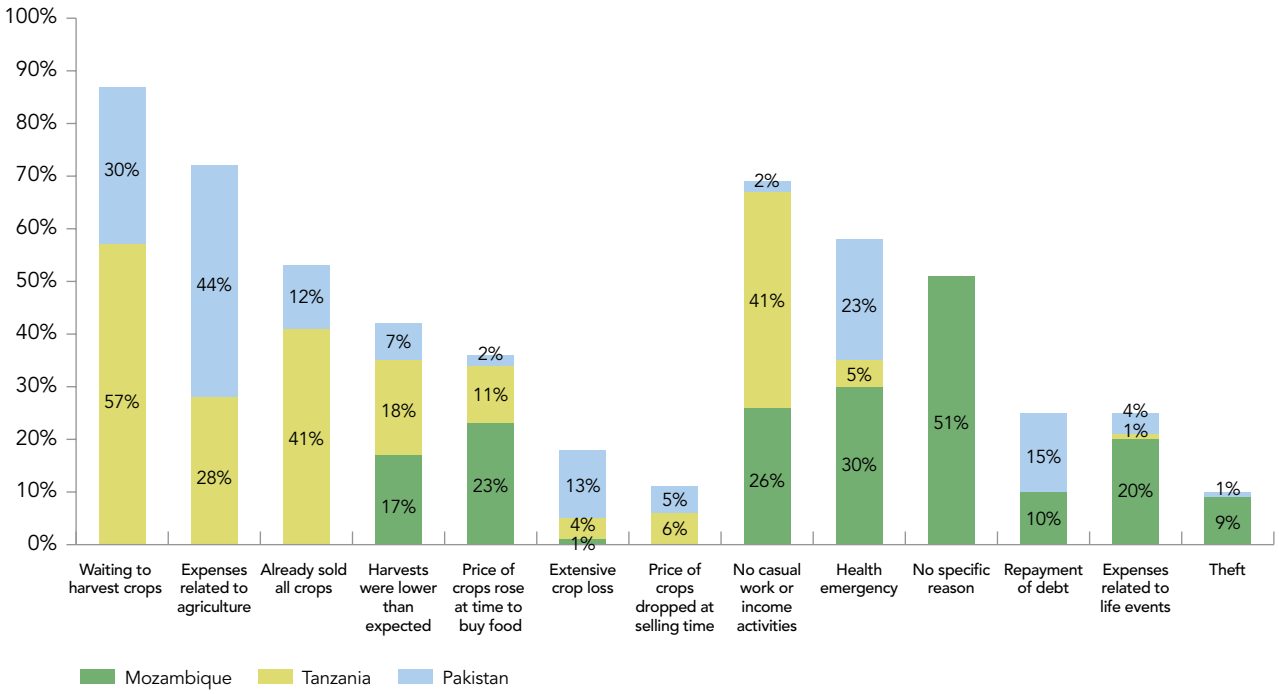
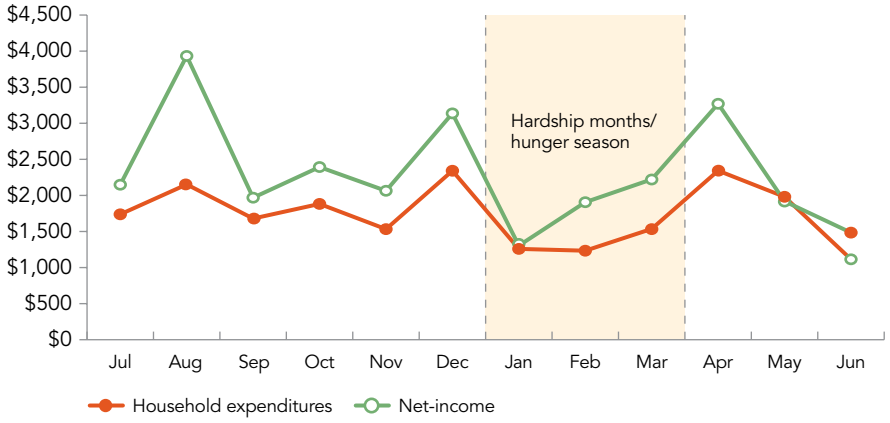


FIGURE 19: Mozambique Smallholder Diaries: Net income and household expenditures all sample level, JULY 2014–JUNE 2015 (US$)[a]



a. The green income line refers to net income. For agricultural production, and small businesses in particular, income refers to revenue less related expenditures. The red expenses line refers to operational expenses of the household separate from income or financial transactions (e.g., spending on groceries, clothes, education, transportation).

credit options and were thus better able to tide themselves over during hardship months. Nevertheless, these families were not immune to the ebbs and flows of the agricultural cycle. Income from agricultural production was negative in July and August (see Figure 21) when the sample in Pakistan spent a sizeable amount on agricultural inputs (see Figure 22). Smallholder households in the sample identified June, July, and August, as well as the winter months between the two major harvests as particularly difficult periods in the year.

BOX 7

SPENDING AS YOU GO: THE LUHENDES (TANZANIA)

Mathias and Zaituni Luhende participated in Smallholder Diaries in Tanzania. They lived with five of their six children and had a range of income sources. The Luhendes grew potatoes and worked on neighboring farms; Mathias sometimes earned money from guarding the forest near the village, and both he and Zaituni also sold timber. Their hardest months were September and April, when income and savings from their potato harvest had run out. All their opportunities to earn income from casual labor were working on other farms, and this was unavailable in the off-harvest period between February and May.

Mathias and Zaituni lived in the village oriented to potato production and sold potatoes to agents as their main source of income. They would harvest their potatoes only after they found an agent and agreed on a price. Mathias and Zaituni had no way to properly store harvested potatoes, and the potatoes would likely rot without proper storage while they tried to find a buyer. They usually consumed the maize they grew, but could sell it in an emergency if they needed cash quickly.

The only agricultural inputs that Mathias and Zaituni were able to afford during the data collection for the Smallholder Diaries were the potato seeds, which they could buy using their earnings from casual labor on other farms. Mathias and Zaituni had other sources of income, but they mentioned throughout the year that they felt it was unaffordable to buy other inputs.

Mathias and Zaituni exhibited spend-as-you-go behavior: their expenses peaked when income was high and dwindled when available cash was low (see Figure B7-1). In July, for example, Mathias received an advance of US$23.40 for casual farming work, which he used on home expenses and kindi, and was given US$1.10 by their son, which they contributed to their savings group. At this time, Zaituni cared for her sick mother and did some casual work to pay for their household expenses, and Mathias borrowed from an unspecified source to pay for two plots of land.

Income and expenses during September were low, as the family had anticipated. Their 14-year-old son started working to contribute to the household budget. Mathias continued spending on kindi with money that he borrowed from a friend.

By October, both Mathias and Zaituni mostly spent time doing casual work in the village. At the beginning of the month, they managed to save some money at home, but by the end of the month, Mathias had spent some of the savings on kindi. The couple continued to depend on their son's income to cover household expenses and interest payments on the loans from their informal savings groups.

In January, Mathias and Zaituni harvested some of their potatoes for sale and consumption and sold two sacks. The household did not earn any income in February. Zaituni harvested the potatoes on her farm by March and used the revenues for food, kindi, and home expenses. The couple had saved some money at home by the end of the month, but by the end of April, the family used up all of their savings for home expenses, food, and kindi.

FIGURE B7-1: Major financial transactions, income, and expenses for the Luhendes (TANZANIA)
JULY 2014–JUNE 2015 (US$)

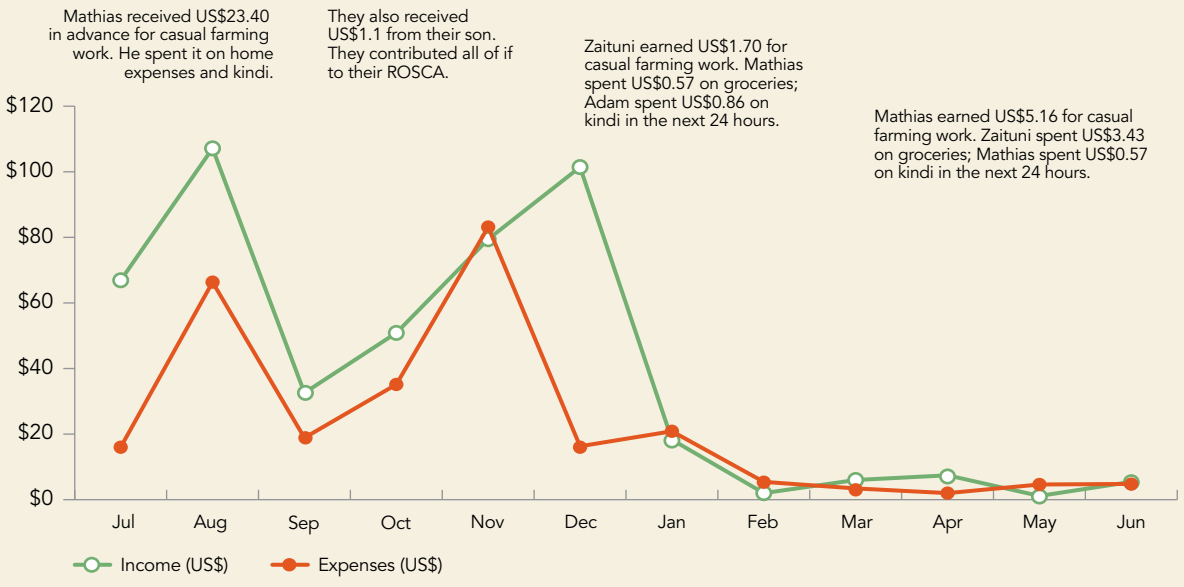
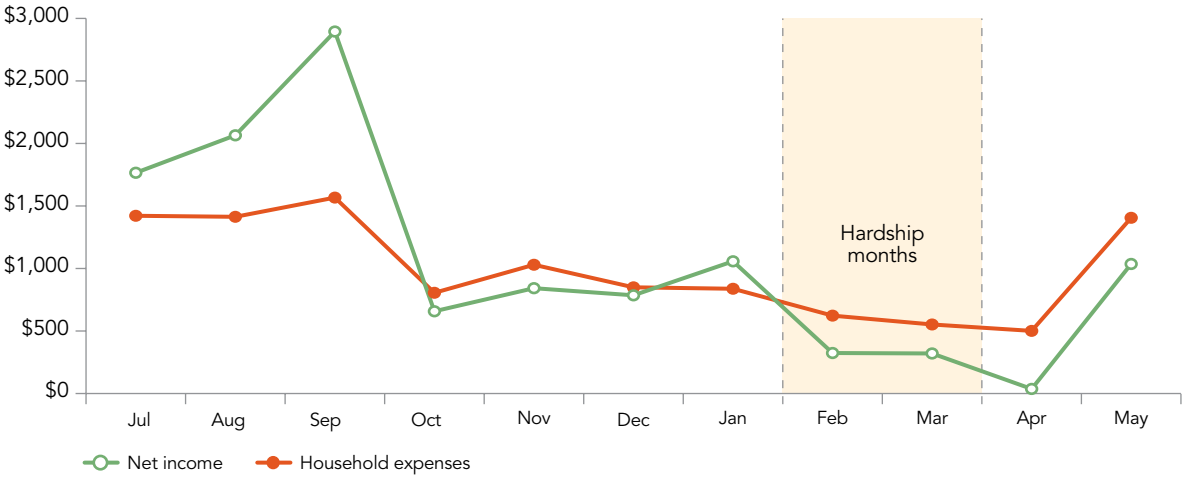
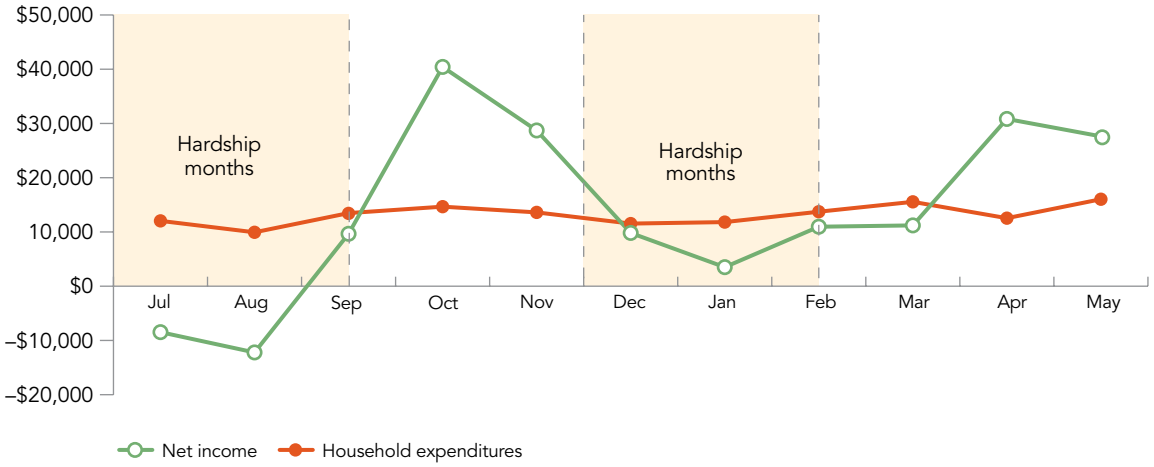


FIGURE 20: Tanzania Smallholder Diaries, rice production village: Net income and household expenditures all sample level, JULY 2014–JUNE 2015 (US$)[a]



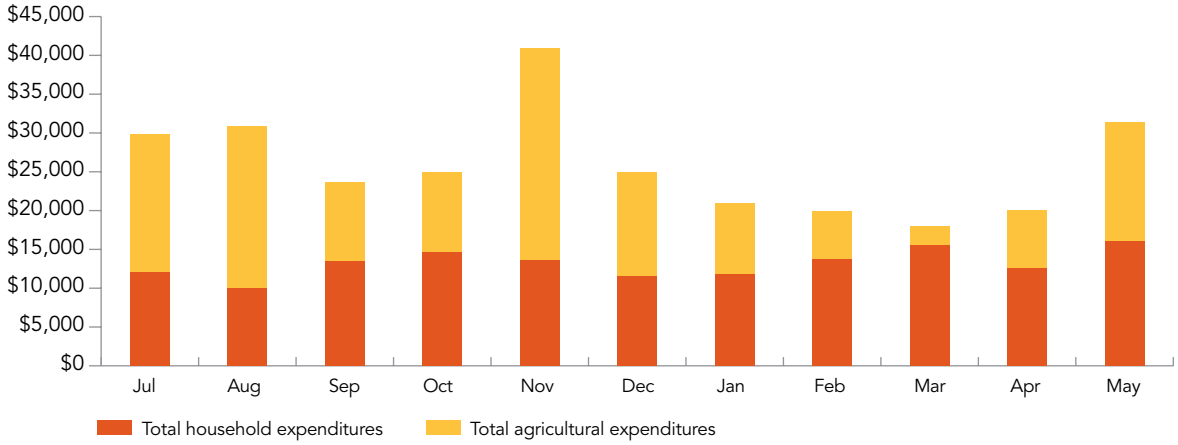
a. The green income line refers to net income. For agricultural production, and small businesses in particular, income refers to revenue less related expenditures. The red expenses line refers to operational expenses of the household separate from income or financial transactions (e.g., spending on groceries, clothes, education, transportation).

FIGURE 21: Pakistan Smallholder Diaries: Net income and expenditures all sample level, JULY 2014–MAY 2015 (US$)[a]



a. The green income line refers to net income. For agricultural production and small businesses in particular, income refers to revenue less related expenditures. The red expenses line refers to operational expenses of the household separate from income or financial transactions (e.g., spending on groceries, clothes, education, transportation, etc.).

