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Executive Summary

Not all shocks are equally damaging and not all vulnerability reducing instruments are equally effective. Rural households in Sub Saharan Africa live in risky environments and very often they cannot protect their income or consumption from shocks. This inability to cope with shocks may permanently damage their earnings prospects and jeopardize their children's future following disinvestment in their human capital. These insights are increasingly appreciated and reflected in the design of poverty reduction strategies. But, shocks take on many forms. They can be climatic (drought, heavy rainfall), biological (illness, death), institutional (appropriation of land, theft or destruction of property) and economic (unemployment, staple or cash crop price shocks). Their relative importance in affecting household welfare across different settings remains poorly documented and the relative effectiveness of different interventions to mitigate household vulnerability is largely unknown.

During the late 1990s and early 2000s attention focused on collapsing commodity prices and new market based insurance instruments emerged to help households cope with shocks. The precipitous decline in many cash crop prices (including coffee) was making headlines, prompting renewed calls for direct market interventions to support small holder cash crop growers. Direct price support interventions, such as buffer stock policies, or international commodity agreements, often failed in the past. The commodity price shocks were inadvertently also diverting attention from potentially more damaging shocks for smallholders such as climatic and health shocks. At the same time, markets witnessed a proliferation of financial instruments to manage risks, such as futures, options, swaps, etc. This development did not only open new avenues to help farmers hedge against unforeseen price declines, but also against weather related shocks. The use of market based insurance schemes such as coffee price insurance and weather based insurance is increasingly being piloted in developing countries.

A holistic perspective on household vulnerability in the United Republic of Tanzania and an assessment of the potential for market based insurance instruments are called for. This report has two objectives. It assesses the nature and the extent of vulnerability among rural households in Tanzania with a particular focus on smallholder cash crop growers though exploring all risks, including the decline in commodity prices. It further explores the potential role for market based insurance schemes such as commodity price and weather based insurance to mitigate household vulnerability. Two rounds of specifically designed surveys of 900 households were conducted in 2003 and 2004 in two cash crop growing region in Tanzania. The inclusion of both a richer (Kilimanjaro) and a poorer (Ruvuma) Region and their contrasting experiences substantially enriches the policy guidance emerging from the report. The report applies descriptive, econometric and contingent valuation techniques to achieve its objectives.

The risk chain provides the organizing framework. According to the risk chain, households live in risky environments which affect their endowments as well as the returns to their endowments. In order to avoid income and welfare losses in case of shocks, households smooth their incomes *ex ante* (before the shock occurs) by reducing their exposure to these events (e.g. through irrigation, use of drought resistant seeds, diversification, use of treated bed nets) or they smooth their consumption *ex post*, after the shock has occurred, e.g. through self or mutual insurance, migration, public safety nets, etc. Vulnerability is defined as the likelihood of being poor in the future. The degree of vulnerability depends on the nature of

the risk environment, the household's exposure to this risk and its capacity to cope with it *ex post*.

While there are significant differences in asset endowments across different categories of producers within each region, these differences are much smaller than the corresponding ones across regions (especially when considering community factors). Consumption per capita was 20 percent higher in Kilimanjaro than in Ruvuma in 2003, which is no surprise given the higher incomes and asset endowments of that region. Food shares are also slightly higher in Ruvuma, as expected among a poorer population. The starkest difference in consumer goods among the two regions is seen in the value of household dwellings, which is over 6 times greater in Kilimanjaro than in Ruvuma, likely a function of higher land prices and better housing quality. Indeed, land ownership is significantly higher in Ruvuma and land scarcity appears to be a key factor that drives livelihood strategies and farm planning in Kilimanjaro. Farmers in Kilimanjaro are more engaged in off-farm employment. They also use higher levels of cash inputs for agriculture, though overall inputs to agricultural production are very low in both regions.

Poor farmers possess less productive assets (including land) and are more specialized, especially in their sources of cash income. They have less physical capital, live in more remote villages with less public services and have less social capital. They tend to obtain a larger share of their cash income from non-farm enterprise in Ruvuma, and from wages in Kilimanjaro. Not only do they have substantially less cash income, they also have fewer sources of cash income than their richer neighbours.

About two thirds of all rural households reported to have experienced at least one major shock to their livelihoods during the 1999-2003 period and those who incurred a shock were on average hit 2.1 times. Clearly, rural Tanzanian households live in risky environments and shock incidence is even more pronounced in Kilimanjaro than in Ruvuma. The difference in shock incidence between poor and non-poor households is not statistically significant in either region.

Health related shocks (death and illness) emerge as the predominant risk, closely followed by drought shocks, though the latter only in Kilimanjaro. Other shocks are much less frequent. On average, respondents in Kilimanjaro reported that rainfall had been very low in 2.5 of the past 10 years, whereas in Ruvuma the average number of very low rainfall years was only 0.65 out of 10. Malaria is the most frequently reported cause of ill health and death. This is followed by respiratory and intestinal infections. Tuberculosis, an opportunistic infection common among AIDS patients, is also among the top five causes. Nonetheless, these results should not be taken to mean that commodity prices did not negatively affect welfare, but rather that other health and weather related shocks are equally critical in determining people's vulnerability. Prices have memory and commodity price declines may thus not come as a surprise and may not have been reported as a shock.

Descriptive analysis suggests that households largely cope with shocks through self (particularly cash savings) and mutual (family and friends) insurance with very with little help from official sources. Almost three quarters of all rural households who experienced a shock during the five years before the survey, used savings to cope with it, with the vast majority drawing down their cash. Only about a quarter of those using savings, sold livestock. Households also strongly relied on assistance from others, mostly family members, and to a much lesser extent, their fellow villagers/friends and neighbours. The proportion of shock-affected households receiving assistance from either public or private institutions is very low. In both regions about 30 percent of shock-affected households tried to generate

additional income when facing a shock. About a quarter of households reduced non-food expenditures and a quarter changed their dietary pattern to cheaper foods. Both ratios were slightly higher in Ruvuma, where households are on average also poorer. Migration and borrowing were much less frequently observed responses to shocks. Overall, the large majority of households manages to cope well with shocks, largely through traditional methods (self and mutual insurance), but a non-negligible proportion also has to revert to more strenuous coping strategies. Formal risk management instruments are virtually unavailable.

The response to cash crop price declines has differed markedly across regions, with smaller producers in Kilimanjaro uprooting coffee trees and producers in Ruvuma planting new trees, suggesting limited viable alternatives to current cash crop production in Ruvuma. In Kilimanjaro producers have been moving out of coffee for more than a decade, and are now actively uprooting their crops, often switching to bananas for Dar-es-Salaam, while Ruvuma farmers continue to invest in both coffee and cashew despite the long-term negative trend of coffee prices and the particularly low prices of both crops in early 2000. Kilimanjaro farm households spend more time in off-farm activities than those in Ruvuma.

Considerable vulnerability exists in rural Tanzania, more so among poorer farm households. The probability that a household's consumption falls below the poverty line in a subsequent period, our definition of vulnerability, was empirically estimated. Households in Kilimanjaro were found to be substantially less vulnerable than households in Ruvuma. Covariate risk (following from aggregate weather and price fluctuations) are significant in both regions, but contribute more to vulnerability in Ruvuma than in Kilimanjaro. The importance of covariate risks underscores the limitations of mutual insurance to help households cope with shocks.

The immediate welfare losses associated with health and rainfall shocks can be substantial. About one third of the rural population in Kilimanjaro suffered either from a drought or health shock in the survey year of 2003 and those households were estimated to suffer on average an 18 percent (gross) loss in their 2003 consumption. Through reliance on savings and aid from others they were able to partly smooth their consumption and reduce the immediate (net) negative welfare effect of these shocks to 8 percent on average. No immediate (negative) welfare losses were found from drought and health shocks in Ruvuma. The former result is related to the low incidence of drought shocks in Ruvuma in 2003, consistent with the generally more secure rainfall patterns. More importantly, these estimated immediate welfare losses are likely only lower bounds of the welfare losses associated with shocks. They do not account for the long-run damage caused by shocks, the opportunity costs from engagement in low risk, low return activities in an attempt to avoid shocks altogether, and the consequences of households' potential disinvestment in children's human capital in response to a shock.