FIGURE 22: Pakistan Smallholder Diaries: Spending on household expenditures and agricultural expenses, JULY 2014–MAY 2015 (US$)



CASE 3

COPING WITH INCOME VOLATILITY AND ANTICIPATING THE HUNGER SEASON: ALINA (MOZAMBIQUE)

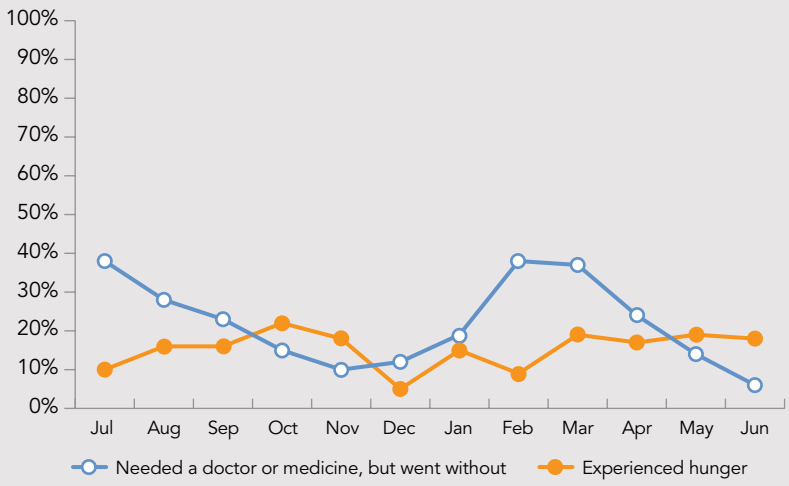
Smallholder Diaries households were able to reduce the volatility of their income, to a degree, through off-farm work, but their struggles still tended to mirror the agricultural cycle. In the Mozambique sample, for example, households earned little cash income from agricultural production and confronted most hardships in the months between the harvests, the period called the "hunger season." But the hunger season was about more than just hunger, and was linked to a number of other environmental and nutritional factors that caused hardship.

Information was collected about hunger in the household and forgone medical care. The results indicated that households did not experience notable increases in the incidence of household hunger between January and March 2015, but that there was a marked increase in reported health problems and forgone medical attention (see Figure 23).

In addition to being known as the hunger season, January, February, and March are also the rainiest months of the year and present a range of challenges that drive a vicious cycle (see Figure 24). Less variety in the diet results in physical weakness and susceptibility to sickness. In these months respondents reported suffering from bad digestion and constipation from eating cassava without much fiber or protein. Some households still had something to eat in the hunger season, but the variety of their diets was lacking.

Inclement weather in the hunger season also means that there is less farm work to do. Construction projects and other forms of manual labor tend to slow down, and there are fewer opportunities for casual work. In addition, the roads often flood. Transportation in and out of villages takes much longer, and sometimes the buses do not run at all. This limits access to markets and health clinics

FIGURE 23: Mozambique Smallholder Diaries: Households that reported forgoing medical expenses (Percentage)



and reduces the local availability of medicine, fuel, and other products. Standing water also results in an increase of the mosquito populations and resulting vector-borne diseases. Local media in Mozambique reported that malaria was up by 22 percent in Nampula in February 2015 due to rains and standing water. In addition, one of the three villages participating in the Smallholder Diaries suffered a cholera outbreak after the heavy rains and flooding.

Like many in the Mozambique sample, Alina, 51, experienced more hardships during the hunger season. Living alone since her divorce, Alina sold cabanga, locally made beer, like many single women. Alina was energetic and managed seven crops working alone on her small plot (0.1 hectare). She raised poultry for eggs and meat and hired additional workers only to help her with planting in August. Alina also received an old age pension from the government, though payments were inconsistent. The pension was meant to provide US$6.60 every month, but in two months Alina received only US$5.90 without explanation.

Alina stored the crops she harvested in September and October in a simple bamboo cistern and bags in her house, and then consumed her stored crops over the lean months (Figure 25). "I eat well because I live alone, and I don't drink or smoke," she said. "I consider that I am eating well when I can eat what is appetizing, what my heart desires. Because of this, whatever money I make, I use to buy foods I like to eat, like fish, meat, rice, cassava flour, and other foods."

Though these income sources made Alina better off than many other smallholders, she still suffered from hunger in the first three months of the year. The whole community was short of money between January and March, and sales of cabanga dropped during this period (see Figure 26). Alina survived only on her pension during these months.

In September, all seven of her chickens and three of her ducks fell prey to disease and died. When Alina needed money for oil, soap, and other necessities during the hunger season, she sold cassava and peanuts in January and maize in February to generate cash. Alina went to sleep without eating for many nights in January, three nights in February, two nights in March, and three nights in April

FIGURE 24: The vicious cycle of the hunger season in Mozambique

CASE 3, continued

when she did not have money to buy anything to accompany cassava or maize. Alina knew what to expect from past hunger seasons, but she did not have access to relevant financial tools (e.g., savings and credit groups, credit at stores or from agents, storing value on a mobile phone) that could help her anticipate these challenges or cope when circumstances grew difficult.

FIGURE 25: Alina consuming and selling crops to survive the hunger season, JULY 2014–JUNE 2015 (KG)

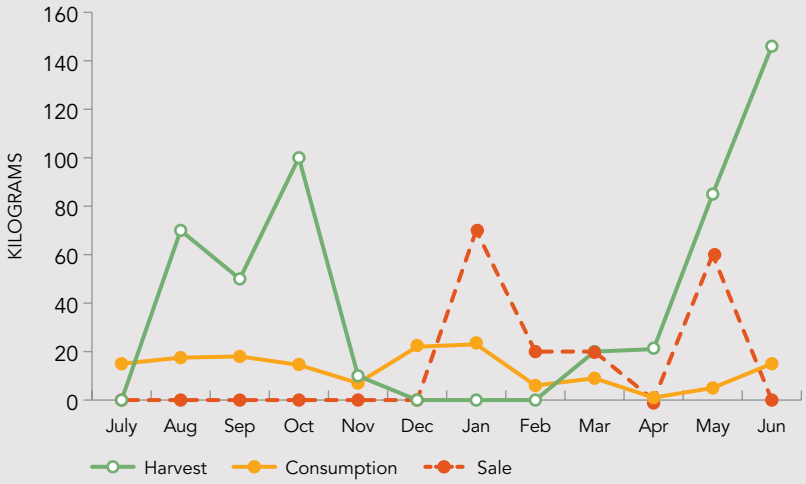
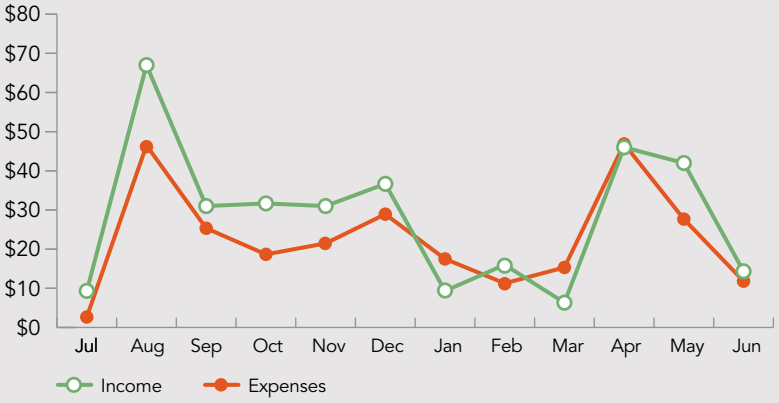


FIGURE 26: Mozambique Smallholder Diaries: Alina's monthly income and expenses, JULY 2014–JUNE 2015 (US$)



4.

RISK MITIGATION AND COPING STRATEGIES

Smallholder households were coping with a range of risks, and the ways they attempted to mitigate these risks and how they coped with shocks reflect the breadth of their financial portfolio and market relationships. Less commercialized smallholders experienced more production-related shocks, while more commercialized households faced more market-related ones. Smallholder Diaries households also faced the health and employment shocks common to all families. These not only depleted their financial, emotional, and human resources, but also disrupted their agricultural activities. Each sample employed a range of strategies to mitigate risk, but most commonly after an agricultural shock there was no specific response, which could signal a lack of tools with which to cope. Over the 12 months of data collection, Smallholder Diaries households reported no use of insurance of any kind.

All profiles of smallholder farming families need a myriad risk mitigation solutions, particularly given the covariant risks of agriculture.[30] To explore the risks smallholders face and their coping mechanisms once shocks occur, the Smallholder Diaries included a module of questions focused on the risks, agricultural and otherwise, faced by smallholder households. The module covered attitudes toward risk, actual shocks experienced in the past five years, perception of risks, and risk management practices.

SHOCKS

In addition to shocks common to all families—such as sickness, accidents, death of a family member, job loss, and business failure—smallholder households are also susceptible to risks related to agriculture, such as production risks from pests and major weather events such as flooding, hail, and drought, and market risks such as input and harvest price fluctuations. Smallholder households may employ a range of risk mitigation strategies, but they cannot always cope when shocks or disasters hit, especially given their limited financial portfolios.

Smallholders faced common health and employment shocks that not only depleted household financial, emotional, and human resources, but also disrupted agricultural activities (see Figure 27). If a household member was sick during harvest, for example, a household may need to hire labor, cutting into their already thin net income and/or harvest. Some respondents in the Tanzania sample reported working through illness and injury so as not to miss fieldwork, though this aggravated their condition. While illness was common in all three

FIGURE 27: Households that experienced selected health and employment shocks at least once over past five years, JULY 2015 (Percentage)

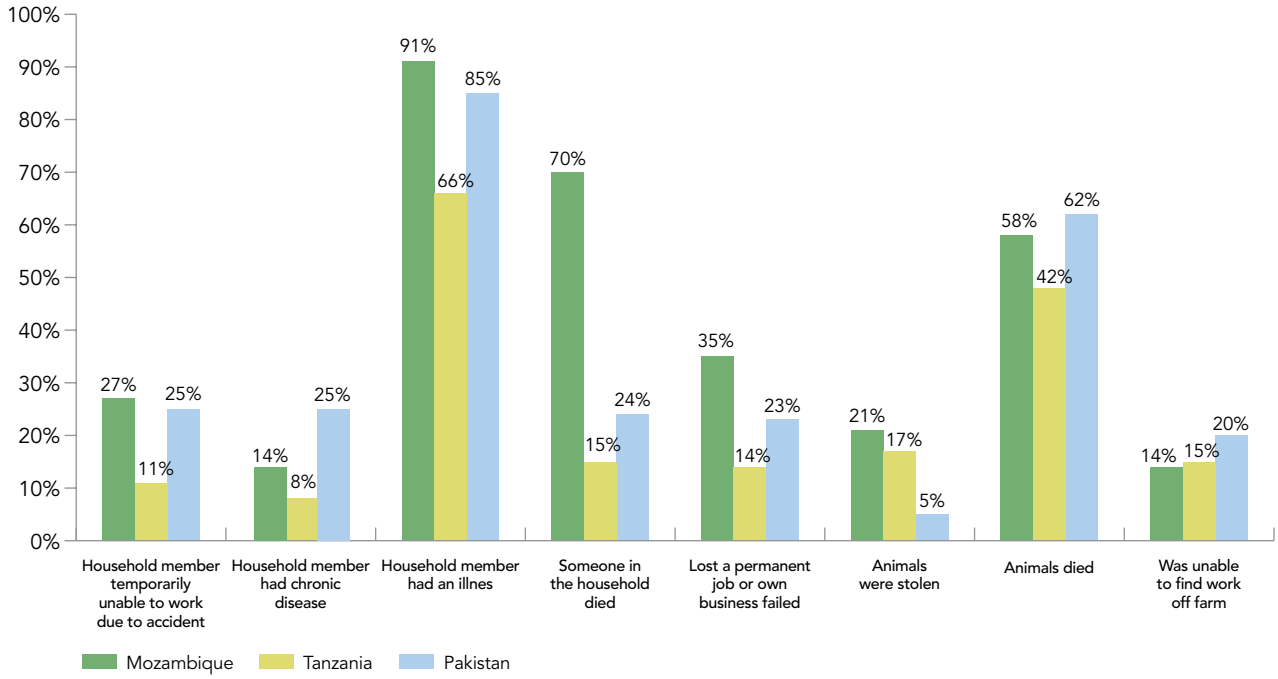
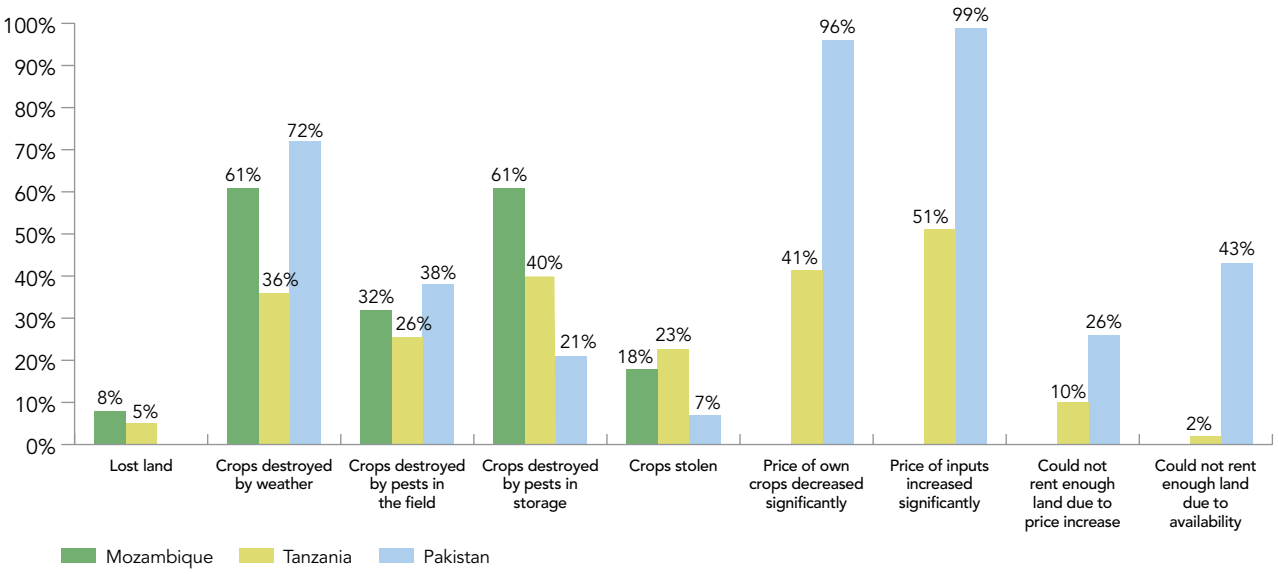


FIGURE 28: Households that experienced selected agricultural shocks at least once in the past five years, JULY 2015 (Percentage)



samples, in the Mozambique sample more than two-thirds of households (70 percent) experienced the death of a household member in the past five years.

Less commercialized smallholders experienced more production-related shocks, while more commercialized households faced more market-related ones (see Figure 28). Weather-related shocks dealt major hardships to families across the sample: 61 percent, 36 percent, and 72 percent of the samples in Mozambique, Tanzania, and Pakistan, respectively, had a significant proportion (25 percent or more) of a crop destroyed by weather in the past five years. Pests also presented a major challenge. Even among the sample in Pakistan, where

the use of pesticides was universal, 38 percent of smallholder households reported significant in-field crop loss due to pests.

Among the largely noncommercial Mozambique sample, where the use of inputs and sale of outputs was minimal, production risks were paramount. About one-third of these households had experienced significant in-field crop loss due to pests (32 percent). After the harvest households needed to store crops for many months to cover their own food consumption, and close to two-thirds of the sample (61 percent) had lost crops in storage due to contamination from pests.

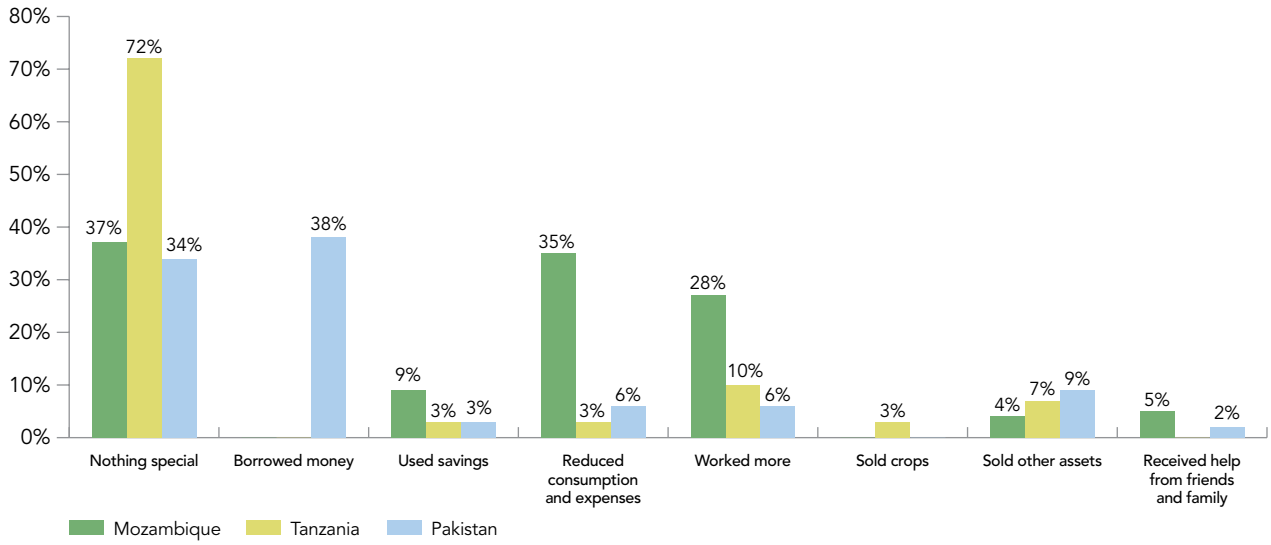
For the more commercial smallholders in the Pakistan sample, market risks presented a greater concern than production risks. Virtually every household had been affected by increases in the price of inputs and decreases in crop sales. But crop loss in the Pakistan sample was much lower than in Mozambique, largely for two reasons. First, a major proportion of the harvest in Pakistan was immediately handed to middlemen. Second, the Pakistani respondents used more secure means of storage, including tin and aluminum containers, than the Tanzanian and Mozambican respondents, who typically stored crops in bags inside their house.

The valuation and incidence of crops lost due to weather and other disasters among Smallholder Diaries households in Mozambique and Pakistan were remarkably large. Attaching an estimated value to an agricultural shock, such as how much crops that had been destroyed would have sold for, provides an indication of their perceived value across the sample and the relative impact of the loss on the household.[31] The median estimated cost of crops destroyed by weather in the Mozambique sample was US$92, which represents a very large shock for families with such low overall incomes. In Pakistan, respondents estimated the cost of in-field crop loss due to pests at US$500 at the median. Among the sample in Tanzania, smallholder households considered the inability to rent sufficient land as one of their costliest and most common negative events; 48 percent reported this as an issue that carried a median cost of US$465. Drops in the market price of crops was also named by 36 percent of the sample in Tanzania, with a median cost of US$258.

RISK MANAGEMENT

Each sample employed a range of strategies to mitigate risk, but most commonly after an agricultural shock there was no specific response, possibly signaling a lack of tools with which to cope. The differences among the samples revealed varying degrees of access to financial tools and safety nets, as well as their degree of market engagement. When their crops were destroyed by weather, for example, many Tanzanian households in the Smallholder Diaries sample did nothing, which could reflect an apparent lack of perceived fallback options and/or a lower impact of weather-related shocks (see Figure 29). When the sample in Pakistan faced the same situation, some smallholder households borrowed money (38 percent), and about one-third also had no specific coping response (34 percent). Their range of active responses indicates both access to a more robust financial portfolio, the central role of agricultural production in their household livelihood strategy, and, in most cases, a contractual obligation to fulfill. When households rely on agricultural production for income and to

FIGURE 29: Households that used these coping mechanisms when crops were destroyed by weather
(Percentage; multiple answers allowed)



clear sizeable debts with the arthi for costly production inputs, crop failure has a dramatic impact on the family.

Looking more closely at a range of risk management tools and their prevalence in the Smallholder Diaries, it is helpful to distinguish between (*i*) traditional risk-management strategies that farmers use without recourse to outside services (i.e., beyond the extended family) and (*ii*) financial risk management tools that involve an explicit demand for and use of savings, credit, and insurance services.[32]

TRADITIONAL RISK MANAGEMENT STRATEGIES

Developed over generations, these mechanisms can reduce risk and smooth consumption, but they have their limitations. They may also entail income loss and discourage on-farm investments and the adoption of innovative technologies (Skees, Hazell, and Miranda 1999). Crop diversification provides an example of this trade-off:

- **Crop and livestock management and diversification.** Looking for countercyclical net flows, farmers planting crops with a defined growing/harvest cycle will also keep cattle, goats, pigs, and chickens as a way to smooth their sources of income and food. In addition, staggered planting dates, especially in irrigated plots, mean similarly staggered harvest dates, thus mitigating risks such as unexpected drought (or floods or pests, as the case may be) in mid-season.

  Crop diversification is perhaps the most dominant strategy of agricultural risk prevention (Hazell, Pomareda, and Valdés 1986). Crop diversification, which could mean planting several crops instead of a single crop or planting the same crop in plots with different rainfall patterns, is intended to lower the possibility that all crops will be affected by specific pests or price fluctuations, but its main shortcoming is that the yields and profits from a diversified crop portfolio are typically lower that those obtained from specializing

"The number of crops I grow depends on the amount of money and capital I have, and also depends on my health and the availability of labor."

—Smallholder respondent in Tanzania

in a single crop or just a few. Diversification can also have the added disadvantage that production volumes from each crop are relatively small, limiting their ability to grow the minimal "critical mass" of produce required to access some markets.

Most smallholder households in the sample grew a variety of crops. The Smallholder Diaries samples in Tanzania and Pakistan grew an average of 3.6 and 4.3 crops, respectively. In Mozambique, households grew an average of 6.3 crops; most had relatively small yields and were mainly intended for consumption at home. In each sample, smallholders calibrated the mix of crops that would give an optimal return, but there was only so much they can squeeze out of the land until they started to see diminishing returns. Many families wanted to, and in some cases attempted to, grow additional crops but did not have enough land or resources, or would not be able to grow the new crop without a financial loss. (See Case 4 on the Namuacas in Mozambique detailing the importance they placed on crop diversification and their unfulfilled interest in expanding and diversifying yet further without a supportive financial mechanism.)

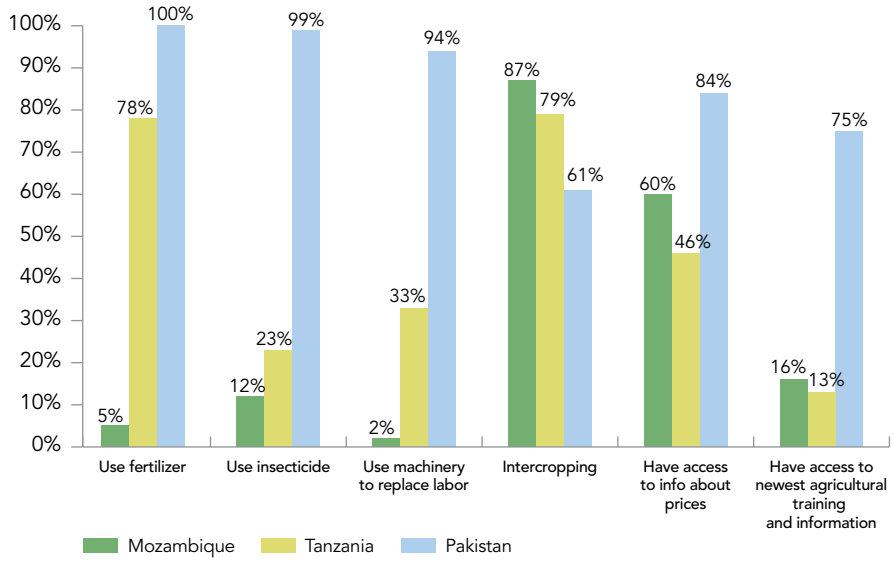
Intercropping—growing two crops on the same plot (e.g., maize and beans) to limit transmission of pests or disease, reduce erosion, shade new growth, and control weeds—was also widely practiced throughout the sample. The proportion of farmers practicing intercropping was the largest in Mozambique (87 percent), in part to ensure as much diversity in consumption as possible (see Figure 30).

On the more general point about access to agricultural training and information about agricultural techniques, responses differed greatly across the samples. Approximately 75 percent of the sample in Pakistan reported that they have access to agricultural information, compared to only 16 percent in Mozambique and 13 percent in Tanzania (see Figure 30).

In terms of strategies focused on improving agricultural production, almost every smallholder household in the Pakistan sample used insecticide and fertilizer, while in Mozambique the use of either was very limited (12 percent and 5 percent, respectively) (see Figure 30). Among the Tanzanian families,

> **"[Intercropping] is important, because when it is harvest time you can harvest at one time all crops and it is easy to clean the plot for two or more crops."**
>
> **—Respondent in the Mozambique Smallholder Diaries**

FIGURE 30: Risk mitigation/production maximizing strategies in use among Smallholder Diaries samples (PERCENTAGE)



use of fertilizer (78 percent) was as prevalent as insecticide (23 percent). Similarly, labor-saving mechanization was prevalent in the Pakistan sample (94 percent), but nearly absent in the Mozambique one (2 percent).

- **Offsetting price and yield variations with surpluses.** Contingent upon their ability to store produce and the perishability of the product, as well as their overall cash-flow fluctuations, smallholder farmers may be able to manage price and yield variations in an attempt to reduce income variability. Storage capacity, a major enabling factor for this strategy, is usually a constraint. Using registered warehouses (which may offer access to credit) involves transport costs, warehouse fees, and the need to meet quality standards.[33]

  The Smallholders Diaries sample in Pakistan and Tanzania reported major concerns about potential decreases in market prices for their crops. Access to information about prices could lower this risk, and a large proportion of the sample in Pakistan (84 percent) but less than half in Tanzania (46 percent) reported access to price information (see Figure 30). Interestingly, both samples of farmers in Pakistan and Tanzania reported that their main sources of information about crop prices were agricultural agents, other people in the village, and people they talk with in the city or town. Tanzanian respondents were particularly concerned that buyers could take advantage of them, while respondents in the Pakistan sample were focused on making sure they would earn a profit, given the high expenses related to their agricultural activities.

  About two-thirds of the smallholders in the Mozambique sample (65 percent) reported that they learned about crop prices at the market when they went to buy and sell. A few of these households mentioned other sources as well, such as friends and family. Given the distance, the poor roads, and the cost of transportation, this effectively meant that they often have to take whatever price is available at the market that day, since they could not afford to return home with their crops and then come back another time.

- **Income source diversification and nonfarm employment.** As noted in Section 1, off-farm agricultural and nonagricultural employment were important sources of revenue for smallholder households outside their own agricultural activities. Some sources rank "increased labor market participation" as the most important risk-adjustment strategy after crop diversification (Walker and Jodha 1986). Moreover, wage labor in particular conveys a steady source of income that few agricultural activities offer, with the possible exception of dairy production and backyard poultry farming (i.e., egg production). An important caveat, however, is that the effectiveness of accessing off-farm employment opportunities to offset fluctuations in agricultural production income depends to a large extent on the covariance between agricultural and nonfarm revenues. Agricultural shocks that affect an entire region will mean that only access to employment in a different region (or country) would be an effective counterbalance.

"My farming is small, thus my income is relatively low. Crop prices help us not fall into total darkness of loss."

—Respondent in the Tanzania Smallholder Diaries

- **Recourse to family and friends.** The use of cash and in-kind contributions from family and friends (i.e., "resources received") to cope with emergencies and meet lumpy expenses (i.e., they occurred in distinct periods over the year, not continuously) is documented in the Smallholder Diaries (see Figure 29). While not a formal risk-prevention or risk-mitigation mechanism, it is considered a general risk-coping tool and plays an important role in smallholder families and low-income households more generally.

- **Sale of assets, mainly livestock.** After nonfarm employment, using livestock as quasi-liquid assets that can be converted into liquid assets to compensate for crop losses or cope with unexpected shocks such as medical emergencies is an important risk management tool. Stockpiling basic assets, therefore, is the corresponding risk-prevention method, and temporary surpluses are usually "invested" in assets that can be easily liquidated, such as small livestock (e.g., goats, pigs, chickens). The limitations of this strategy stem from the mortality/loss rates associated with livestock, the price disadvantage associated with emergency sales, and asset indivisibility (i.e., the need to sell the entire pig even if handling the emergency would call for only half of the pig's value). Other quasi-liquid assets suitable for stockpiling are building materials (e.g., bricks, gravel), firewood, and manure. Over the period of data collection in the Smallholder Diaries, sales of any kind of livestock to generate cash or cope with shocks were reported by 55 percent of sample households in Tanzania, and 72 percent of sample households in Pakistan, but not at all among the sample in Mozambique.

FINANCIAL RISK MANAGEMENT TOOLS

Using financial tools such as savings, credit, and insurance products in conjunction with traditional methods of risk management is arguably a more comprehensive and preferred overall strategy for those farmers with access to those services. The literature on agricultural insurance begins with an assessment of farmer demand for insurance. A critical question in this assessment is whether risk-management methods used by farmers adequately protect household consumption stability and maintain farm productive capacity. If the answer is yes, then there is limited scope for public policies such as crop insurance to help farmers adjust to risk (Walker and Jodha 1986).[34]

- **Savings and insurance.** Poor households hesitate to commit their limited cash-flow surpluses to insurance premium payments for the coverage of relatively low-impact or unlikely risks (i.e., with low expected losses). They prefer to keep those funds in liquid or quasi-liquid assets that have multiple uses. The low uptake of nonlife insurance in low-income countries is usually attributed to this preference.[35] The Smallholder Diaries reported no use of insurance, of any kind, across the samples in Mozambique, Tanzania, and Pakistan over the entire period of data collection.

- **Crop and livestock insurance.** A separate topic with its own abundant literature, crop insurance, including index-based insurance, has a mixed record in low-income countries. This is in no small measure due to the tendency of governments to intervene in the presence of systemic shocks, such as droughts, floods, or pests, and totally or partially relieve farmers of all obligations (interest and principal) with regard to their creditors. The incentives for farmers to purchase insurance are therefore minimal, and more successful efforts to extend insurance rely on bundling the insurance with the purchase of seeds or fertilizer. The case for financial institutions to purchase index-based insurance has been convincingly made by Miranda (2009), since their nonperforming loans would drastically and almost immediately increase in the event of systemic weather-based shocks.[36]

To understand their overall priorities in responding to risk, participants in the Smallholder Diaries were asked to rank their three most important agricultural risk mitigation strategies. Among the Mozambique sample, buying or leasing machinery (41 percent) and using fertilizer (39 percent) were named the two most important strategies. Interestingly, though they were deemed important, virtually no one in the sample used either approach, which could suggest that they were already convinced about their efficacy but lacked the financial tools to deploy these strategies.

CASE 4

DIVERSIFYING CROPS, DIET, AND INCOME, BUT CONSTRAINED FROM DOING MORE: THE NAMUACAS (MOZAMBIQUE)

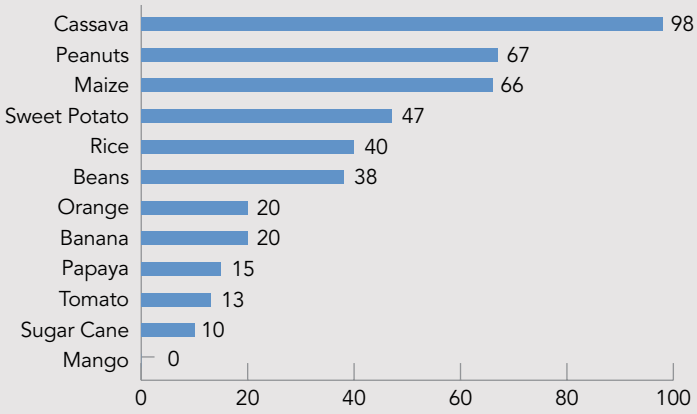
As part of the Smallholder Diaries sample in Mozambique, the Namuacas live with their three daughters and two sons on a very small plot of land (0.10 hectare). Alberto, 50, and Teresa, 40, both started studying but did not complete primary school. They considered educating their children a priority and ensured that their school-age children remained in school.

Working with three small parcels of land, Alberto and Teresa grew 12 crops: peanuts, sweet potatoes, rice, cassava, maize, beans, sugar cane, bananas, papaya, orange, tomatoes, and mangoes. The Namuacas consumed most of their agricultural production (see Figure 31), and sold only four of their crops: bananas, mangoes, tomatoes, and rice. They did consume some of these four crops, but they were grown primarily for sale. The most important harvests for the Namuacas were cassava in August, peanuts in May, rice in June, and bananas in August/September and February (see Figure 32).

Like other smallholder families in the Mozambique sample, the Namuacas felt that it was important to eat different things over the year. They equated good nutrition with consuming a diversity of foods, which motivated their extensive crop diversification. "We eat well," Alberto explained, "And I thank God that I harvest enough food to feed my children. I think my family has good nutrition because we manage to eat fish, cassava flour, sorghum, rice, and I also have fruit trees. These are foods that neighboring households can't always get."

Even among this extensive variety of crops, none of the 12 could be harvested during the hunger season in December and January. When food stores ran low, the Namuacas were tempted to harvest and eat crops, particularly cassava, from the field before they were ripe. Other families in the Smallholder Diaries sample in Mozambique considered this, too, but eating unripe cassava can be dangerous. It contains a substance that, when consumed, can trigger the production of cyanide and be poisonous. In addition, families also made a trade-off between planting bitter and sweet varieties of cassava. The bitter variety contains more cyanide when unripe and should not be harvested early, yet it is more resistant to pests; sweet cassava is less dangerous and allows food to stretch across more months of the year, but it is more susceptible to pests. The Namuacas valued the resistance to pests and chose to plant the bitter cassava, which takes more time to mature.