Welfare losses from health shocks are mainly related to illness shocks, likely resulting from increased medical expenditures and not from reduced income from labour. In depth investigation suggests that the estimated absence of an immediate welfare loss in Ruvuma from health shocks is related to the limited use of medical services which is in turn linked to the lower access to health facilities. The potential income loss from reduced labour supply or reduced return to labour following illness or death appears sufficiently small to not change this picture for Ruvuma. The estimated welfare loss from illness is also largely associated with increased medical expenses in Kilimanjaro and not due to reduced labour income. These results do not not necessarily imply that households in Ruvuma suffer less from illness shocks, but rather that they spend less to deal with them. Finally, while the direct reported

expenses related to death shocks are on par with those related to illness shocks, death shocks have much smaller immediate welfare effects. This is consistent with the well documented existence of effective group-based funeral insurance schemes.

The evidence suggests that most coffee growers (except the smaller ones) have managed to weather the effects of the coffee price decline, at least to the point of not falling below the welfare levels of the non-cash crop growers. Ceteris paribus, coffee growers in Kilimanjaro and Ruvuma appear no worse off than non-coffee growers, apart from the smallest in Kilimanjaro whose consumption level was 20 percent lower. The largest coffee growers in Ruvuma are actually better off. Most coffee growers largely managed to weather the effects of the coffee price decline at the expense of a depletion of their (cash) savings. The drop in coffee prices since the late 1990s came on the heels of an income windfall from coffee. In addition, many coffee growers in Kilimanjaro, who have access to the market in Dar-es-Salaam, have also been able to switch to bananas as an alternative cash crop. Indeed, even in 2003 coffee growers in Ruvuma (as well as the richer coffee growers in Kilimanjaro) tend to be more inclined to use their own savings in case of health or drought shocks compared with non-cash crop growers. Cashew crop growers on the other hand, especially the smaller ones, appear worse off than non-cash crop growers in Ruvuma.

Own savings are mostly used to cope with covariant shocks such as droughts, but also in case of idiosyncratic shocks such as illness. Aid from others is especially forthcoming in case of death. There are little formal insurance or assistance schemes available to help households smooth their consumption. Own savings are the more important recourse in case of drought shocks, though they are also relied upon to deal with health shocks, especially illness shocks. Aid from others is frequently received in case of death shocks, and to a lesser extent in case of illness, though not in case of a drought shock. Somewhat surprisingly, physical asset ownership and educational attainment appear to be poor predictors of the use of savings, pointing to the importance of cash savings in rural Tanzania. Female headed households tend to rely more on aid and less on their own savings.

Public health interventions, better connectivity, increased access to off-farm employment and better water management techniques emerge as important household vulnerability reducing interventions. Effective health interventions include continued efforts to combat the HIV/AIDS epidemic and prevent malaria infections. The higher death toll from the HIV/AIDS epidemic jeopardizes the capacity of traditional funeral societies to effectively deal with death shocks. The importance of connectivity in raising overall income levels and thus also households' ability to cope with shocks, cannot be sufficiently underscored. Consumption levels were found to be ceteris paribus 15 to 30 percent higher in villages with a tarmac road compared with those without a tarmac road. Access to non-agricultural employment also helps raising overall welfare levels and reduces exposure to drought shocks. Finally, the ability to control water levels for example through irrigation emerges as an important general instrument to help enhance household consumption even though it has lost its effectiveness as an insurance instrument in Kilimanjaro given its reliance on gravitation irrigation. The need for better water management capacity is confirmed in the strong stated demand for weather based insurance.

The demand for cash crop price insurance is substantial. Households do not only face unexpected cyclical and downward trending commodity prices, but they also face a wide price range within the same year and area, even when these prices are low. Households are on average willing to pay between 13 and 30 percent of the option value they will receive as premium for coffee price insurance. This compares favourably with the actual costs of such

option contracts in the New York stock exchange, where 3-month put options trade for about 5-10 percent of the strike price, and slightly more for 6-month put options. Setting the premium at the average willingness to pay (WTP), about 25 000 to 30 000 households in Kilimanjaro (or about one quarter of all coffee growing households) would buy coffee price insurance insuring a total of 1 200-1 700 tonnes or 20-30 percent of the total coffee production in Kilimanjaro. Were the premium to equal average WTP in Ruvuma, about one third of all coffee growing households (i.e. about 20 000 households) would buy the insurance, insuring about 7 000 tonnes of coffee or about 45 percent of Ruvuma's total production. Similarly, about one third of the cashew growers would buy cashew price insurance insuring about 4000 tonnes or about 45 percent of Ruvuma's total cashew nut production. Were the coffee and cashew price contracts offered at a premium equal to households' average willingness to pay, the societal benefit (consumer surplus) could be up to Tsh 700 million or about US$700 000. Clearly, the cost of uninsured consumption is large and the societal benefits from insurance substantial.

In addition there is considerable demand for weather based insurance. Given that agricultural income constitutes on average 57 and 71 percent of total income in Kilimanjaro and Ruvuma respectively, a more comprehensive measure of the cost of uninsured residual consumption risk is provided by our estimates of the WTP and consumer surplus related to weather based insurance. Households were more interested in Kilimanjaro and in contracts which provided wider coverage (i.e. covering both more frequent and less severe as well as infrequent but severe droughts). While the average WTP for the 10 percent below normal rainfall contracts was between 12 and 23 percent of the payout in Kilimanjaro, it was only between 10 and 14 percent for contracts which pay out when the rain drops 30 percent below normal. A similar phenomenon was observed in Ruvuma. Were the premium set at the average WTP, about one quarter of all households in Kilimanjaro would insure about 60,000-77,000 acres (about 18-24 percent of total land cultivated) resulting in a consumer surplus or benefit to society of about Tsh 1 billion or US$ 1 million. This is substantial and underscores the welfare loss associated with uninsured risks.

Yet, liquidity constraints substantially reduce the demand for insurance and subsidies may be necessary for weather based insurance to be viable for more vulnerable households. In Kilimanjaro the average WTP constitutes about only 30-55 percent of the actuarially fair value of the contract, depending on the contract. In Ruvuma the average WTP is only 5-18 percent of the actuarially fair premium. About half of all households in Kilimanjaro and about one third of all households in Ruvuma indicated an interest in weather based insurance. Liquidity constraints were mentioned as the main reason for not being interested in such a scheme. The demand for rainfall insurance is further linked with households' actual coping mechanisms. Those that use own savings in case of shocks are more interested and more willing to pay, compared with those that use other safety mechanisms, especially family based ones. This may be related both to differential liquidity constraints and different costs related to these coping strategies. Whether the societal benefits from insurance provision are sufficiently large to justify subsidization deserves further investigation. In doing so, explicit attention must be paid to the long-term welfare loss, the gains from portfolio adjustment as well as the long term gains from increased investment in the human capital of the next generation.

In sum, the report identifies drought, health and commodity price shocks as the key risks faced by rural households in Kilimanjaro and Ruvuma. The welfare loss associated with these shocks are substantial. Households extensively use self and mutual insurance to cope

with these shocks, but nonetheless, there remains substantial uninsured risks as indicated by the considerable stated demand for coffee and weather based insurance which could have important societal benefits. The "latent" demand for insurance further suggests that current ways of coping may not be efficient and that there may be important economic opportunities which insurance could open up. Liquidity constraints emerge as important impediments in adopting such market based insurance schemes. Great care will need to go into the design and institutional delivery mechanisms of market based insurance. The establishment of interlinked markets such as input, credit and insurance packages deserves special attention in this regard. Finally, other, more traditional, public interventions such as providing public health services, fostering connectivity and access to off-farm employment, and better water management techniques were also identified as promising household vulnerability reducing interventions.

1 Introduction

While it is increasingly recognized that household vulnerability mitigating interventions must be an integral part of any poverty reduction strategy (World Bank, 2001), the links between risks, shocks and poverty are multifold, their quantitative effects and relative importance poorly documented, and the relative effectiveness of different interventions to mitigate household vulnerability largely unknown. This appreciation of both the importance and inadequate understanding of the links between vulnerability and poverty instigated the Government of Tanzania (GoT) to call for a series of studies to help inform its National Strategy for Growth and Reduction of Poverty (MKUKUTA).

A comprehensive qualitative assessment of households' risk environment, their coping strategies, and the resulting household vulnerability was first undertaken under the 2002/2003 Participatory Poverty Assessment (PPA). It concluded that vulnerability is the result of the interplay between the number and intensity of the impoverishing forces households face and the number and effectiveness of their response options. It identified environmental and macroeconomic conditions, governance, ill health, lifecycle conditions, and cultural beliefs and practices as important impoverishing forces (i.e. forces pushing people down the ladder of well-being). To manage these impoverishing forces the PPA finds that households make use of assets (including human, social, political, natural, physical and financial assets). Thus poverty itself limits people's capacity to improve and safeguard their well-being. In addition, it is seen that people's capacity to manage impoverishing forces diminishes as they struggle to survive successive waves of shocks and stresses. The PPA further emphasizes that there are some disadvantaged social groups in the country that due to their low access to assets are particularly vulnerable. These include children, persons with disabilities, unemployed youths, elderly persons, persons with chronic illnesses, widowed women, drug addicts and alcoholics (United Republic of Tanzania, 2004).

This study supplements this analysis through a quantitative and in-depth assessment with a particular emphasis on cash crop growing households. The late 1990s and early 2000s have been characterized by a precipitous decline in many cash crop prices such as coffee and cashew nuts grabbing headlines and renewing calls for direct market interventions to support small holder cash crop growers. However, direct price support interventions, often backed by buffer stock policies, or through international commodity agreements, often failed in the past (Gilbert, 1996). Following globalization markets also witnessed a proliferation of financial instruments to manage risks, such as futures, options, swaps, etc. This development opened new avenues to help farmers hedge against unforeseen price declines. The use of market based insurance schemes such as coffee price insurance and weather based insurance is increasingly being piloted in developing countries. The ongoing World Bank pilot project to assist the Kilimanjaro Native Cooperative Union in using internationally traded options to obtain coffee price insurance provided an ideal opportunity to gauge the actual demand among cash crop growing smallholders for such market based insurance schemes (and thus the cost from uninsured residual risk), which is usually completely unknown. Nonetheless, as illustrated by the findings from the PPA, cash crop growers are not only exposed to commodity price declines, but as other households, they face many risks and a holistic perspective on household vulnerability is called for.

In particular, the objectives of the study are to 1) quantitatively assess the nature and the extent of vulnerability among rural households in Tanzania with a particular focus on smallholder cash crop growers; and 2) explore the relative effectiveness of different strategies

to mitigate household vulnerability with a particular emphasis on the potential role for market based insurance schemes such as commodity price and weather based insurance.

To do so, two rounds of household and village surveys were conducted in 2003 and 2004 in two different cash crop growing regions in Tanzania, Kilimanjaro and Ruvuma, covering about 900 households in each region. The surveys were designed to be representative of rural farm households, and among them of cash crop (coffee in Kilimanjaro, coffee, tobacco and cashew nuts in Ruvuma) as well as non-cash crop producing households. Large-scale public and private coffee estates are not included. The questionnaire was designed to investigate the complete socio-economic characteristics of households with a particular emphasis on their vulnerability to a variety of risks. Special modules were developed to gauge households' demand, i.e. their willingness to pay, for both coffee price and weather based insurance. A community-level questionnaire was administered concurrently to village focus groups.

The study uses the risk chain as conceptual framework (Heitzman *et al*, 2002) and applies descriptive, econometric and contingent valuation techniques to shed light on the immediate effects of shocks on household welfare and the demand and welfare benefit from different interventions. According to the risk chain, households live in risky environments which affect their endowments as well as the returns to their endowments. In order to avoid income and welfare losses in case of shocks, households smooth their incomes *ex ante* (before the shock occurred) by reducing their exposure to these events (e.g. through irrigation, use of drought resistant seeds, diversification, use of treated bed nets) or they smooth their consumption *ex post*, after the shock occurred, e.g. through self or mutual insurance, depletion of assets or divestments, migration, public safety nets, etc. Vulnerability is then defined either as the likelihood of experiencing future loss of welfare, generally weighted by the magnitude of expected welfare loss (Ligon and Schechter, 2003) or, as the likelihood of being poor in the future (Christiaensen, 2000; Chaudhuri, 2002). Vulnerability can thus be seen either as low expected welfare/utility or expected poverty, respectively. The degree of vulnerability depends on the nature of the risk environment, the household's exposure to this risk and its capacity to cope with it *ex post*.

Two further caveats are in place. First, while distinct, the concepts of poverty and vulnerability are also closely related as those who are poor today are also more likely to be poor tomorrow. Second, in the absence of effective *ex post* coping mechanisms, households usually attempt to smooth their income *ex ante* thereby trapping themselves often in low risk, but also low return activities. Uninsured risks may for example hamper the adoption of more risky, but more remunerative technologies and (crop) portfolio strategies. For example, households with limited options for smoothing grow lower return, but safer crops (sweet potatoes, sorghum and millet) than the richer households which usually have more options for consumption smoothing. The cost of such diversification strategy can be high and the farmer can forgo up to 20 percent of their expected income in exchange for greater stability (Dercon, 1996). Similarly, risks may motivate farmers to apply less productive technologies (Rosenzweig and Binswanger, 1993; Kurosaki and Fafchamps, 2002; Dercon and Christiaensen, 2007).

The report proceeds as follows. Chapter 2 describes how households in rural Tanzania combine their assets into different income generating activities and livelihoods. Understanding people's livelihood structure is important, as it determines the risks people are exposed to and their capacity to cope with them *ex post*, and thus their overall vulnerability.

Households in the study regions were classified as cash crop[1] and non-cash crop producers. Given the different production processes and marketing arrangements governing the different cash crops in our study, we further classified the cash crop growers according to the type of cash crops grown, i.e. coffee, cashew or tobacco.[2] The descriptive analysis of people's livelihoods and welfare is followed by a description of their risk environment and coping strategies in Chapter 3. Chapter 4 then shows how assets, risks and coping combine into determining household vulnerability as captured by a series of comprehensive vulnerability measures. These measures are subsequently used to explore the relative role of the different determinants of household vulnerability. The report proceeds by estimating the immediate welfare loss associated with shocks, i.e. the (private and societal) benefits from insurance (Chapter 5). Chapter 6 estimates the stated preferences or willingness to pay for commodity price and weather based insurance, implicit measures of the costs of uninsured consumption risk. Derivation of the resulting demand curves for insurance further allows us to estimate the societal benefit from insurance provision at different premiums.

[1] While some traditional food crops such as maize and bananas are also sold for cash, the term "cash crops" is used here to refer to traditional export crops such as coffee, tobacco, cashew nuts.
[2] The large majority of smallholder farmers was only engaged in one cash crop.

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2 Assets, Livelihoods and Poverty

by Vivian Hoffmann, Panayotis Karfakis and Luc Christiaensen

2.1 Introduction

In this chapter, we characterize the endowments, livelihood strategies, and welfare outcomes of rural households in Kilimanjaro and Ruvuma Regions, with attention to the differences between cash crop growers and those who exclusively cultivate food crops, as well as between the poor and non-poor. Through this descriptive analysis we seek to generate hypotheses about the determinants of poverty and vulnerability across livelihoods, which we will further explore in subsequent chapters. The conceptual framework combines the standard model of the farm household (Singh, Squire, and Strauss, 1986), with livelihoods analysis (Ellis, 2000).