FIGURE 31: In-kind consumption: The Namuacas (MOZAMBIQUE) (KG)

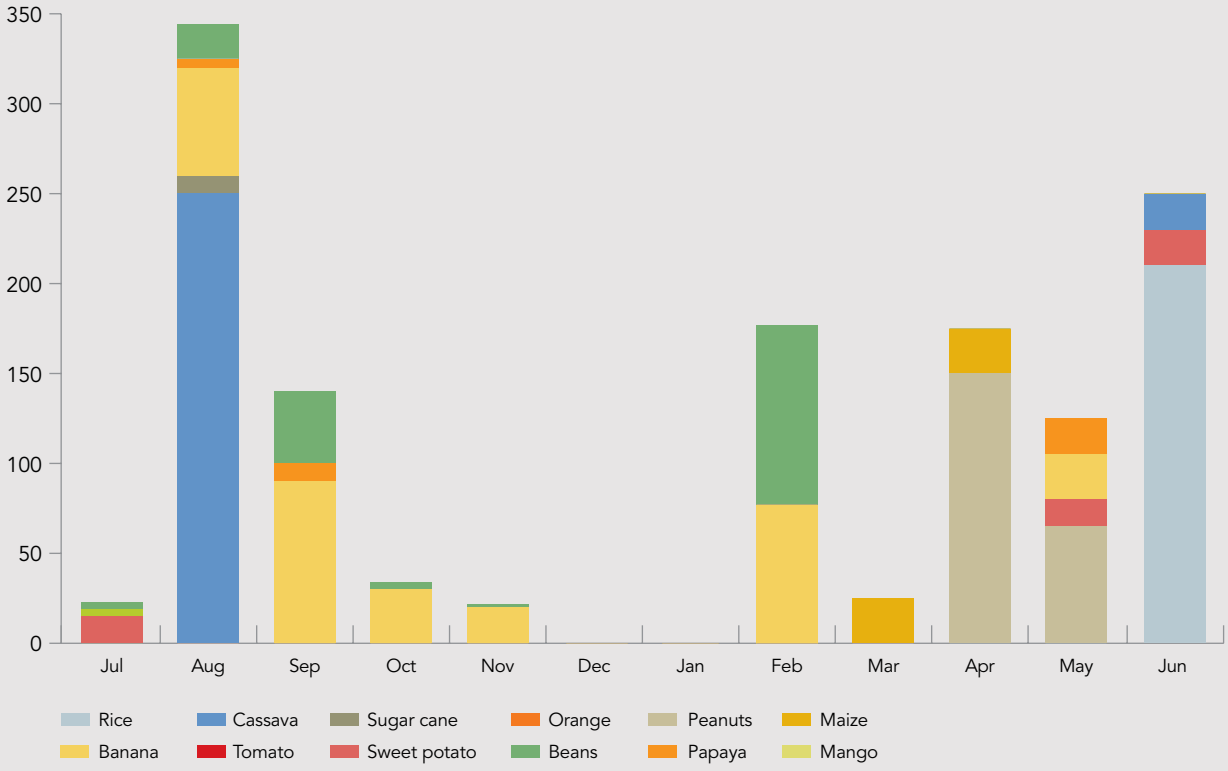


In the Tanzania sample, the use of fertilizer was named as an essential production input by over two-thirds of sample households (68 percent). Having savings (42 percent) and strong networks of friends and family (41 percent) were also seen as important. Many farmers in the village with access to irrigation also named the use of irrigation or having access to a water reservoir. The Pakistan sample considered three approaches essential: having assets that can be sold in times of need (81 percent), using fertilizer to drive higher yields (66 percent), and maintaining close ties with friends and family who can help (56 percent).

On a few occasions, the Namuacas skipped meals during the Smallholder Diaries because they did not have caril, a vegetable or meat sauce that accompanies rice, and xima, creamed cassava. Caril plays an important role for flavor and nutrition as well as digestion, as cassava alone is hard to digest. Families often prefer to go hungry rather than to eat cassava without caril.

The Namuacas wanted to fill this lull in what they could harvest and consume in December and January by growing other vegetables. They needed the seeds for these additional crops, but did not want to spend money on buying them. Since they did not have access to a financial tool that could support the acquisition of these additional seeds (e.g., layaway or savings plan, input credit from a retailer or buyer), their plans to further diversify and expand their agricultural activities were on hold.

FIGURE 32: Crops harvested by the Namuaca family by month (KG)



Mozambique. Photo by Erin Scronce.

5.

HOUSEHOLD FINANCIAL PORTFOLIOS

Smallholder Diaries households can be grouped into three loose profiles by the breadth of their financial portfolios: narrow, moderate, and broad. Most Smallholder Diaries households had access to only a thin scattering of informal financial tools. The degree to which sample households could sustain their consumption levels and cope with shocks during lean periods between harvests depended heavily on the range of tools in their financial portfolio. Each financial mechanism had its own limitations, and across the sample all financial portfolios were insufficient to meet the varied needs of smallholder households.

SMALLHOLDER DIARIES SAMPLE IN MOZAMBIQUE—NARROW FINANCIAL PORTFOLIOS

Smallholder households in the Mozambique sample used only three financial instruments at the median. And overall they were working with only two types of financial instruments at the median.[37] Their very narrow financial portfolio was mostly limited to savings at home (see Table 4).

Only a fraction of the Mozambique sample was engaged in informal savings and credit groups, and all participants in ASCAs were women. Among Small-

TABLE 4: Mozambique Smallholder Diaries: Use levels and other data for common financial devices (N=93 households)

	HOUSEHOLD LEVEL	MEAN STATISTICS AT DEVICE LEVEL			
TOP 5 SAVINGS INSTRUMENTS	PERCENTAGE OF HOUSEHOLDS	LATEST BALANCE	# OF TRANSACTIONS PER INSTRUMENT	AVERAGE DEPOSIT	AVERAGE WITHDRAWAL
Savings in the house	87	$17.44	9	$10.90	$12.88
Lending to friends and family	41	$10.49	2	$33.77	$18.23
Credit given	18	$1.92	3	$3.17	$4.64
ROSCA	12	$15.89	7	$10.37	$51.91
ASCA	9	$17.38	6	$6.18	$41.05
TOP 5 CREDIT INSTRUMENTS	PERCENTAGE OF HOUSEHOLDS	LATEST BALANCE	# OF TRANSACTIONS PER INSTRUMENT	AVERAGE DEPOSIT	AVERAGE WITHDRAWAL
Borrowing from friends and family	59	$3.41	2	$10.80	$8.62
Credit at a store	22	$2.57	2	$3.89	$3.28
Borrowing from informal group	5	$6.92	2	$27.69	$6.49
Pawn	5	$6.58	1	$1.83	$1.73
Act as money guard	5	$1.33	1	$17.60	$0.58

holder Diaries households in Mozambique, only 12 percent used a ROSCA, 9 percent an ASCA, and 5 percent a money guard to save.

Smallholder families in the Mozambique sample often relied on casual labor as a kind of automatic teller machine (ATM) to generate cash during lean times. With limited savings and credit options, sample households looked to wages from casual labor to get through the hunger season. Casual labor filled a gap, but was not a perfect solution. The timing of this income did not always match the timing of the needs and it was often insufficient to carry families through this difficult period (see Box 8).

A fraction of households in the Mozambique sample had heard of mobile money products (21 percent), and use was nonexistent. Use of mobile money was at least in part impaired by low mobile phone ownership and capability. Those who did not use it but who had heard of it considered it a useful product

BOX 8

CASUAL LABOR AS AN ATM AMONG THE WAPERIWAS (MOZAMBIQUE)

Among the sample in Mozambique, the Waperiwa family used casual labor as a kind of ATM. A family of six, they relied heavily on casual labor to supplement their subsistence farming. Issa and his wife Fabiana lived with their four teenage children, and also often cared for Fabiana's mother. The Smallholder Diaries found only two financial mechanisms at work in this household: Issa saved at home and borrowed from his brother, just once at the very beginning of the research.

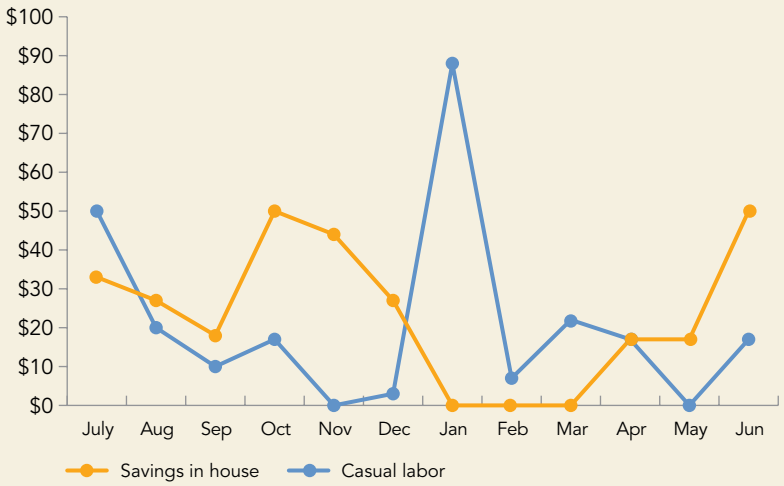
The family produced cassava, peanut, sweet potato, beans, and maize. The harvests in July to September to some extent carried the family through the hunger season. The household sold only small quantities of sweet potato in July 2014 and cassava in June 2015 because they preferred to store as much food as possible for their own consumption.

Although Issa had amassed a significant amount of savings by October in a secret saving place at home, this savings was not enough to carry the family through the months of the hunger season (see Figure B8-1). To continue to have enough to eat during the hunger season, the Waperiwa family spent all of their savings by January, and did not contribute to their savings at all during this time. Although the family may have been able to borrow from their social network in times of need during these months, everyone in the village tended to have limited financial resources. Households in the Mozambique sample had virtually no access to credit during the lean months and instead increased their work on other farms and small construction projects in January, at the height of the hunger season.

By relying on income from casual labor, the Waperiwas did not go hungry during the past lean season, but they did feel the burden of the "sick season." Family members needed medical care in September, December, and March, but went without. In all cases, instead of going to the doctor, they bought medicine in the village.

The one financial instrument the Waperiwa household used, saving at home, was not sufficient to carry the family through the hunger season. Casual labor filled a gap, but it was an imperfect, insufficient solution, and they were lucky to find as much casual work as they did. Some households reported struggling to find employment during the lean months.

FIGURE B8-1: Waperiwa household's monthly savings in the house balance and casual labor earnings (US$)



(hypothetically). One farmer in the Mozambique sample explained that though he was not using it, he liked the idea of the service because "it is a faster way to send and receive money. It is a pity that we don't have an agent near. If we had I would have tried it. I heard that you don't need a bank account."

Working with such a narrow portfolio of financial tools, the Mozambique sample generally exhibited spend-as-you-go behavior with uneven and volatile spending on expenditures. The average family in the Mozambique sample actually drew on their savings least during the hunger season from January to March because it had run out by this point. To cope, they reduced their household consumption, and expenditure levels dropped to the lowest in this period.

SMALLHOLDER DIARIES SAMPLE IN TANZANIA—MODERATE FINANCIAL PORTFOLIOS

Smallholder households in the Tanzania sample used 12 different financial tools, and overall six types of financial instruments, at the median (see Table 5). They relied most heavily on current income and short-term savings for both their agricultural and nonagricultural expenses. Awareness of mobile money (98 percent) was almost universal, but only 19 percent reported using it during the Smallholder Diaries to receive or send money (either from their own mobile money account or someone else's).[38]

Only the village that focused on potato production had access to ROSCAs and ASCAs, but even then loans from informal savings groups were generally not used for agricultural expenses. Those who borrowed had a number of small loans with informal groups and in their social network. With few opportunities to borrow, most relied heavily on short-term savings (including stored crops) and earnings from casual labor to make investments in fertilizer and other value-adding inputs. Clearly, savings in the house is too liquid an instru-

TABLE 5: Tanzania Smallholder Diaries: Use levels and other key data for common financial devices

	HOUSEHOLD LEVEL	MEAN STATISTICS AT DEVICE LEVEL			
TOP 5 SAVINGS INSTRUMENTS	**PERCENTAGE OF HOUSEHOLDS**	**LATEST BALANCE**	**# OF TRANSACTIONS PER INSTRUMENT**	**AVERAGE DEPOSIT**	**AVERAGE WITHDRAWAL**
Savings in the house	100	$18.25	101	$10.86	$3.10
Lending to friends and family	48	$10.52	2	$15.91	$15.84
ASCA	53	$5.83	3	$1.01	$34.47
ROSCA	33	$2.14	28	$1.09	$32.23
Credit given	28	$5.20	6	$2.81	$3.82
TOP 5 CREDIT INSTRUMENTS	**PERCENTAGE OF HOUSEHOLDS**	**LATEST BALANCE**	**# OF TRANSACTIONS PER INSTRUMENT**	**AVERAGE DEPOSIT**	**AVERAGE WITHDRAWAL**
Borrowing from friends and family	77	$4.53	2	$11.20	$11.56
Borrowing from informal group	67	$10.74	6	$7.83	$15.74
Credit at a store	60	$2.00	4	$7.31	$4.47
Agent credit	14	$12.44	1	$71.87	$41.35
Act as money guard	13	$0.09	3	$18.58	$18.67

ment to be used for such large investments, and without leverage, smallholders had limited options to invest in the productivity of their agricultural activities. Many of the Tanzanian respondents planned strategically to invest in their farms. Some families borrowed from middlemen and repaid in-kind with their own crops but for many, however, the amounts offered by agents were very low compared with their overall farming expenses. Other households saved revenue from sales of their agricultural production for months to purchase inputs and pay workers when needed (see Case 5 on the experience of the Bitungwas in Tanzania, who used this approach).

A majority of smallholder households in the Tanzania sample (59 percent) reported that keeping cash in the house was their most important way to save. Smallholder families also used stored crops as a kind of "term deposit," waiting for their production to gain "interest" with price increases over time; 21 percent considered crop storage their most important form of savings.[39] In many cases, families delayed the sale of rice, and when necessary, maize, until funds were needed or there was an emergency. Cash that was obtained from selling the crops was then stored at home.

The Tanzania sample also used casual labor like an ATM to generate small amounts of cash for expenses such as agricultural inputs. Families worked at odd jobs until they earned enough cash to buy what they needed. One smallholder household in the rice-producing village said they generally do not go to bed hungry; when they were low on food, they could "just work in someone's fields" and earn money to buy food. In the same vein, respondent households in the potato-producing village sometimes engaged in casual labor when a large expense came up that their other income sources (particularly agricultural production) could not cover. David, the head of one household, for example, engaged in construction work to repay debts to his informal savings group. He had expected to earn US$80 from the job but, as this was casual work, he was not working under a formal contract and in the end received only US$46 from his employer.

The Tanzania sample also exhibited a spend-as-you-go approach and suffered most during nonagricultural production periods. Among the Smallholder Diaries sample in villages focused on rice cultivation in Tanzania, families identified February, March, and April as the hardest months of the year, when money, crops, and opportunities for casual labor related to the previous harvest dwindled. Families were unable to efficiently draw on their financial tools when they needed them most (see Figure 34): saving withdrawal activity (yellow line) dipped significantly and borrowing was almost nonexistent over these three months, mirroring corresponding dips in income.