We consider the household as the primary decision-making unit, and evaluate welfare at the household level.[1] Households are endowed with a set of assets, which have been either inherited or accumulated since the household's establishment. Assets are defined broadly to include the physical capital (land, livestock, agricultural tools), social capital (relationships to people and to institutions), and human capital (labour and education) held by the household, as well as the services and institutional environment of the community in which the household is situated.[2] While some of these assets are under the direct control of the household, others are at least partially outside its control, and may be thought of as the environment within which the household exists. Needless to say, a lack of assets undermines not only current but also future efforts to achieve prosperity and resilience against adverse shocks.

Through its production decisions and participation in markets, the household makes use of the assets at its disposal to maximize its welfare. When markets are imperfect (transaction costs are high) or incomplete (not all goods are tradable, credit and insurance markets, for example may not exist), welfare maximization is not separable from the maximization of income. Households' production decisions or livelihood strategies may for instance be conditioned on the need for stable income flows, lack of credit to purchase inputs, and lack of access to markets for its produce.

Thus, assets and markets determine livelihood options; livelihood choices determine expected income and income volatility; and these (variable) income flows determine welfare outcomes. This chapter follows progression. After describing the geographical distribution and demographic characteristics of households, we detail the productive asset base, broadly defined. We then consider the allocation of inputs to, and income streams generated by, various livelihood strategies. This is followed by a discussion of the welfare, poverty, and inequality outcomes.

Throughout the chapter variables are summarized by households' status as cash crop growers at the time of the first survey round, as well as their poverty status at that time. Coffee and

[1] We abstract from intra-household allocation of resources which may further affect the welfare of individual members. Our survey methodology was not designed to address these issues in depth.

[2] This context can be extended to the regional, state, or global level, to include such factors as the macroeconomic and political environment. In the present analysis, however, we limit our attention to the local community (village) and regional levels.

cashew nut producers are respectively defined as farmers who own any coffee or cashew trees, although deliberate non-production decisions or aged trees may result in insignificant or zero produced quantities. Since tobacco is an annual crop, tobacco producers are defined as farmers that report some positive production during the year preceding the first survey round.

2.2 Geographical distribution

The diversity of agro-ecological conditions within both Kilimanjaro and Ruvuma imply that particular crops are concentrated within certain districts of each region. Coffee is the primary cash crop grown in Kilimanjaro. While coffee production is somewhat geographically concentrated within the region, all districts contain a significant number of coffee growing households (see Table 2.1). Within Kilimanjaro, Rombo is the district with the largest proportion of coffee growers (83.4 percent). While Rombo has a relatively high poverty rate at 56.2 percent, the other two major coffee growing districts in Kilimanjaro, Hai and Moshi Rural, have the lowest poverty, at 24.5 and 32.2 percent respectively, compared with the regional rate of 39 percent.

Table 2.1: Kilimanjaro geographic distribution of coffee growers and the poor

		Rombo	Mwanga	Same	Moshi Rural	Hai	Kilimanjaro
Households	Units	40,572	12,737	21,063	77,595	39,555	191,522
Proportion	%	21.2	6.7	11.0	40.5	20.7	100.0
Coffee growers	%	83.4	22.7	22.0	54.5	79.4	60.1
Poor	%	56.2	42.9	60.6	32.2	24.5	39.5

Growers of coffee, as well as cashew, are much more highly concentrated within certain districts of Ruvuma (Table 2.2). All coffee grown in Ruvuma is found in Mbinga, where 73.7 percent of households own trees. While still poorer than Kilimanjaro, this is the district with the lowest rate of poverty in Ruvuma, at 55.6 percent. Tunduru, the cashew growing district, is the poorest, with a poverty rate of 77.1 percent. Over 90 percent of households in this district grow cashew, while cashew growers represent fewer than 7 percent of households in the rest of Ruvuma. Tobacco is both less geographically concentrated and less common overall, with the highest concentration in Namtumbo district at only 20.9 percent of households. Geographical dispersion of cash crop production in Ruvuma is also related with ethnicity (Matengo in the coffee producing district of Mbinga, Yao grow cashew nuts in Tunduru while the Ngoni tribe is occupied with Tobacco production).

Table 2.2: Ruvuma geographic distribution of cash crop growers and the poor

		Songea Rural	Tunduru	Mbinga	Namtumbo	Ruvuma
Households	units	29,814	42,666	77,555	23,886	17,3921
Proportion	%	17.1	24.5	44.6	13.7	100.0
Coffee	%	0.0	0.0	73.7	0.0	32.9
Cashew	%	0.9	92.1	3.7	6.1	25.3
Tobacco	%	6.3	0.0	0.3	20.9	4.1
Poor	%	58.3	77.1	55.6	70.2	63.3

2.3 Demographics and asset base

The differences in demographic characteristics between the two regions are immediately apparent in Tables 2.3 and 2.4. Household heads in Ruvuma, at an average age of 43, are significantly younger than those in Kilimanjaro (the corresponding average is 53 years). This gap may be partially explained by outmigration from Kilimanjaro, where 26 percent of households receive remittances, compared with only 13 percent in Ruvuma. At the same time, the population of Ruvuma overall is younger than that of Kilimanjaro: the average age in Kilimanjaro is 26 years whereas the average age in Ruvuma is 21. Female headship is almost twice as common in Kilimanjaro as in Ruvuma, characterizing 12.5 percent of all households. Female-headed households are less likely to be involved in cash crop production, and households in Kilimanjaro with younger heads less likely to cultivate coffee. The education level of heads is similar across regions and cash crop categories at around six years, but the poor in Ruvuma have on average one year less education than the non-poor. The poor in both regions tend to live in larger households, with a higher proportion of dependents. In Kilimanjaro, the poorer households tend to have younger heads, whereas the opposite holds in Ruvuma.

Table 2.3: Kilimanjaro household demographic and human capital characteristics

		All	Coffee	Non-coffee	Non poor	Poor
Number of households	Units	191,522	117,266	74,256	115,903	75,682
Proportion of total	%	100.0	61.2	38.8	60.5	39.5
Household size**	Units	5.3	5.4	5.2	4.6	6.5***
Female headed***	%	12.5	9.4	17.4***	13.2	11.4
Dependency ratio***	%	50.9	50.6	51.4	48.2	55.1***
Age of head***	years	53.5	55.7	50.1***	54.9	51.3***
Education of head	years	6.0	5.9	6.1	6.1	5.8*

***, ** and * indicate statistical significance of the difference in means at the 1%, 5% and 10% level respectively. Significance of difference between regional means is noted next to the name of the variable (left-most column). Means of each producer group (coffee for Kilimanjaro; coffee, cashew, and non-cash for Ruvuma) and the poor are tested against the rest of the sample within the region.

Table 2.4: Ruvuma household demographic and human capital characteristics

		All	Coffee	Cashew	Tobacco	Non-Cash	Non-Poor	Poor
Number of households	Units	173,921	57,195	44,060	7,091	66,849	63,801	110,131
Proportion of total	%	100.0	32.9	25.3	4.0	38.4	36.7	63.3
Household size	Units	5.2	5.3	5.1	5.5	5.2	4.5	5.6***
Female headed	%	7.7	4.8*	4.3**	0.0	13.2***	9.9	6.5
Dependency ratio	%	47.7	48.0	45.0**	46.9	49.4*	42.3	50.8***
Age of head	years	43.4	42.2	43.2	45.7	44.5	41.9	43.9***
Education of head	years	6.0	6.3**	5.6**	5.8	6.0	6.6	5.6***

***, ** and * indicate statistical significance of the difference in means at the 1%, 5% and 10% level respectively. Significance of difference between regional means is noted next to the name of the variable (left-most column). Means of each producer group and the poor are tested against the rest of the sample within the region.

Turning to the physical asset base, the difference between regions is striking (Tables 2.5 and 2.6). The total value of productive assets, which includes the value of land and livestock, agricultural production tools, and non-agricultural enterprise assets, is more than twice as high in Kilimanjaro as in Ruvuma. This difference is mainly due to the higher value of land in Kilimanjaro and the larger livestock holdings, particularly of cattle. The average land holding in Ruvuma actually triples that of Kilimanjaro, but either lower land quality or lower

population density mean that the cost of land is much lower in Ruvuma. Land pressure in Kilimanjaro may be one reason behind the apparent higher rates of migration out of rural Kilimanjaro. Note however furthermore that the total productive asset value among coffee growers in Ruvuma is only slightly lower than among coffee and non-coffee growers in Kilimanjaro.

Table 2.5: Kilimanjaro household productive physical assets

		All	Coffee	Non-coffee	Non-poor	Poor
Total productive asset value[1] ***	Tsh000	969.4	961.8	981.3	1210.4	600.4***
Land owned last year ***	acres	2.66	2.66	2.67	2.82	2.42***
Land owned value[2] ***	Tsh000	517.8	566.5	440.5	633.1	341.7***
Agricultural capital **	Tsh000	150.7	122.0	196.0	233.2	24.3***
Non-agricultural capital **	Tsh000	60.2	59.5	61.4	71.5	43.0
Head of cattle, oxen, horses ***	units	1.90	1.56	2.44**	2.24	1.39**
Head of goats, sheep, pigs *	units	3.91	3.19	5.05***	4.34	3.27**
Livestock value ***	Tsh000	241.5	213.8	285.3**	274.3	191.3***
Coffee trees ***	units	263.9	431.1	0.0***	322.7	174.0***
Banana trees ***	units	315.9	440.0	119.8***	388.1	205.4***
Fruit, timber and other trees ***	units	26.6	32.4	17.5	27.5	25.2
Herfindahl index of productive assets	index	0.635	0.592	0.705***	0.631	0.641***

***, ** and * indicate statistical significance of the difference in means at the 1%, 5% and 10% level respectively. Significance of difference between regional means is noted next to the name of the variable (left-most column). Means of each producer group (coffee for Kilimanjaro; coffee, cashew, and non-cash for Ruvuma) and the poor are tested against the rest of the sample within the region.

Table 2.6: Ruvuma household productive physical assets

		All	Coffee	Cashew	Tobacco	Non Cash	Non-poor	Poor
Total productive asset value	Tsh000	453.0	823.6***	298.0***	201.9	263.2***	618.9	356.9***
Land owned	acres	6.1	5.7***	9.1***	5.8	4.6..	6.3	6.0
Land owned value[3]	Tsh000	270.2	461.7***	220.3***	149.3*	150.7***	303.9	250.7**
Agricultural capital	Tsh000	87.3	218.0***	23.7**	3.1	25.0*	165.9	41.8
Non-agricultural capital	Tsh000	14.4	7.3	11.1	0.0	24.0**	30.1	5.3***
Head of cattle, oxen, horses	units	0.4	0.9***	0.2**	0.2	0.2***	0.7	0.2***
Head of goats, sheep, pigs	units	3.4	4.6***	2.2***	4.1	3.2	4.3	2.9***
Livestock value	Tsh000	81.1	136.6***	42.9***	49.5	63.4**	118.9	59.1***
Coffee trees	units	408.1	1240.9***	6.3***	0.0***	0.0***	503.1	353.0***
Banana trees	units	41.5	82.2***	9.0***	11.8	31.0	55.9	33.2***
Cashew trees	units	76.3	0.0***	301.1***	0.0*	0.0***	51.0	90.9**
Fruit timber and other trees	units	131.1	223.3***	70.9**	83.6	96.2	176.4	104.8**
Herfindahl index of assets[4]	index	0.695	0.611***	0.815***	0.740	0.682**	0.641	0.726***

***, ** and * indicate statistical significance of the difference in means at the 1%, 5% and 10% level respectively. Significance of difference between regional means is noted next to the name of the variable (left-most column). Means of each producer group and the poor are tested against the rest of the sample within the region.

[1] Calculated from value of land, livestock, agricultural tools, and non-farm enterprise assets (including vehicles).
[2] Land is valued using median price of purchases at the ward level during the year before the survey, and at the district level if there were no such transactions. This yields rather high values for some wards, which inflates the mean. The median values of land held are 237.7 for all households and coffee growers, 235.3 for those not growing coffee, 178.3 for the poor, and 240 for the non-poor.
[3] Land is valued using median price of purchases at the ward level during the year before the survey, and at the district level if there were no such transactions. This yields rather high values for some wards, which inflates the mean. The median values of land held by the respective groups are: 149 for all households, 380 for coffee growers, 136.5 for cashew growers, 100 for those cultivating tobacco, 82.5 for those not cultivating coffee, cashew or tobacco, 160 for the non-poor, and 121.5 for the poor.
[4] Calculated from value of land, livestock, agricultural tools, and non-farm enterprise assets (including vehicles).

Within Kilimanjaro, the difference in total productive asset value between cash crop and non-cash crop growers is negligible, though coffee growers tend to have higher land values and less livestock than average. The poor have on average only half as much productive capital as the non-poor, owing mostly to the lower value of their land. They also possess less animals. In Ruvuma, coffee producers are much better endowed with productive capital than average, while cashew producers as well as non cash crop producers are particularly asset-poor. Traditionally, livestock ownership and use is minor in all Ruvuma (apart from the Mbinga district) due to unfavourable environmental conditions (tsetse flies). Differences in productive assets between the poor and non-poor are also starker in Ruvuma, with significant differences in the holdings of almost every asset. In the framework of Carter and Barret (2006), this suggests that poverty in Ruvuma is to some degree structural, as opposed to purely stochastic or transitory.

In both regions the average number of all trees is around 600, but Ruvuma coffee producers have more intensively planted their fields with coffee trees (over 250 per acre among coffee growers, in contrast with 180 per acre in Kilimanjaro). Likely owing to the partial shade needs of coffee trees, coffee producers tend to own more banana trees than other groups, and in Ruvuma they also have more trees for fruit, timber, and other trees. When looking at the coffee growers only, coffee growers in Ruvuma have on average three times as many coffee trees than their counterparts in Kilimanjaro.

The final row of Tables 2.5 and 2.6 displays the Herfindahl index, a measure of concentration, applied to the values of the major productive assets of land, livestock, agricultural, and non-agricultural capital. For each observation, the share of total productive asset value constituted by each of the particular assets is squared, and the squares added together to derive an index ranging from zero to one. Average Herfindahl index values of 0.6 or greater imply a relatively high degree of concentration of assets, with over 70 percent of all productive value held in one asset.

Over time, farmers may adjust the composition of their assets in response to changes in the relative returns to those assets. With the fall of coffee and cashew prices (described in Chapter 3), we would expect to see disinvestment in these crops and perhaps reallocation of land to more remunerative activities. Indeed, the diminishment of coffee trees in Kilimanjaro can be seen in Table 2.7, both in the decrease of 30 trees in the average number of trees between 2000 and 2003, and in the significant degree of uprooting and much lower rate of planting during the past year. At the same time the number of banana trees has increased since three years, suggesting that some farmers are switching from coffee to into bananas for food or possibly as a cash crop. Increasing banana dependence is equivalent in some degree to increasing self-sufficiency in food, as bananas constitute about 11 percent of the value of food consumption in Kilimanjaro.

Yet, bananas are increasingly also a cash crop sold in the markets of Dar-es-Salaam. Furthermore, the increase in banana production may also affect the power balance in the household as bananas are traditionally grown by women, while coffee production is the domain of the men. While some of the movement out of coffee may be attributable to the low price of coffee since 2000, coffee has been losing some ground in Kilimanjaro since well before the recent price collapse: almost 70 percent of trees are over 30 years old, and just 10 percent were planted during the past ten years. The long-term decline of coffee is also echoed in the older age of heads in coffee-growing households (Table 2.5).