SMALLHOLDER DIARIES SAMPLE IN PAKISTAN—BROAD FINANCIAL PORTFOLIOS

Working with the broadest, most robust financial portfolio of the sample, Smallholder Diaries households in Pakistan used almost 18 different financial tools from six types of financial instruments at the median (see Table 6). The average smallholder family's income fluctuated dramatically with the farm-

FIGURE 34: Tanzania Smallholder Diaries, rice production village: Income, borrowing, withdrawals from savings devices, and balances of saving devices at the sample level, JULY 2014–JUNE 2015 (US$)

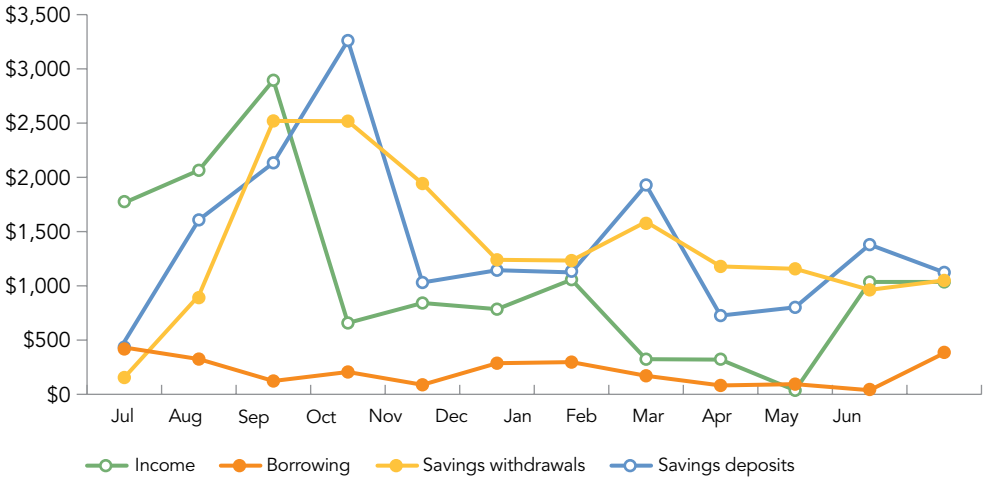


FIGURE 35: Pakistan Smallholder Diaries: Average income, borrowing, withdrawals from savings devices, balances of saving devices (US$), JULY 2014–MAY 2015

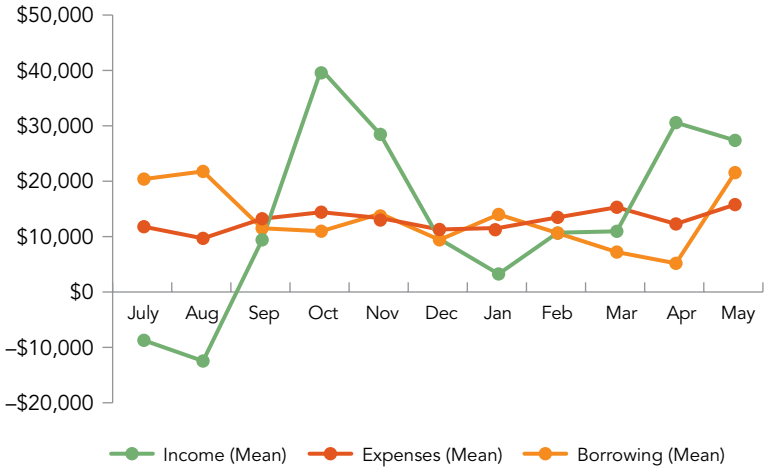


TABLE 6: Pakistan Smallholder Diaries: Use levels and other key data for common financial devices

	HOUSEHOLD LEVEL	MEAN STATISTICS AT DEVICE LEVEL			
TOP 5 SAVINGS INSTRUMENTS	PERCENTAGE OF HOUSEHOLDS	LATEST BALANCE	# OF TRANSACTIONS PER INSTRUMENT	AVERAGE DEPOSIT	AVERAGE WITHDRAWAL
Savings in the house	85	$72.74	9	$146.65	$82.78
Lending to friends and family	61	$45.32	2	$135.36	$108.62
Money guard	56	$122.68	4	$583.83	$280.89
Credit given	23	$175.95	20	$21.15	$51.92
ASCA	19	$37.55	1	$80.60	$130.14
TOP 5 CREDIT INSTRUMENTS	PERCENTAGE OF HOUSEHOLDS	LATEST BALANCE	# OF TRANSACTIONS PER INSTRUMENT	AVERAGE DEPOSIT	AVERAGE WITHDRAWAL
Borrowing from friends and family	99	$74.08	2	$97.14	$80.67
Agent credit	97	$106.98	9	$199.19	$49.43
Credit at a store	94	$22.87	14	$36.98	$5.99
Joint liability loan	27	$122.16	2	$259.05	$252.80
Business loan	16	$1,244.98	2	$262.38	$939.74

ing cycle, but the Pakistan sample was able to leverage credit (see orange line, Figure 34) so that expenses could at times exceed income (e.g., January). Almost all of the smallholders in the Pakistan sample had heard of mobile money (82 percent), but none used it during the study.

Households used various forms of credit to get through the months when spending on agricultural inputs was high and revenue from farming was low, borrowing from family and friends (99 percent), arthis (97 percent), and local stores (94 percent) to get through the summer and winter months. Over the year of data collection, the typical household in the Pakistan sample obtained goods on credit from an individual store on 14 occasions. The sample also relied heavily on credit to buy expensive farming inputs, which, given the scale of agriculture in the region, was probably the only option.

But even this relatively broader, more diverse financial portfolio did not meet all needs of the Smallholder Diaries families in Pakistan. Spending on agricultural inputs was very high, and at times basic household needs were sacrificed to afford investments in their agricultural activities. Almost one-fifth (19 percent) of households in the Smallholder Diaries sample in Pakistan reported that buying food was their most challenging expense.

Arthis were embedded in the agricultural and financial lives of the sample in Pakistan. Arthis offered inputs (e.g., fertilizer, pesticides) on credit to be repaid after the harvest and then bought crops from farmers at harvest (see Box 9). Arthis also acted as money guards for smallholder households, holding onto their cash savings, which was often the income from their agricultural production. Smallholder households in the Pakistan sample appreciated that their financing arrangements with arthis had some flexibility, in that they could defer repayment in the event of crop failure. Working with an arthi also reduced some risks, such as major income shocks from crop failure, not finding buyers when needed, and the probability that the price might go down.

"After we cut the crop, we sell right away. We have to return the credit to the arthi. Because of this helplessness, I have to sell. And sometimes the selling price is low, and we suffer a loss [financially]."

—Smallholder participant in Pakistan

But smallholders generally found the interest rates high and were required to repay immediately after harvest, which meant smallholders could not wait to sell their agricultural production until prices were more favorable. Arthis generally charged smallholders about 21 percent interest on the amount borrowed, citing the flexibility they offered and the risk they were taking on, and expected payment after six months, right after the harvest. Some arthis were so eager to obtain repayment that some families reported feeling "bothered" by the arthi to repay. Some families felt forced to sell their crops at an inopportune time, when supply was high and prices low, and saw this as exerting a large, negative impact on their income (see Box 10). Upon repaying their debt after harvest, many families reported immediately borrowing again to finance inputs for the next season, creating a cycle of debt. There was also some concern about the ledgers that arthis kept on the saved amounts, and the quality and transparency of their record keeping.

BOX 9

THE FINANCIAL LIFE OF ALI, AN ARTHI (PAKISTAN)

Ali has been an arthi for five years and serves one of the villages with participants in the Smallholder Diaries in Pakistan. After his father, who had been a businessman in the oil industry, passed away, Ali used his inheritance to start working as an arthi, following the advice of a friend. Ali had about 80 ongoing clients in 12 villages, most of whom farmed less than 4.8 hectares of land.

Working in competition with other informal arthis, Ali spent millions of rupees each year buying wheat, rice, cotton, and mustard seed. He did not store the crops he bought, but sold right way to pukka (formal) arthis and mill brokers. The price he obtained for the crops was based on bidding, and influenced by the quality of the crop and the international market. Prices changed daily, and after deducting a fee (1.5 percent for staple crops such as wheat and maize, and 2.5 percent for cash crops such as rice and cotton), he paid the farmers, usually within a week of the sale. His borrowing needs were covered by banks.

Ali also bought pesticide and fertilizer from various shops, stored them at certain stores, and sold them to farmers at a 25–30 percent profit. He held about 5–7 million rupees (about US$49,000–69,000) in savings for farmers. He kept a record of transactions in a register, and only some farmers kept track themselves and cross-checked with them. Most farmers borrowed for agricultural needs, and sometimes for expenses such as marriages and funerals. He lent only to regular clients and rarely had a problem with repayment. When crops failed, farmers could repay next season. He said he has generally good relations with farmers, but that some did get upset if he denied them credit. Overall, Ali considered being an arthi a good business with a "handsome pay off."

BOX 10

PERCEPTIONS OF A MIDDLEMAN: FARID AND SEEMA (PAKISTAN)

The experiences of Farid and Seema shed light on how arthis, as well as other service providers, are typically viewed by the respondents in the Smallholder Diaries in Pakistan. Farid, 43, and Seema, 40, live with their four young children and grow mainly rice and wheat on their 0.8 hectares of land. The family had trouble meeting all of their expenses and often borrowed to cover daily expenses, which they cited as their most difficult expense to cover, but their financial portfolio consisted only of informal financial mechanisms.

Farid and Seema dealt with one arthi whom they borrowed from and stored money with as well. The family occasionally borrowed for nonagricultural expenses from the arthi, but it had difficulty obtaining funds from the arthi in a timely manner. In December 2014, for example, Farid and Seema needed diesel to operate the tube well that would irrigate the wheat, but they were unable to obtain funds from the arthi when they needed them. This had a negative effect on the output of their wheat crop. Similarly, they needed money for medicine during the same month, but the arthi did not lend it to them on time.

Farid did not like working with the arthi very much, but felt majboor [helpless or obligated] since he had no other way to obtain fertilizer. He thought banks charged too much interest and that microfinance institutions would charge extra interest that would be difficult to pay back if he could not repay on time. Farid did appreciate that he could repay the arthi after the harvest. "With the middleman, we don't have a fixed time to repay our debt. Whenever the crop is ready, we sell and repay," he explained. He also preferred to save with the middleman because he felt that money kept at home was easily spent.

CASE 5

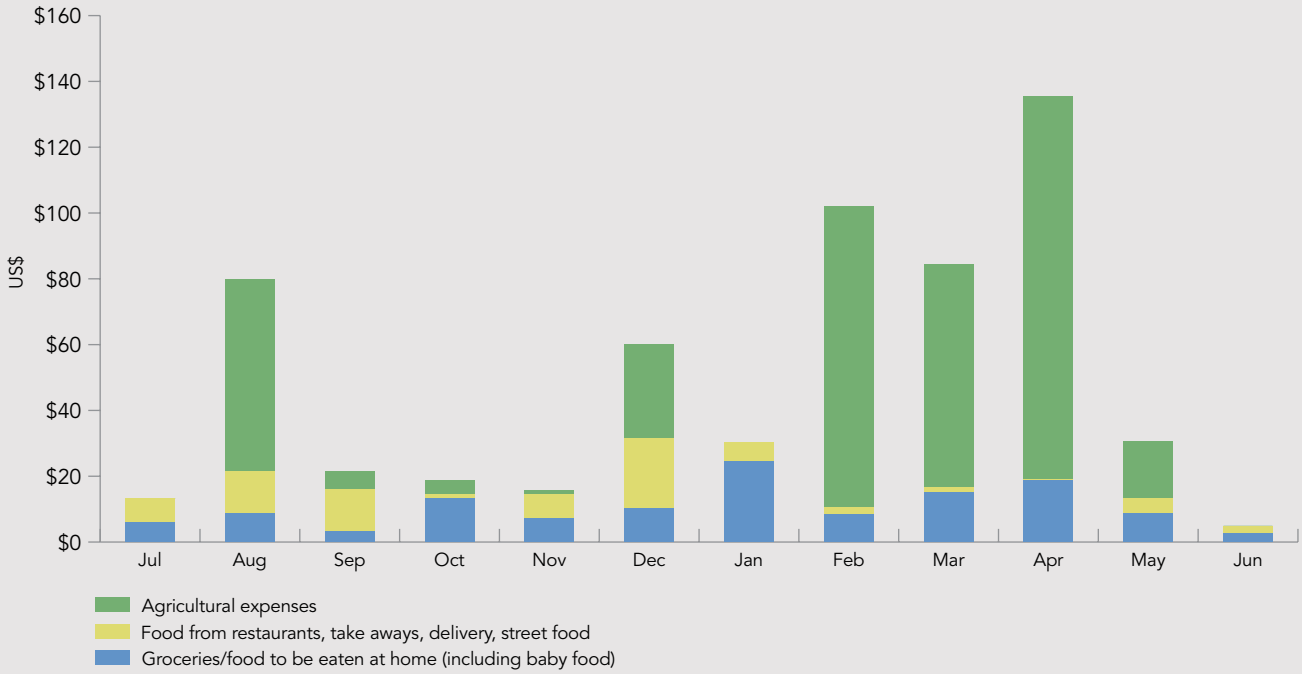
WORKING WITH A MODERATE FINANCIAL PORTFOLIO AND STRUGGLING TO MAKE AGRICULTURAL INVESTMENTS: THE BITUNGWAS (TANZANIA)

William and Anitha Bitungwa, participants in the Smallholder Diaries sample in Tanzania, were married and lived with three children, one adopted and two of Anitha's from before their marriage. They owned more than two hectares of land and relied primarily on their income from growing potatoes, wheat, maize, beans, and peas and selling milk. They planted potatoes twice a year and, because of a suitable climate, considered them "easy to care for" and good for generating "quick income." They grew wheat once a year and harvested in April for extra income. The Bitungwas earned additional income from selling rat poison and received resources from family and friends outside the household. William also worked as a researcher with a local university.

William and Anitha used a number of financial mechanisms. They both kept money aside at home as a form of savings and took informal credit from shops. William also borrowed from family and friends and saved with an ASCA. Though he had borrowed from five informal savings groups, the Bitungwas did not like them and felt that the groups did not benefit them. They both believed that when they had a loan they must work harder, but only because they wanted to repay the loans to the groups, not for some greater benefit to their household. It was social pressure that led William to join the groups nonetheless. Local interest groups wanted everyone in the village to be part of these savings groups, and William was forced to join one operating under the political party of which he is a member.

Agricultural production was their main source of income, and William and Anitha "take it seriously," which was evident from the amount they spent on inputs for potatoes and wheat, what they considered their cash crops (see Figure 36). The Bitungwas used

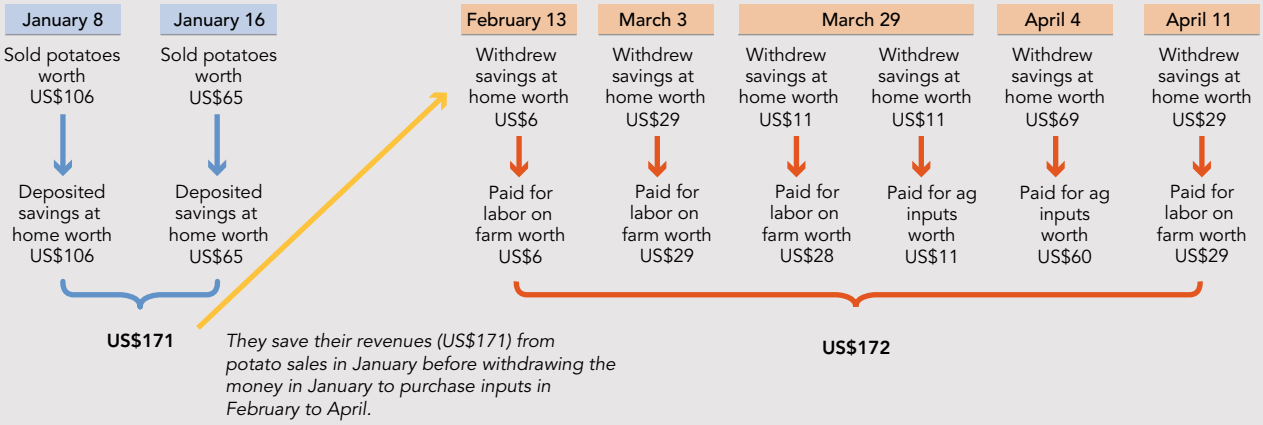
FIGURE 36: Agricultural expenses (labor, seeds, fertilizer) compared to restaurant, food, and grocery expenses: The Bitungwas (TANZANIA) JULY 2014–JUNE 2015 (US$)



their savings in an attempt to meet their farming expenses and saved revenue from potato sales for up to three months before withdrawing the money to purchase inputs, but they were unable to meet all of their farming investment needs with the financial tools at hand. Most of the time they bought inputs using money earned from selling their cash crops, or they used money that they had received from their children living in town. Sometimes they sold assets to cover input expenses as well, since they believed that they would be able to purchase more assets after harvest and after they had sold their cash crops. For the Bitungwas in the period of the Smallholder Diaries, this was in fact true (see Figure 33).

William and Anitha did not always need to buy inputs when they sold their cash crops, but they purposely set aside money from selling cash crops to buy fertilizer and pesticide and pay for laborers in their fields when needed. While they were actively withdrawing from and depositing into their savings at home between January and April, the US$171 that they earned from potato sales in January clearly corresponds to the US$172 they later spent on labor and agricultural inputs in February, March, and April when planting potatoes and wheat. In fact, William and Anitha earned only US$35.20 in February but had saved enough from selling potatoes to cover their expenses, which was not an uncommon approach to meeting agricultural expenses in their village. But despite the Bitungwa's careful planning to afford inputs, they still insisted that they did not have enough. "I have enough plots, but I don't have enough capital to invest in all plots I have," said William. "If I could have capital, I would I have gotten more out of my farm."