Table 2.7: Kilimanjaro switches into banana?

		All	Coffee	Non-coffee	Non-poor	Poor
Coffee trees at survey time***	units	268.6	441.8	0.0***	322.7	174.0***
Coffee trees 3 years ago**	units	301.0	492.3	2.7***	369.6	189.8***
Coffee trees planted last year	units	7.6	12.4	0.0**	9.3	4.9
Coffee trees uprooted last year***	units	28.1	45.4	1.0***	30.2	24.6
Banana trees at survey time***	units	323.5	442.3	122.2***	388.1	205.4***
Banana trees 3 years ago***	units	289.1	405.5	108.8***	324.9	210.0***
Banana trees planted last year**	units	14.0	18.2	7.4	18.5	6.9
Banana trees uprooted last year***	units	7.6	9.2	5.2	10.3	3.4**

***, ** and * indicate statistical significance of the difference in means at the 1%, 5% and 10% level respectively. Significance of difference between regional means is noted next to the name of the variable (left-most column). Means of each producer group and the poor are tested against the rest of the sample within the region.

Ruvuma, on the other hand, shows expansion of coffee cultivation both over the past decades and since 2000. A third of coffee trees were planted less than 10 years ago, and a further 50 percent between 10 and 30 years ago. Despite low prices in recent years, coffee farmers owned over 40 more trees on average at the time of the survey than two years before (Table 2.8). The same pattern of expansion holds for cashew, with a net increase of 16 trees per cashew farmer during the past two years. Only 19 percent of cashew trees are older than 30 years. One possibility for the seemingly perverse response to low coffee and cashew prices is the lack of alternative cash income sources for farmers in Ruvuma, who are relatively distant from well developed markets compared with those in Kilimanjaro (Tables 2.9 and 2.10).There is some evidence for the tobacco growers shifting out from tobacco production.

Table 2.8: Ruvuma switches into coffee?

		All	Coffee	Cashew	Tobacco	Non-Cash	Non-poor	Poor
Coffee trees at survey time	units	413.8	1258.4***	6.3***	0.0**	0.0***	503.1	353.0***
Coffee trees 2 years ago	units	393.9	1197.3***	6.3***	0.0**	0.4***	492.9	336.6***
Coffee trees planted last year	units	13.1	40.0***	0**	0.0	0.0**	14.4	12.5
Coffee trees uprooted last year	units	1.7	5.1***	0**	0.0	0.0*	2.5	1.2*
Cashew trees at survey time	units	76.7	0.1	308.5***	1.4	0.0	51.0	90.9**
Cashew trees 2 years ago	units	72.7	0.1***	292.9***	3.5	0.0***	50.6	84.9**
Cashew trees planted last year	units	4.2	0.0***	16.7***	0.0	0.0***	2.0	5.6
Cashew trees uprooted last year	units	0.3	0.0*	1.3***	1.2	0.0*	0.2	0.4***
Banana trees at survey time	units	41.7	83.3***	9.0***	10.6	31.1	55.9	33.2
Banana trees 2 years ago	units	36.9	74.3***	8.0***	8.0	27.1	52.0	27.9
Banana trees planted last year	units	3.5	4.6**	0.7**	1.9	4.6	3.9	3.3**
Banana trees uprooted last year	units	0.5	0.7	0.2*	0.0	0.6	0.4	0.6*

***, ** and * indicate statistical significance of the difference in means at the 1%, 5% and 10% level respectively. Significance of difference between regional means is noted next to the name of the variable (left-most column). Means of each producer group (coffee for Kilimanjaro; coffee, cashew, and non-cash for Ruvuma) and the poor are tested against the rest of the sample within the region.

The social capital and institutional access of households in Kilimanjaro and Ruvuma appear similar. Differences among the producer categories in both regions are noteworthy: in both regions coffee producers are better connected socially than others, and in Ruvuma tobacco growers are even more so. The poor in both regions appear to be somewhat socially marginalized, with a significantly lower rate of participation in social groups, and in Ruvuma

also in savings and credit cooperatives (SACCOs) and positions in community leadership, than the non-poor. Access to formal financial institutions is very low, with only 12.5 and 10 percent of all households in Kilimanjaro and Ruvuma respectively holding a bank account, and 85 and 80 percent reporting that seasonal credit for inputs is difficult to obtain. The poor are particularly excluded in both regions from formal banking and in Kilimanjaro from credit access more broadly.

Table 2.9: Kilimanjaro social capital and institutional access characteristics

		All	Coffee	Non-coffee	Non-poor	Poor
Member belongs to social group	%	37.4	36.7	38.5	38.7	35.5
Member in community leadership position	%	26.7	26.9	26.4	27.7	25.2
Member belongs to SACCO	%	12.4	11.9	13.1	13.5	10.6
Member possesses a bank account	%	12.4	13.5	10.7	16.6	6.0***
Difficult to access seasonal credit	%	85.0	85.2	84.7	82.0	89.5***

***, ** and * indicate statistical significance of the difference in means at the 1%, 5% and 10% level respectively. Significance of difference between regional means is noted next to the name of the variable (left-most column). Means of each producer group (coffee for Kilimanjaro; coffee, cashew, and non-cash for Ruvuma) and the poor are tested against the rest of the sample within the region.

Table 2.10: Ruvuma social capital and institutional access characteristics

		All	Coffee	Cashew	Tobacco	Non-Cash	Non-Poor	Poor
Member belongs to social group	%	32.6	37.8***	17.5***	13.5**	17.6***	36.2	30.5*
Member in leadership position	%	27.8	30.2	24.8	45.4*	24.9	32.5	25.1**
Household belongs to SACCO	%	13.6	12.5	5.2***	48.9***	5.4**	19.1	10.5***
Possesses bank account	%	9.9	12.6**	5.1***	22.9*	5.3	14.0	7.5***
Difficult to access seasonal credit	%	79.8	78.9	87.0**	49.4***	87.6	78.0	80.8

***, ** and * indicate statistical significance of the difference in means at the 1%, 5% and 10% level respectively. Significance of difference between regional means is noted next to the name of the variable (left-most column). Means of each producer group and the poor are tested against the rest of the sample within the region.

Infrastructure is clearly more developed in Kilimanjaro than in Ruvuma. This includes connectivity to markets, access to information, and the presence of agricultural services. The nearest town in Kilimanjaro is about half the distance of the nearest town in Ruvuma, and the availability of bus service is twice as common in Kilimanjaro. While electricity and especially cellular phone signals are widely available in rural Kilimanjaro, these amenities are practically non-existent in the surveyed communities in Ruvuma. Agricultural extension, veterinary services, and input shops are also less widespread in Ruvuma.

Within Kilimanjaro, we also see that communities in which coffee growers are concentrated have significantly higher access to a number of services, including more paved roads and greater proximity to larger towns, higher rates of electricity and cell phone access, and more agricultural services and input sales points. The direction of causality here is unclear, but given the historical importance of coffee as a cash crop in Kilimanjaro, it seems likely that infrastructure was developed to serve the economically dynamic coffee-growing areas. Within Ruvuma again coffee growers in Mbinga district appear to have better access to infrastructure or other services, though still lower in comparison with Kilimanjaro.