FIGURE 33: Sales from potatoes between January and April 2015: The Bitungwas (TANZANIA)



Tanzania. Photo by Erin Scronce.

6.

ACCESS TO MOBILE PHONES AND USE OF DIGITAL FINANCIAL TOOLS

Use of digital financial tools in the Smallholder Diaries sample was very limited and only among households in the Tanzania sample. The Smallholder Diaries also point to a crucial gap between basic access to a phone, which itself remains a barrier, and the ability to use it to conduct financial transactions. Overall, the degree to which smallholder households might engage with mobile financial services varies across the profiles observed in the Smallholder Diaries, particularly in terms of their starting point.

The use of mobile phones to access financial services has been of particular interest in smallholder finance, because of the potential of digital financial services (DFS) to overcome some of the key constraints to providing rural finance at scale.[40] Financial inclusion in rural areas has been constrained by its inherent lower population density, as well as relatively lower incomes, and therefore higher transaction costs, outside urban centers. The possibility of providing a wide array of financial services—including easy-access bridge loans, savings mechanisms that target various goals, and insurance for the most devastating risks, as well as nonfinancial services, such as weather and price information and linkages to value chains—all seem to come within closer reach when using new applications of technology and mobile phones. But first things first: access to and capability with mobile phones drive the viability of DFS.

Most of the most economically active members in the Tanzania and Pakistan samples owned a mobile phone (56 percent and 70 percent, respectively), but less than half in Mozambique did (45 percent) (see Table 7). Most other household members did not have a mobile phone. In addition to the main respondent, someone else in the household also had a mobile phone in only 38 percent, 43 percent, and 21 percent of the samples in Mozambique, Tanzania, and Pakistan, respectively. More broadly, the great majority of respondents in Tanzania and Pakistan had used a phone—including both their own or a borrowed one—in the past year (77 percent and 73 percent, respectively), but the proportion in the Mozambique sample was much lower. Only 55 percent of the sample smallholder households in Mozambique had used a phone at all in the past year.

There is a crucial gap between basic access to a phone, which itself remains a barrier, and the ability to use it to conduct financial transactions, which entails basic literacy in the operating language. SMS functionality is also important for mobile financial services; for those unable to send or receive SMS,

performing USSD- or text-based financial transactions on a mobile phone is likely to pose significant challenges. Of the respondents with access to a mobile phone, 68 percent in Tanzania could use SMS functionality (but not access the internet), compared with only 24 percent in Pakistan and 25 percent in Mozambique (see Table 7). Thus DFS remain important tools to explore and expand, but must be carefully targeted to each customer profile. Some types of DFS (e.g., mobile financial services such as P2P transfers) may be more appropriate for mobile-literate smallholders who are more capable with their phone, while other digital solutions will need to be explored to reach those with low levels of mobile literacy (e.g., OTC, agent-facilitated transactions).

Use of digital financial tools in the Smallholder Diaries was very limited (and only in the Tanzania sample), despite varying levels of awareness of and aspiration to use this financial tool across the three countries. General awareness of mobile money (defined in this study as a transfer of funds using a mobile wallet) as a financial tool ranged greatly across Smallholder Diaries respondents, from a low of 21 percent in the Mozambique sample to near complete awareness among the sample in Tanzania (see Table 7), which is expected given the strength of the Tanzanian digital infrastructure. This was reflected in the perception of mobile money within the sample as a financial tool relevant to their needs. When asked what financial mechanisms they might use to send or receive money, "mobile money" was selected as one answer by almost three-quarters of the sample in Tanzania and more than half of the sample in Pakistan. Yet the perceived relevance or aspiration to use mobile money—defined for these purposes as a transfer or transaction using a mobile wallet—did not materialize over the year of data collection in the Smallholder Diaries. Based on the actual transactions of sample households, only 19 percent of Smallholder Diaries fami-

TABLE 7: Mobile phones and mobile money among Smallholder Diaries households (percent),[a] NOVEMBER 2014

	MOZAMBIQUE	TANZANIA	PAKISTAN
Access to mobile phones and use of mobile money			
Had a mobile phone	45	56	70
Had a SIM card	48	56	65
Other household members had a mobile phone	38	43	21
Other household members had a SIM	57	35	22
Had used a phone, even a borrowed one, in the past year	55	77	73
Had heard of mobile money	21	98	82
Selected "Mobile money" as one response when asked "What would you likely use to send or receive money?" (multiple answers allowed)	0	74	57
Had used mobile money (for transfers and transactions on a mobile wallet based on actual cash flows from June 2014 to June 2015)	0	19	0
Self-reported capability with mobile phones			
"I cannot initiate or receive a call, or send or receive an SMS."	0	3	1
"I can only receive calls."	45	9	7
"I can only dial and initiate calls."	2	0	19
"I can dial and initiate calls and receive calls."	27	15	37
"I can dial and initiate calls, receive calls, and send and receive SMS."	25	68	24
"I can dial and initiate a call, receive calls, send and receive SMS, and access the internet."	0	1	7

a. Responses are from a Smallholder Diaries module administered to the most economically active member of the sample household.

lies in Tanzania used mobile money in the study period. No smallholder households in either the Mozambique or Pakistan sample used mobile money at all.

Considering the potential of DFS to serve smallholder households in areas that traditional brick-and-mortar FSPs have failed to reach, DFS remain important tools to explore and expand for purposes of financial inclusion, and they must be carefully targeted to each customer profile. Digital savings and credit products could provide more compelling use cases than payments, as many households in the sample lacked access to even informal financial services, such as savings groups. Additionally, some smallholders may be well-served by digital payment services that facilitate transactions such as bill payments and school fee payments (i.e., person-to-business [P2B] and person-to-government [P2G] payments), though smallholders may prefer OTC payment methods over self-initiated mobile transactions from their own wallet.

CASE 6

RELYING ON CREDIT IN MONTHS BETWEEN HARVEST: THE BHATTIS (PAKISTAN)

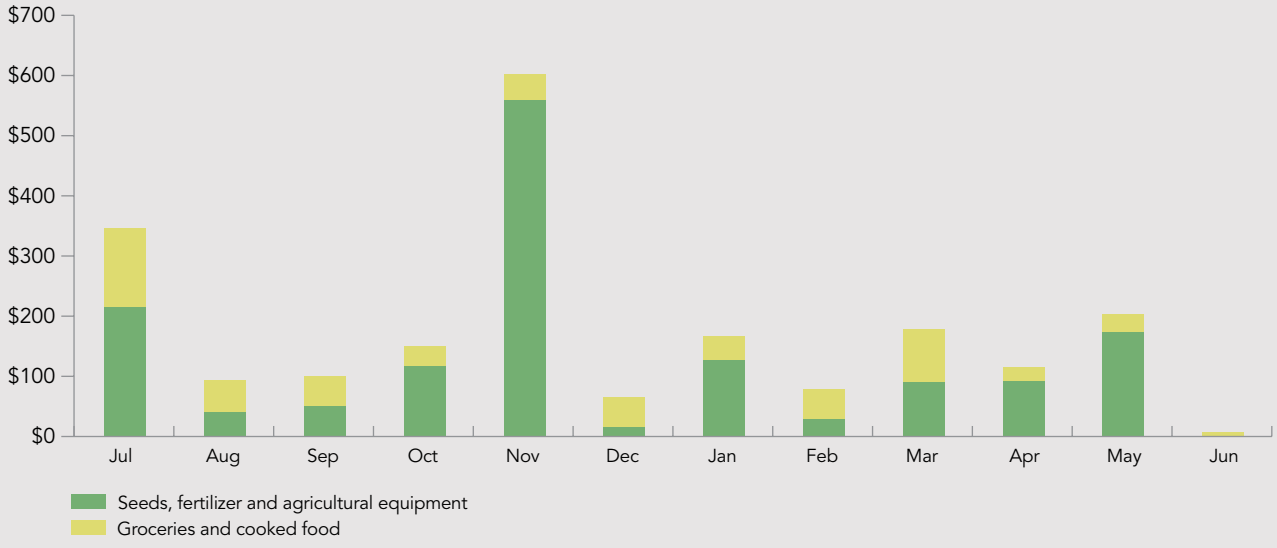
The experience of Abdul and Rania Bhatti, one of the Smallholder Diaries households in Pakistan, demonstrates how families in this sample used their relatively broad financial portfolio to access goods and cash when they needed it most. While the family had savings both at home and with its arthi, and also lent money to its family and friends, it was the liability side of its portfolio—informal credit at the store, agent (arthi) credit, and occasionally borrowing from friends and family—that carried them through tough times. The family's views of the arthi were also typical across the sample.

Abdul, 57, and Rania, 48, lived with their son and daughter on a small plot of land (1.2 hectares). Their older son and his wife lived in their house, too, but kept their expenditures separate. Though Abdul and Rania were not educated, their 11-year-old daughter was enrolled in school. Their younger son, 13, preferred to work rather than go to school and was training in a workshop.

The Bhattis grew two main crops, rice in November and wheat in May, as well as a variety of vegetables and fodder to feed their three buffalos and one cow. They relied heavily on revenues from selling milk. The Bhattis incurred significant spending on agricultural inputs throughout the year and spent substantial amounts on their agricultural production each month relative to what they spent on food. In November alone, their spending on agriculture reached US$559 (see Figure 37).

Financially, November was the best month for the Bhattis. They sold their rice and, as a result, were able to spend the most. But the family had the hardest time budgeting in July, December, and January, and faced unexpected hardships throughout the year. In July, all the vegetables that Abdul had been growing were destroyed, costing him about US$502. Then in September, bad weather completely destroyed the fodder crop as well.

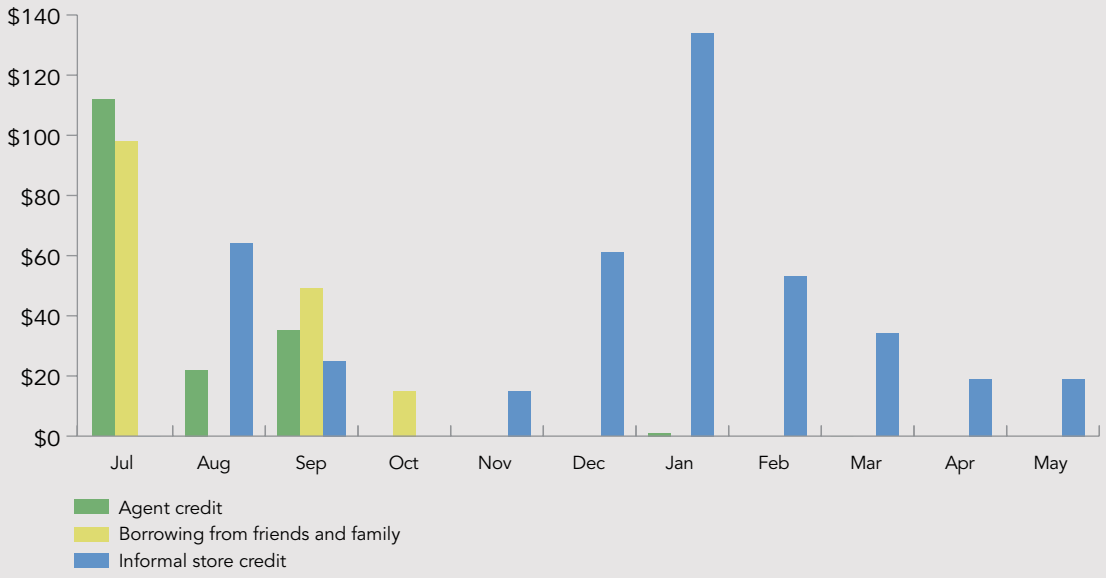
FIGURE 37: Total spending on food-related items and agricultural inputs: The Bhattis (PAKISTAN), JULY 2014–JUNE 2015 (US$)



In the hard winter months, the Bhattis spent more than they earned by relying on store credit at seven different shops, including a butchery, a vegetable store, clothing shops, and a kirana shop, which sells small goods such as soap. In January, the household experienced a particularly difficult period, and they could not even purchase shoes, despite the harsh winter weather. Their crops ran out, as did their savings, and Abdul and Rania's purchases on credit peaked in January. In May, after they harvested the wheat, they paid much of this debt back. Without access to these many lines of credit, the Bhattis would have experienced even more hardships during the year.

The Bhattis borrowed money to purchase inputs for their rice from the arthi from July to September (see Figure 38). Abdul had a line of credit open with just one arthi, and he liked some aspects of borrowing from him. "Whenever I need fertilizer, [the arthi] gives it to me . . . even if my arthi has a shortage when I need fertilizer, he'll get it from someone else and bring it to me. After the harvest comes, I pay back. He doesn't demand money from me every day; that's why he is the best for me." That said, Abdul had to repay the arthi with 21 percent interest on the amount borrowed after six months, a rate common across the Smallholder Diaries sample in Pakistan, which he felt was too high. "After six months when I need to repay him, I have to pay a lot of interest. If the government could give us fertilizer without interest, that would be best for us. Our [future] income would be saved."

FIGURE 38: Credit amount and frequency of instrument use: The Bhattis (PAKISTAN)
JULY 2014–MAY 2015 (US$)



Tanzania. Photo by Hailey Tucker.

7.

IMPLICATIONS FOR FINANCIAL SOLUTIONS: TRANSLATING THE EVIDENCE INTO FINANCIAL TOOLS TAILORED TO EACH SMALLHOLDER HOUSEHOLD PROFILE

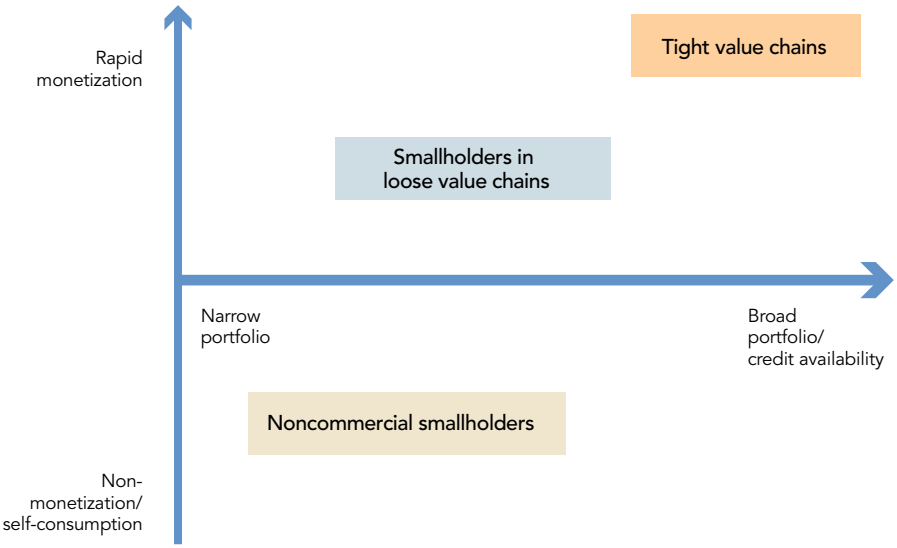
How FSPs sustainably engage with smallholder households, particularly when it comes to DFS, depends heavily on the household profile they serve. Smallholder Diaries households can be placed into three loose profiles based on observed differences in (*i*) their patterns of agricultural production and sales and (*ii*) the breadth of their household financial portfolios. Each profile requires its own tailored financial solutions, and the degree to which smallholder households might engage with mobile financial services varies, particularly in terms of their starting point.

Translating this evidence into financial solutions, the Smallholder Diaries observed key differences across the sample in (*i*) their patterns of agricultural production and sales (see Section 2) and (*ii*) the breadth of their household financial portfolios (see Section 5). Bringing these two variables together, the Smallholder Diaries households can be placed into three loose profiles, which correspond with the location of the sample (see Table 8): (*i*) noncommercial smallholder households (Mozambique); (*ii*) those in loose value chains (Tanzania); and (*iii*) those in tight value chains (Pakistan) (see Figure 39). Each profile has a distinct set of challenges and features that service providers will need to fully understand and address to successfully meet their demands for financial tools.