Table 2.11: Kilimanjaro village characteristics

		All	Coffee	Non-coffee	Non-poor	Poor
Distance to the nearest town[1]***	km	23.2	17.0	33.1***	19.5	28.9***
Tarmac road to village**	%	9.7	9.0	10.7***	12.2	5.7***
Bus services***	%	42.7	42.1	43.7	47.7	35.1***
Market	%	27.5	27.4	27.5	31.8	20.9***
Electricity***	%	64.6	79.2	41.4***	66.7	61.3
Cell phone***	%	82.9	88.7	73.7***	83.6	81.8
Agricultural input shop**	%	19.9	23.4	14.4**	23.2	14.8**
Agricultural extension agent**	%	62.8	60.0	67.3**	60.8	66.0*
Veterinary services***	%	50.6	54.8	44.1***	54.3	45.0**
Health facility[2]	%	52.1	51.3	53.5	50.5	54.6

***, ** and * indicate statistical significance of the difference in means at the 1%, 5% and 10% level respectively. Significance of difference between regional means is noted next to the name of the variable (left-most column). Means of each producer group and the poor are tested against the rest of the sample within the region.

Table 2.12: Ruvuma village characteristics

		All	Coffee	Cashew	Tobacco	Non-Cash	Non-Poor	Poor
Distance to the nearest town	km	42.7	35.0***	42.6**	51. 6	47.5*	43.6	42.1
Tarmac road to village	%	4.1	0***	0***	3.9	10.3***	8.8	1.4***
Bus services	%	22.3	5.9***	13.5**	55.3***	38.2***	24.0	21.3
Market	%	33.3	25.5	30.2**	61.9**	39.3**	33.0	33.5
Electricity	%	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Cell phone	%	2.5	6.8***	0.0**	0.0	0.8**	3.0	2.2
Agricultural input shop	%	4.1	0.0**	0.0**	3.8	10.4***	8.8	1.4***
Agricultural extension agent	%	44.8	51.4***	16.4***	65.4	55.8***	48.2	42.9*
Veterinary services	%	28.2	26.4	14.2***	36.3	38.5***	27.6	28.5
Health facility	%	56.5	56.5	37.3***	80.5***	67.5***	64.0	52.2***

***, ** and * indicate statistical significance of the difference in means at the 1%, 5% and 10% level respectively. Significance of difference between regional means is noted next to the name of the variable (left-most column). Means of each producer group (coffee for Kilimanjaro; coffee, cashew, and non-cash for Ruvuma) and the poor are tested against the rest of the sample within the region.

The poor in Kilimanjaro are likewise highly clustered in communities without good access to services. The differences are less pronounced in Ruvuma, though cashew growers are particularly poorly served, and the poor suffer from less access to agricultural extension and inputs, as well as health facilities. While placement effects are no doubt at least partially responsible for the correlation between infrastructure and wealth levels, poor communities' lack of access to information and markets can only hamper their economic development.

In sum, within each region the differences in asset endowments across different categories of producers appear significant but smaller than the corresponding ones across regions (especially when considering community factors). Land scarcity appears to be a key factor that drives livelihood strategies and farm planning in Kilimanjaro. The response to cash crop price declines differs markedly across regions and may indicate a lack of viable alternatives for cash crop production in Ruvuma. In Kilimanjaro producers have been moving out of coffee for more than a decade, and are now actively uprooting their crops, while Ruvuma farmers continue to invest in both coffee and cashew despite the long-term negative trend of coffee prices and the particularly low prices of both crops in recent years.

[1] The sample for means tests between regions is one observation per village, for producer categories household level observations are used.
[2] Dispensary, health centre, or hospital.

2.4 Livelihood strategies

Households choose how to employ their asset endowments to derive income and consumption flows in what we here term a livelihood strategy. In this section, we look at the labour, land, and other variable inputs allocated to various productive activities, and the income flows derived from these.

In addition to starting from a higher asset base as seen in the previous section, Kilimanjaro farm households also allocate more time to production activities, and use higher levels of cash inputs for agriculture. Of all agricultural inputs, only inorganic fertilizer is used to a greater extent by farmers in Ruvuma, and this difference is not statistically significant. In fact, input levels are extremely low in both regions, with a total of Tsh 40 000 and Tsh 8 000 per acre worth of cash inputs used in Kilmanjaro and Ruvuma respectively.

While land holdings are three times as high in Ruvuma as in Kilimanjaro (Tables 2.5 and 2.6), only two-thirds of land is cultivated in Ruvuma, while in Kilimanjaro, where land pressure appears to be much higher, practically all land is under continuous cultivation. In addition to cultivating their scarce land more intensively, Kilimanjaro households also spend more time in non-agricultural activities. Reflecting the more variable (even though on average ample) rainfall pattern in Kilimanjaro irrigation is more common than in Ruvuma, where it is practically nonexistent.

Table 2.13: Kilimanjaro livelihood inputs

		All	Coffee	Non-coffee	Non-poor	Poor
Total family labour days***	units	699.0	728.6	652.2***	666.0	749.4***
Family time in non-agr. activities***	%	19.7	15.9	25.6***	20.8	16.8**
Cultivated land size last year***	acres	2.7	2.7	2. 7	2.8	2.4***
Number of plots***	units	2.0	2.0	1.9*	1.9	2.0
Hired labour days for own farm**	days/ac	5.1	4.0	6.7**	6.4	2.9***
Family labour days on own farm***	days/ac	239.8	239.3	240.5	204.7	293.3***
Total cash inputs***	Tsh000/ac	39.7	39.5	40.1	46.9	28.7***
Hired labour cost***	Tsh000/ac	5.3	4.4	6.8**	7.1	2.6***
Traditional seeds***	Tsh000/ac	2.4	2.2	2.8	2.5	2.3
Improved seeds***	Tsh000/ac	4.0	4.0	3.9	4.1	3.8
Organic fertiliser***	Tsh000/ac	7.3	8.4	5. 7**	7.3	7.4
Inorganic fertiliser	Tsh000/ac	3.9	3.9	4.0	4.3	3.2
Insecticides, herbicides***	Tsh000/ac	2.1	2.6	1.2**	2.4	1.5
Veterinary expenses***	Tsh000/ac	2.0	1.6	2.6**	2.5	1.2***
Livestock related expenses***	Tsh000/ac	5.9	6.2	5.4	8.0	2.7***
Ploughing expenses***	Tsh000/ac	2.1	1.8	2.6**	2.6	1.3***
Transport***	Tsh000/ac	2.8	2.9	2.6	3.5	1.7***
Other production expenses***	Tsh000/ac	1.9	1.5	2.5**	2.4	1.0***
Percent of land irrigated***	%	20.7	17.3	26.2***	22.3	18.3*

***, ** and * indicate statistical significance of the difference in means at the 1%, 5% and 10% level respectively. Significance of difference between regional means is noted next to the name of the variable (left-most column). Means of each producer group and the poor are tested against the rest of the sample within the region.

The poor in both regions spend more time working and allocate more labour per acre to own farm production. Non cash crop producers in both regions allocate more time to non-agricultural activities. Time share to non-agricultural activities, as well as cash input use, on the other hand, are lower among the poor. In Ruvuma, coffee and cashew producers use fewer cash inputs, while tobacco and non cash crop growers use more than average. While the poor own less land than the non-poor (Table 2.6), the difference in the amount of land

under cultivation by the poor and non-poor is not statistically significant in Ruvuma, pointing to the abundance of land in the region. Nonetheless, coffee producers appear to face land constraints in the Mbinga district, resulting in migration out of the highlands to the lower parts of the district.