TABLE 8: Financial Portfolio Breadth and Sales and Consumption of Agricultural Production in the Smallholder Diaries

	MOZAMBIQUE	TANZANIA	PAKISTAN
Financial portfolio breadth (median)			
Number of financial instruments	3	12	18
Number of savings instruments	2	5	3
Number of credit instruments	1	6	14
Number of households using credit (%)	67	92	100
Main method of borrowing money (self-reported)	Friends and family	Friends and family	Friends and family, agents
Main method of funding inputs (self-reported)	Savings, current income, in-kind	Savings, current income	Credit
Sales and consumption of agricultural production			
Percentage of harvests consumed (self-reported)	68	18	12.5
Buyers	N/A	Village agents; agricultural agents; retail consumers at market	Agricultural agents; village agents
Crop storage	Bags in the house, traditional bamboo silos	Bags in the house	Tin and aluminum containers
Main method of storing value (self-reported)	Money at home	Money at home	Livestock; money at home; money guard (arthi)

FIGURE 39: Three smallholder profiles based on degree of agricultural commercialization and breadth of financial portfolio



SOLUTIONS FOR NONCOMMERCIAL SMALLHOLDER HOUSEHOLDS: STRETCHING SMALL AMOUNTS OF INCOME, IMPROVING CROP STORAGE AND OTHER MEANS OF SAVING

Financial tools to store and stretch the small amounts of income earned by noncommercial smallholder households on an infrequent basis, particularly from casual labor, could be useful to these families. Noncommercial smallholder households receive income infrequently and are not able make savings deposits on a structured schedule, but financial mechanisms such as ASCAs that allow families to deposit intermittently when they do have a bit of surplus can help households build up small reserves. This pool of stored funds could also be useful as a type of household-generated safety net during the hunger season. That said, any additional savings derived from their very limited incomes would still likely be insufficient to insulate the household from shocks or meet all consumption needs.

Close to two-thirds of the Smallholder Diaries sample in Mozambique lost crops in storage, which points to a clear opportunity to improve both their agricultural and financial lives. Smallholders in the Mozambique sample stored their agricultural production in burlap sacks in the house or simple bamboo cisterns that pests could easily penetrate. With these rudimentary crop storage systems, households were unable to store crops for many months. Securing agricultural output in a more resilient form of storage (e.g., reinforced plastic bags, small metal grain silos) could be an improvement for noncommercial smallholders.[41] A range of financial tools and service providers could support the uptake of improved storage methods, including targeted layaway products from retailers and commitment savings plans and tailored credit products from FSPs. These could be facilitated by mobile phones or use of standard transactions.

This profile is likely the most challenging to serve via mobile financial services, and successful approaches will need to overcome the barriers of limited access to and capability with mobile phones. The experience and understanding of mobile phones in the Mozambique sample was the lowest in the Smallholder Diaries: roughly half (55 percent) had used a phone in the past year and many knew only how to receive calls with their phone (45 percent). Low levels of literacy, the lack of access to electricity to charge phones, and limited infrastructure presented additional challenges, and no one in the Mozambique sample used mobile money during the Smallholder Diaries. Input retailers, off-takers, and FSPs would need to address these constraints and then develop tailored products that offer the option or provide incentives to use mobile financial services (e.g., to receive payment, to contribute to a layaway account for inputs or an improved form of crop storage), perhaps in the near term through an agent (though this poses its own challenges) and, with time, independently.

Improved agronomic practices and better agricultural risk management would also be important in this profile, and off-takers interested in reaching noncommercial smallholders and embedding them in their supply chain would need to bundle this agronomic support with financial tools. Loans from off-takers to finance agricultural production may be relevant to some noncommercial smallholder households, but probably only when combined with a fairly extensive range of support that enables some marketable surplus, including high-quality seeds and inputs, agronomic information, weather information, and access to markets. Noncommercial smallholders present the most challenging producers to link to value chains, and it will be important to explore ways to push beyond the estimated 7 percent of smallholders currently embedded in tight value chains (Christen and Anderson 2013), looking for opportunities to broaden this approach to include additional crops and livestock, offer financial services beyond input credit, and reach lower-income, less skilled producers.

Nonfinancial interventions are also critical to improve the well-being of noncommercial households. Improvements in financial inclusion are important for noncommercial smallholder households, but only one of many relevant and needed interventions.[42] The experiences of the Smallholder Diaries sample in Mozambique emphasized the connections among health and nutrition, food security, and irregular incomes. Interventions to improve healthcare, provide wider safety nets, increase agricultural production, and better preserve the harvest are important for improvements in the overall well-being of noncommercial households. When someone in the family needs medical attention, for example, they cannot pay for transportation to a health clinic or hospital without cash on hand, which may prevent them from seeking care. Vouchers that allowed bus and taxi drivers to receive payment from NGOs or the government for transportation to medical care could ease this constraint.

SOLUTIONS FOR SMALLHOLDER HOUSEHOLDS IN LOOSE VALUE CHAINS: MOVING SAVINGS FROM THE MATTRESS INTO A FINANCIAL TOOL, LEVERAGING DFS

Overwhelmingly, families in the Smallholder Diaries sample in Tanzania kept their savings in-kind or under the mattress, presenting a clear opportunity for FSPs to offer more avenues to store money. These relatively higher-income (or somewhat less poor) households could in some cases more successfully postpone crop sales until market prices increased after the initial harvest period, and some also purposefully set aside their stored crops to "save" for a targeted lump sum of money or more generally in case of emergency. Tailored savings instruments could be designed around this seasonal pattern as well as the agricultural and household needs of smallholder families, but FSPs must recognize that these financial savings tools would be competing with the nonfinancial crops in storage as their own form of savings, each with its own rate of return and attributes. Crops can be consumed or traded in times of need and the gains on crop sales due to changes in market price can be substantial, but prices are unpredictable and crops can rot or be destroyed. These savings tools could also be positioned as compatible, and smallholder households may have an interest in using both. Warehouse receipts may also be useful for both storage and financial purposes.

Service providers need to take into account the full range of income sources when evaluating risk. Household cash flows and their volatility—from income sources both related to and independent of agricultural production—should be considered when calculating the risk and terms of any loan. Commercial smallholders are in a stronger position to take on debt than non-commercial smallholders, but a deeper understanding of the dynamics of household cash flows could provide comfort to service providers and borrowers alike by demonstrating that certain forms of agricultural lending may not be as risky as previously perceived, or that they are at least mitigated by other less volatile sources of income outside of agricultural production. On the other hand, credit is not always the answer. Lenders may consider some loans too risky, and some consumers may wish to avoid debt in any circumstances, in which case some near-term investments and purchases can be achieved through other financial mechanisms, such as layaway products, leasing, commitment savings, and in-kind payments.

In countries with a robust mobile financial services infrastructure, such as Tanzania, access to credit and payments could be facilitated via digital channels. Many smallholder households in the Smallholder Diaries sample in Tanzania purchased fertilizer, and access to a mobile-based offering that provides this kind of small-scale finance could build on this interest and be applied to other goods and assets. Savings-based and layaway financial mechanisms—where goods are saved for in small increments over time and secured when the total amount has been reached—that are delivered via digital channels could also facilitate these purchases. They would also provide an alternative for those who prefer to avoid taking on debt or who are not creditworthy. In addition, Smallholder Diaries households used cash to make payments to formal entities such as government offices, schools, and hospitals, which suggests that P2B and

P2G payments could present other use cases for formal financial services or mobile payments.

Closer connections to buyers and aggregators in the value chain could also benefit this profile, and in countries such as Tanzania that have a robust digital infrastructure, these relationships and services could be enabled via digital channels. Such services could facilitate the creation of purchase agreements or formal contracts, for example, against which smallholders could borrow for fertilizer, an oft-cited need among the Tanzania sample households.

FSPs that offer any type of insurance would need to demonstrate its value very early on to build trust, counter scepticism, and distance their product from other negative experiences. Agricultural insurance may be worth exploring, but insurance and insurers had a weak reputation among the sample. Households are wary of any insurance due to reports of poor service when using the national health insurance card. Stories abound among the Tanzania Diaries sample where someone has gone to a public hospital with their national health insurance card, only to wait for hours to be served, while someone else who pays for services in cash is immediately assisted.

SOLUTIONS FOR SMALLHOLDERS IN TIGHT VALUE CHAINS: ENGAGING MIDDLEMEN, CHANNELING SAVINGS

Smallholders in tight value chains need financial tools that facilitate their relationships with middlemen and could benefit from mechanisms that reduce their dependence on this one FSP. The households in the Pakistan Smallholder Diaries had by far the widest, most complex portfolio of financial tools, but a significant portion of their income sources and financial tools flowed through an individual middleman. There is clearly space for more options on the supply side, but to compete, other service providers would need to match the flexibility and proximity of arthis, or offer better terms and service. In the event of crop failure, for example, the arthi will likely agree to be repaid in the following year, while most FSPs would not. Smallholder families may have issues with the middleman, particularly the timing of repayment immediately upon harvest, but they do return to them, at least in absence of a compelling alternative.

Savings is widespread and the opportunity for FSPs to offer financial tools to harness this is great. When smallholder households saved from October to November and April to May, for example, when agricultural income was high, the largest share of these savings went to arthis or to savings in the house, and of course neither earned any interest.

In addition to providing financial services alternatives to the middlemen, greater transparency could strengthen and better balance the arthi–smallholder relationship. Smallholders could benefit from a short-term loan to repay arthi debt and obtain inputs elsewhere, which would also allow breathing room to take advantage of price increases as time passes after harvest. Even when savings are kept with the arthi, digital finance and tools may help farmers

Pakistan. Photo by Erin Scronce.

keep better track of the large amounts of money they have saved. The written ledger of savings that arthis keep for farmers, for example, could be converted to a new record keeping system using mobile technology.

The middlemen themselves may benefit from a wider range of financial tools to cope with liquidity constraints, transaction costs, and risk. Addressing their pain points may allow greater flexibility on the products and terms that they offer the smallholder households with whom they work. Easing financial pressures at the top of the value chain may benefit farmers at the bottom, though middlemen would still hold the balance of power in negotiating with smallholders. The eventual impact on smallholder households of improving the financial mechanisms available to middlemen should be further explored.

AREAS FOR FURTHER RESEARCH

The Smallholder Diaries are designed to spotlight some key observations in income, expenses, risk management, and financial portfolios across three distinct profiles of smallholder households in Mozambique, Tanzania, and Pakistan and drive advances in their financial inclusion. While the specific context of each sample is important, these findings also have implications for the smallholder household sector worldwide. The sample of smallholder households in each study country has characteristics shared with broader types of smallholder segments identified in countries around the world, which presents the opportu-

nity to discuss the financial tools these common segments demand regardless of their location. As in any research effort, the results spark as many questions as they may answer and the work to better understand smallholder households and improve their agricultural and financial lives continues.

Key areas for further exploration include how value chain finance approaches could reach lower-income, less skilled smallholders, embed additional crops and livestock in tight value chains, and bundle financial services beyond input credit in their production support packages. The relationship among participants is also an important aspect of value chains. Understanding how smallholders and purchasers benefit from these connections, financially and otherwise, and where vulnerabilities remain will be important to their successful and equitable expansion. In addition, as FSPs develop and tailor a range of financial tools to specific profiles of smallholder households, it would be useful to understand how household financial portfolios change over time, including what financial mechanisms are replaced, how transaction costs change, when informal tools continue to complement formal financial tools, and where gaps persist. Considering the level of financial exclusion among smallholder households, additional research on how FSPs can most effectively develop products that rapidly and effectively reach scale is also key.

Forthcoming data and analysis from the national smallholder surveys will help further contextualize the results of the Smallholder Diaries and contribute to building the evidence base on the financial and agricultural lives of smallholder households. The segmentation of the smallholder sector in each country will inform FSPs developing financial tools tailored to each segment and designing the business cases to deliver them sustainably. It will also identify client groups whose primary needs are in basic health, education, and infrastructure, and where collaboration with government and NGO partners would be even more important. Together, the data and results from the Smallholder Diaries and the national surveys and segmentations should help FSPs, government partners, NGOs, and other stakeholders better understand smallholder households and make strides in advancing their financial inclusion.

ANNEXES

ANNEX 1

AVERAGE VALUE OF ASSETS PER HOUSEHOLD

Asset values were calculated using self-reported, approximate values from respondents themselves.

FIGURE A1-1: Smallholder Diaries sample in Mozambique: Average value of assets per household (US$)

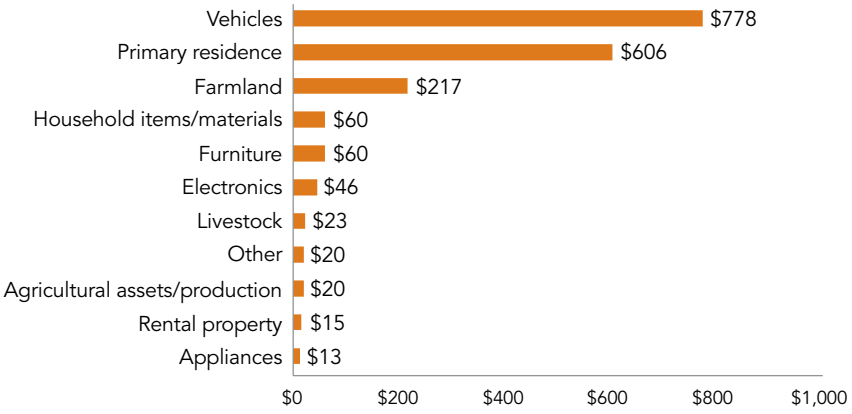


FIGURE A1-2: Smallholder Diaries sample in Tanzania: Average value of assets per household (US$)

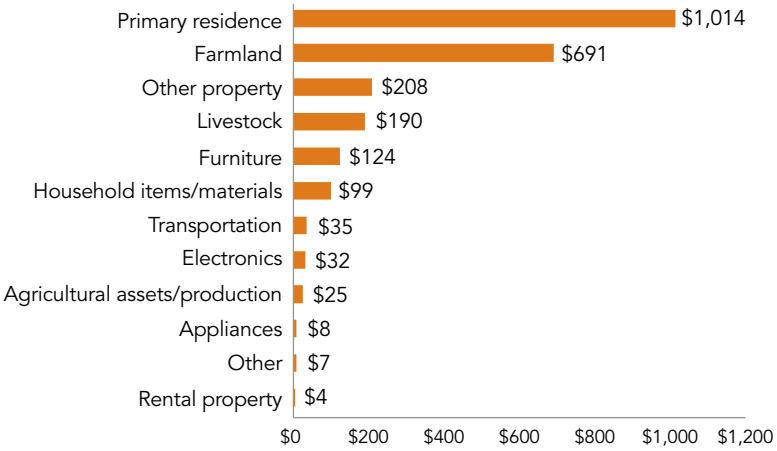
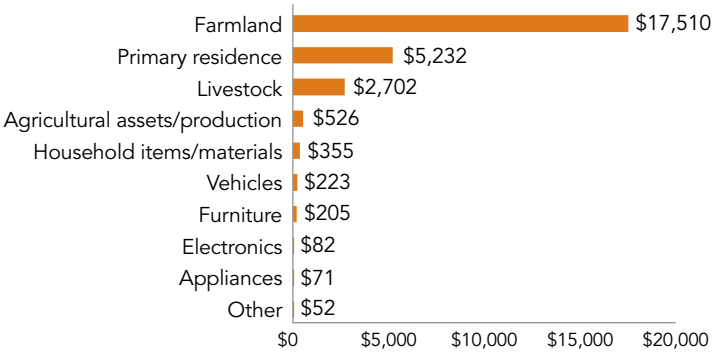


FIGURE A1-3: Smallholder Diaries sample in Pakistan: Average value of assets per household (US$)



ANNEX 2

DEFINITIONS OF INCOME SOURCES IN THE SMALLHOLDER DIARIES

Agricultural production income is money earned from the production and sale of agricultural goods, such as crops, livestock from an established agricultural business, and livestock byproducts (milk and eggs).

Casual labor income includes irregular income from short-term employment, such as work on construction sites or helping with the harvest on other people's farms. People employed in casual labor are not making management decisions or investments, which distinguishes it from self-employment income.

Nonemployment income includes grants and other institutionally provided support from charities, hospitals, and government.

Regular/waged employment is salaried income received that has been at least tacitly agreed to be earned on a regular basis.

Rental income is usually linked to the lease of land or property.

Resources received is monetary or in-kind contributions or remittances provided to respondents through their social networks.

Self-employment income relates to sole-proprietor microbusinesses in which the owner manages an enterprise and invests money in inputs, stock, and tools; the activity may be formal or informal, and the work may be full-time, part-time, or occasional. Self-employment income does not come from agricultural production, as this would be considered agricultural production income.

ANNEX 3

DEFINITIONS OF FINANCIAL TOOLS IN THE SMALLHOLDER DIARIES

Accumulating Savings and Credit Associations (ASCAs): Relatively more complex informal savings groups (compared to ROSCAs, see below) that allow members to build up savings over time, lend the group fund to one another, and accumulate interest. A share-out typically occurs once a year when members divide the savings and earned interest among the group.

Agricultural middleman credit or agent credit is a loan from an input supplier, usually with the understanding that repayment will be in cash or in-kind after that crop has been harvested. In Pakistan, these middlemen are known as arthis. Farmers sell produce to arthis and obtain fertilizer and pesticides on credit. They can also go to arthis to finance other major expenditures, such as weddings or emergencies.

Borrowing from friends and family includes informal borrowing from their social network.

Borrowing from an informal group includes borrowing from ASCAs and other community-led savings and credit groups.

Business loans are loans in which someone borrows money for a business and is individually liable for repaying the loan. Usually these loans are from banks, cooperatives, credit unions, or microfinance institutions if the borrower does not belong to a group.

Checking accounts are current accounts with a formal commercial bank.

Credit at a store is an arrangement whereby the shopkeeper lets a household member take goods now and pay later. A household member may buy a sack of flour from a shopkeeper on credit, for example, and promise to pay for it on his or her next visit to the shop.

Credit given occurs when the respondent runs any type of small business and lets clients take items on credit and pay later.

Hire purchase is when an individual purchases something from a shop but does not pay the full amount upfront. The good is taken first, usually upon payment of a deposit or an installment, and then the buyer continues paying installments over time until the good is paid off.

Joint liability loan is when someone belongs to a group and the group has an account with a microfinance institution or bank that lends them money. The person may take a portion of that as a personal loan, but all the members of the group are guarantors. If the person stops paying, then all the group members are responsible for covering her debt.

Layaways are financial tools in which a person pays in installments for a good, and acquires it only once all payments are made.

Lending to friends and family is when members of the household or social network provide others with financial services.

Loan from employer is a loan from your employer (not a wage advance). The repayments may be deducted from pay slips over multiple periods or the borrower may have to repay separately.

Money guard is a person who holds money and keeps it safe for someone else.

Moneylender is a private individual who lends money and charges interest. Interest rates tend to be high and repayment times tend to be strict, but people borrow from money-lenders during emergencies or when they prefer to keep the reason for the loan private from friends and family.

Pawning occurs when a person brings something of value (e.g., gold, phones, appliances) to a pawn shop or an individual who then gives her money for the item. If the borrower repays on time, then they can have the item back. If not, they forfeit the item.

Rotating Savings and Credit Associations (ROSCAs) are informal savings groups in which members generally combine their savings together at regular, recurring meetings and take turns giving the entire pot to one member.

Savings in the house typically includes cash stored in a safe, readily accessible place. Note that strategies such as storing gold and raising livestock are not classified as savings at home, but rather household (physical) assets.

Supplier credit refers to informal credit given by a small business owner's regular suppliers. The supplier may allow the business owner to pay off the loan after a week, a month, or even longer, depending on the arrangement.

Wage advance is when an employer pays an employee's wages early. The amount the employee owes is either deducted from their salary, repaid in one lump sum, or over a few paychecks.

ANNEX 4

USE OF FINANCIAL TOOLS FOR SAVINGS AND CREDIT AMONG SMALLHOLDER DIARIES HOUSEHOLDS

The averages calculated in the tables below refer to instruments in use. Mean withdrawals and deposits refer to average transaction size. Latest balance refers to self-reported balances at the end of the study, when available.

TABLE A4-1: Percentage of Households with Financial Tools for Savings[a]

SAVINGS INSTRUMENTS	% HOUSEHOLDS USING	LATEST BALANCE (MEAN)	TRANSACTIONS INSTRUMENTS # PER (MEAN)	WITHDRAWAL (MEAN)	DEPOSIT (MEAN)
Mozambique					
Savings in the house	87	$17.44	9	$12.88	$10.90
Lending to friends and family	41	$10.49	2	$18.23	$33.77
Credit given	18	$1.92	3	$4.64	$3.17
ROSCA	12	$15.89	7	$51.91	$10.37
ASCA	9	$17.38	6	$41.05	$6.18
Checking account	8	$246.99	7	$69.14	$106.91
Using money guard	5	$178.86	2	$34.62	$37.50
Layaway	1	$0	5	N/A	$14.42
Tanzania					
Savings in the house	100	$18.25	101	$3.10	$10.86
Lending to friends and family	48	$10.52	2	$15.84	$15.91
ASCA	53	$5.83	3	$34.47	$1.01
ROSCA	33	$2.14	28	$32.23	$1.09
Credit given	29	$5.20	6	$3.82	$2.81
Using money guard	21	$26.54	3	$54.15	$125.48
Layaway	17	$13.87	3	$50.20	$25.80
Checking account	5	$128.18	28	$164.43	$267.27
Pakistan					
Savings in the house	85	$72.74	9	$82.78	$146.65
Lending to friends and family	61	$45.32	2	$108.62	$135.36
Using money guard	56	$122.68	4	$280.89	$583.83
Credit given	23	$175.95	20	$51.92	$21.15
ASCA	19	$37.55	1	$130.14	$80.60
Checking account	16	$158.00	2	$98.39	$107.83
Layaway	7	$285.28	2	$195.77	$15.06
ROSCA	4	$87.85	7	$126.50	$9.04

a. Certain instruments were uncommon (e.g., some were used by only one household) and in such cases the mean refers to very few observations.

TABLE A4-2: Percentage of Households with Financial Tools for Credit

CREDIT INSTRUMENTS	% HOUSEHOLDS USING	LATEST BALANCE (MEAN)	# TRANSACTIONS INSTRUMENTS PER (MEAN)	BORROWING (MEAN)	DEPOSIT REPAYMENT (MEAN)
Mozambique					
Borrowing from friends and family	59	$3.41	2	$8.62	$10.80
Credit at a store	22	$2.57	2	$3.28	$3.89
Act as money guard	5	$1.33	1	$0.58	$17.60
Borrowing from informal group	5	$6.92	2	$6.49	$27.69
Pawning assets	5	$6.58	1	$1.73	$1.83
Wage advance	2	$0.43	1	$0	$28.85
Business loan	1	$956.60	3	$1,009.68	$26.54
Supplier credit	1	$0	1	N/A	$12.98
Tanzania					
Borrowing from friends and family	77	$4.53	2	$11.56	$11.20
Borrowing from informal group	67	$10.74	6	$15.74	$7.83
Credit at a store	62	$2.00	4	$4.47	$7.31
Agent credit	14	$12.44	1	$41.35	$71.87
Act as money guard	13	$0.09	3	$18.67	$18.58
Supplier credit	8	$7.95	2	$13.78	$5.55
Moneylender	6	$43.42	2	$125.77	$15.51
Hire purchase	3	$0	2	$8.70	$0.00
Business loan	1	$12.92	2	$26.36	$13.18
Tafu airtime credit	1	$0	4	$0.39	$0.39
Pakistan					
Borrowing from friends and family	99	$74.08	2	$80.67	$97.14
Agent credit	97	$106.98	9	$49.43	$199.19
Credit at a store	94	$22.87	14	$5.99	$36.98
Joint liability loan	27	$122.16	2	$252.80	$259.05
Business loan	16	$1,244.98	2	$939.74	$262.38
Hire purchase	14	$90.88	4	$176.53	$56.57
Loan from employer	7	$88.35	3	$64.76	$57.92
Pawning assets	6	$71.71	2	$351.39	$100.40
Moneylender	5	$140.56	1	$200.79	$150.59
Wage advance	5	$97.05	4	$82.83	$50.20
Supplier credit	3	$29.72	6	$26.40	$31.43
Act as money guard	2	$107.93	22	$4.17	$28.79

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NOTES

1. See Cuevas and Anderson (2016) for a discussion of smallholders in poverty statistics and their role in food security and financial inclusion.
2. The several income sources identified by the Smallholder Diaries are defined in Annex 2. Note that households may have multiple types of the same income category (e.g., income from cultivation of four crops, wages from casual labor on two different jobs). Each individual income source is counted and tracked separately.
3. The financial tools (or instruments) identified by the Smallholder Diaries are defined in Annex 3. Note that there may be multiple, distinct uses of each type of financial tool in Smallholder Diaries households (e.g., participation in two savings and credit groups, informal credit at three different stores). Each individual financial tool is counted and tracked separately.
4. ROSCAs are informal savings groups in which members generally combine their savings together at regular, recurring meetings and take turns giving the entire pot to one member. ASCAs are somewhat more complex informal savings groups. They allow members to build up savings over time, lend the group fund to one another, and accumulate interest. A share-out typically occurs once a year when members divide the savings and earned interest among the group.
5. In a layaway purchase agreement, a retailer holds merchandise secured by a deposit until it is paid in full by the customer, usually through a series of payments over time.
6. See Lowder, Skoet, and Singh (2014), Christen and Anderson (2013), Dalberg (2012), and Wyman (2007) for background on the population estimates related to smallholder farmers and households.
7. Data on the number of smallholder households worldwide are fraught with caveats and nuance. See Cuevas and Anderson (2016) for a discussion of smallholders in poverty statistics and their role in food security and financial inclusion.
8. See, for example, Conning and Udry (2007), GIZ (2011), and Udry (1994).
9. Not all smallholder households are located in rural areas. Data collected by CGAP in nationally representative surveys of smallholder households in Mozambique and Uganda found an estimated 15 percent of smallholder families in peri-urban and urban areas.
10. The World Bank Group Global Findex database, the world's most comprehensive database on financial inclusion, provides in-depth data on how individuals save, borrow, make payments, and manage risks. Collected in partnership with the Gallup World Poll and funded by the Bill & Melinda Gates Foundation, Global Findex is based on interviews with about 150,000 adults in over 140 countries. See http://www.worldbank.org/en/programs/globalfindex.
11. The Findex 2014 database does not report findings for an urban/rural split due to inconsistencies in the definitions of urban and rural across countries, although it includes estimates for account penetration in rural populations. The database effectively does have these estimates; Table 1 was generated using those estimates, and extrapolating the urban account penetration using rural population shares from IFAD Poverty Report (2010).
12. CGAP retained the services of Bankable Frontier Associates (BFA) to manage the Smallholder Diaries. For in-country data collection, BFA worked with International Capital Corporation in Mozambique, Digital Divide Data in Tanzania, and RCons in Pakistan.
13. CGAP retained the services of InterMedia to manage the national surveys of smallholder households, and it worked with Ipsos in Mozambique and Uganda for in-country data collection. National surveys and segmentations of the smallholder sector are also underway in Tanzania, Côte d'Ivoire, and Bangladesh, and results and data from all five countries will be published in 2016.

14. Key sources on the diaries methods and findings are Collins et al. (2009) and Kenya Financial Sector Deepening Trust (2014). Other references indicated as appropriate.
15. All data were collected between April 2014 and July 2015, including the initial questionnaires and additional qualitative modules. Data collection on household cash flows started in June 2014 and ended in June 2015. The module on risk was administered in July 2015.
16. All data and questionnaires are available at http://www.cgap.org/topics/financial-innovation-smallholder-families.
17. "In-kind" refers to goods, services, and transactions not involving money (i.e., payments in-kind, barter transactions).
18. The Financial Diaries methodology was developed by David Hulme of the University of Manchester and Stuart Rutherford of *Safe*Save.
19. Smallholders Diaries households were selected purposefully and not randomly, and the samples are not statistically representative of smallholder farmers in these areas or in the three countries. There are additional reasons the Diaries methodology does not use a random sample. The study is able to include only households that are willing to commit to a year-long study and, to minimize attrition issues, are likely to stay in the community. Households initially oversampled to include 286 households and the study ended with 273. Households left the study by leaving the study villages, seasonal migration, and occasionally by the prompting of the research team due to concerns about the household's willingness to be forthcoming about important sources of income. The research firms provided small cash gifts at surprise times throughout the study to thank respondents for their participation. The value of these cash gifts were a very small share of income for most households. The gifts were tracked as income and expenditures enabled by these extra inflows were also tracked.
20. Figures for assets were self-reported.
21. The exchange rates used in this paper, calculated as the average exchange rate during the period of the study, are as follows unless otherwise indicated: Mozambique Metical to the U.S. Dollar: 34.66; Tanzania Shilling to the U.S. Dollar: 1934.72; Pakistan Rupee to the U.S. Dollar: 99.60.
22. In the terminology of the Smallholder Diaries, wage labor generates salaried income that has been at least tacitly agreed to be earned on a regular basis. This is distinct from casual labor, which is irregular income from short-term employment, such as work on construction sites or helping with the harvest on other people's farms.
23. The several income sources identified by the Smallholder Diaries are defined in Annex 2. Note that there may be multiple, distinct income streams from each type of income source in Smallholder Diaries households (e.g., income from cultivation of four crops, wages from casual labor on two different jobs). Each individual income source is counted and tracked separately.
24. Some income sources even go negative in a given month, since the Diaries charted net income from the source. In agriculture production and self-employment, some expenses may be incurred before revenue, resulting in negative net income for a given month. While agricultural revenues in Pakistan can be high, agricultural income is calculated by subtracting farming expenses, which can be substantial, from gross revenue.
25. This includes any crops consumed, traded, or given away for any reason.
26. In the Smallholder Diaries a distinction was made between self-generated agricultural production income and income from casual labor related to agriculture (e.g., working on a neighbor's farm). Someone providing casual labor is not the main decision-maker or investor in those crops or livestock and their work starts and stops at the will of someone outside the household.
27. For a detailed exploration of value chain finance, see AgriFin 2015 (forthcoming) and Miller and Jones (2010).
28. Commercial smallholders in tight value chains have the capacity to generate reliable, high-quality outputs that are sold on a contract basis through relatively highly organized value chains. See Christen and Anderson (2013).
29. The village in the Tanzania sample focused on potato production had the same pattern, with expenses dipping to their lowest during hardship months.
30. Covariant risk arises when many households in one area are adversely affected by a single phenomenon such as a natural disaster, epidemic, unexpected change in world prices, macroeconomic crisis, or civil conflict. Individual risks, in contrast, randomly affect individual households.
31. Most Tanzanian respondents evaluated the cost of crops destroyed in the field as zero, since they were unable to put a monetary value on the loss.
32. Strategies to manage risk are fairly well documented. See for example, Skees, Hazell, and Miranda (1999) on crop insurance; Miranda and Farrin (2012) on index-based insurance in low-income countries; Mahul and Skees (2012) on index-based livestock insurance; and Hazell, Pomareda, and Valdés (1986).

33. An interesting experience evolving in Kenya is the e-warehouse system that records onsite storage and allows its use as collateral against short-term loans (See http://www.grameenfoundation.org/what-we-do/financial-services/agricultural-finance),.
34. The other question posited by Walker and Jodha refers to the effect of risk-management methods on static and dynamic social efficiency, which (if detrimental), would justify public policy for the sake of social welfare.
35. See for example Armendariz and Morduch (2010).
36. See Miranda (2009) and Collier and Skees (2014).
37. Note that each tool is distinguished by both its financial function and its source. For example, each account at a financial institution is a separate device. Each ROSCA is a different device and if it has separate functions—such as merry-go-round, accumulation, lending, and welfare—then each of those functions would be registered separately. Each source of informal borrowing, including each individual moneylender and each individual lender among friends and family, is also tracked separately. See Annex 3 for definitions of the various types of financial tools observed in the Smallholder Diaries.
38. Note that there may be multiple, distinct uses of each type of financial tool in Smallholder Diaries households (e.g., participation in two savings and credit groups, informal credit at three different stores). Each individual financial tool is counted and tracked separately.
39. When considering a household's financial portfolio, both informal and formal financial tools, as well as physical assets, including crops and livestock, mobile phones and radios bought and sold with a clear intention of financial management, are important. Also see Kenya Financial Sector Deepening Trust (2014).
40. For additional detail and examples of smallholder households and digital finance, see also Mattern and Tarazi (2015) and Grossman and Tarazi (2014).
41. See, for example, the Purdue Improved Crop Storage triple-layer storage bag (http://www.entm.purdue.edu/PICS3/index.php) and the POSTCOSECHA metal silo developed by the International Maize and Wheat Improvement Center (http://www.cimmyt.org/en/projects/effective-grain-storage-project/about-the-project).
42. See Cuevas and Anderson (2016) for a discussion of variables associated with rural poverty and smallholder well-being.

Consultative Group to Assist the Poor
1818 H Street, N.W., MSN IS7-700
Washington, DC 20433 USA
Phone: +1 202 473 9594
cgap@worldbank.org