Table 2.14: Ruvuma livelihood inputs

		All	Coffee	Cashew	Tobacco	Non-Cash	Non-Poor	Poor
Total family labour days	days	637.5	667.6**	592.9***	656.6	636.5	615.7	650.2*
Time in non-agricultural activities	%	14.5	11.3**	11.4**	6.5**	19.9**	19.4	11.6***
Cultivated land size last year	acres	6.1	5.7**	9.1***	5.8	4.6***	6.3	6.0
Number of plots	units	2.6	3.0***	2.5	3.0	2.4***	2.7	2.6
Hired labour on own farm	days/ac	1.6	1.1**	1.2*	2.4	2.3**	3	0.8***
Family labour on own farm	days/ac	101.9	100.0	76.4***	87.68	121.8***	82.2	113.4***
Total cash inputs	Tsh000/ac	8.0	5.3***	3.4***	14.9***	12.7***	12	5.8
Hired labour cost	Tsh000/ac	1.8	1.0**	1.3**	2.1	2.8***	3.6	0.8***
Traditional seeds	Tsh000/ac	0.1	0.1*	0.1	0.0	0.2**	0.1	0.1
Improved seeds	Tsh000/ac	0.1	0.2	0.0**	0.0	0.2*	0.3	0.1***
Organic fertilizer	Tsh000/ac	0.1	0.2**	0.0	0.0	0.0	0.1	0.0
Inorganic fertilizer	Tsh000/ac	4.2	1.8***	1.3***	11.3***	7.3***	4.9	3.8**
Insecticides, herbicides	Tsh000/ac	0.3	0.8**	0.1	0.0	0.1	0.7	0.1**
Veterinary expenses	Tsh000/ac	0.2	0.2	0.0**	0.1	0.3**	0.3	0.1
Livestock related expenses	Tsh000/ac	0.2	0.2	0.0***	0.0	0.3**	0.4	0.1***
Ploughing expenses	Tsh000/ac	0.0	0.0	0.1**	0.0	0.0	0.0	0.0
Transport	Tsh000/ac	0.7	0.6	0.2***	0.6	1.0**	1.2	0.4***
Other production expenses	Tsh000/ac	0.4	0.2	0.2	0.8	0.5**	0.5	0.3***
Irrigated land	%	3.9	3.7	1.5	2.7	5.7	4.8	3.4

***, ** and * indicate statistical significance of the difference in means at the 1%, 5% and 10% level respectively. Significance of difference between regional means is noted next to the name of the variable (left-most column). Means of each producer group (coffee for Kilimanjaro; coffee, cashew, and non-cash for Ruvuma) and the poor are tested against the rest of the sample within the region.

Unsurprisingly, given the higher asset base and input levels, gross incomes in Kilimanjaro (including food produced for own consumption) are a third higher than in Ruvuma. As suggested in section 2.3, coffee retains greater importance to rural livelihoods in Ruvuma, comprising over 20 percent of gross cash income among coffee growers, and only 4 percent in Kilimanjaro. This is also reflected in the much lower production per tree in Kilimanjaro compared with Ruvuma (114 and 220 grams per tree respectively), even though yields are extremely low in both regions. Cashew constitutes a similar income share as coffee in Ruvuma among its growers, whereas tobacco producers are much more specialized in the crop, from which they derive 40 percent of their cash income. For all groups except tobacco growers, the single most important source of income is food crops. Land productivity, defined as net income from crops over land under cultivation, is higher in densely populated Kilimanjaro.

The poor have less income from non-farm enterprise in Ruvuma, and more income from wages in Kilimanjaro; in both regions the poor derive a lower share from livestock and agricultural processing activities. Comparing Herfindahl indices of income and cash income calculated using 34 different income sources[1] we see that farm households in Kilimanjaro rely more heavily on fewer sources of income than households in Ruvuma. In particular, cash

[1]Income sources consist of 20 particular crops, regular wages, irregular wages, non-farm enterprise, pensions, state assistance, gifts, remittances, processed farm products, and livestock sales and products.

income portfolios are highly specialized in Kilimanjaro, with the typical household relying on one source for about 70 percent of total cash income. Coffee growers in both regions have more diverse income streams than other producers, and the poor's sources of income, particularly of cash income, are more concentrated.

Table 2.15: Kilimanjaro household income flows

		All	Coffee	Non-coffee	Non-poor	Poor
Gross income per capita***	Tsh000	162.5	159.0	168.2	212.4	86.4***
Cash income per capita***	Tsh000	111.1	107.9	115.9	149.6	52.1***
Non-farm business	%	11.8	9.9	14.7	11.2	12.6
Transfer income (1)***	%	3.7	3.3	4.3	4.4	2.7**
Remittances***	%	5.4	6.1	4.4**	6.5	3.7***
Coffee***	%	2.6	4.3	0.0***	2.5	2.8
Other crops***	%	43.3	44.8	40.8**	42.4	44.6
Livestock & processing income***	%	18.1	18.1	18.1	19.5	16.0***
Wages***	%	15.1	13.4	17.8**	13.5	17.6***
Labour productivity (2)	Tsh000/day	0.75	0.58	1.02	0.80	0.44***
Land productivity***	Tsh000/ac	94.1	102.2	81.4*	105.3	76.5*
Herfindahl index of gross income (3)***	index	0.44	0.42	0.47***	0.44	0.44
Herfindahl index of cash income (3)***	index	0.57	0.55	0.62***	0.53	0.59***

(1) Includes pensions, state assistance and gifts
(2) Net income from crops, divided by person-days in cultivation.
(3) Net income from crops, divided by acres under cultivation.
(4) Herfindahl indices contain 34 income sources.

***, ** and * indicate statistical significance of the difference in means at the 1%, 5% and 10% level respectively. Significance of difference between regional means is noted next to the name of the variable (left-most column). Means of each producer group (coffee for Kilimanjaro; coffee, cashew, and non-cash for Ruvuma) and the poor are tested against the rest of the sample within the region. Income shares (%) relate to shares of cash (not total) income.

Table 2.16: Ruvuma income flows

		All	Coffee	Cashew	Tobacco	Non-Cash	Non-Poor	Poor
Gross income per capita	Tsh000	118.4	130.1*	92.2***	127.4	124.3	201.6	70.2***
Cash income value per capita	Tsh000	80.7	81.3	64.1**	90.3	90.0	143.4	44.3***
Non-farm business	%	12.9	11.3	9.7***	6.2**	16.9***	17.0	10.5***
Transfer income	%	1.2	0.7	0.9	0.9	1.8**	1.3	1.1
Remittances	%	2.6	2.3	1.3**	1.9	3.7***	3.6	2.0*
Coffee	%	7.0	21.2***	0.2***	0.0**	0.0***	8.5	6.1**
Cashew	%	5.6	0.0***	22.2***	0.0**	0.0***	3.4	6.9***
Tobacco	%	1.6	0.0***	0.8	39.9***	0.0***	0.8	2.1
Other crops	%	50.3	47.6	48.8	36.2***	55.1***	45.2	53.3***
Livestock & processing income	%	9.4	12.1***	4.5***	12.8	9.9	11.6	8.1***
Wages	%	9.4	4.8***	11.6*	2.0**	12.6***	8.5	9.9
Labor productivity	Tsh000/day	0.91	0.60	1.54	0.91	0.76	1.06	0.83
Land productivity	Tsh000/ac	43.4	49.4***	31.2***	66.1***	44.3	50.5	39.3***
Herfindahl index of gross income	index	0.36	0.32***	0.38**	0.38	0.38***	0.36	0.36
Herfindahl index of cash income	index	0.53	0.51**	0.56*	0.51	0.54	0.50	0.56***

***, ** and * indicate statistical significance of the difference in means at the 1%, 5% and 10% level respectively. Significance of difference between regional means is noted next to the name of the variable (left-most column). Means of each producer group and the poor are tested against the rest of the sample within the region. Income shares (%) relate to shares of cash income.

2.5 Welfare outcomes

To gauge the relative welfare of rural households, not only across regions and between groups, but also over time, we construct a consumption aggregate that is as comparable as possible with that used in the 2000/01 Tanzanian Household Budget Survey (HBS) Final Report (NBS, 2002).[1] Consumption per capita was 20 percent higher in Kilimanjaro than in Ruvuma in 2003, which is no surprise given the higher incomes and asset endowments of that region. Food shares are also slightly higher in Ruvuma, as expected among a poorer population. The starkest difference in consumer goods among the two regions is seen in the dwelling value, which is over five times greater in Kilimanjaro than Ruvuma, likely a function of higher land prices as well as housing quality. Improved roofs are nearly universal in Kilimanjaro, and a majority of households have access to piped drinking water, compared with only a third of Ruvuma households.

Table 2.17: Kilimanjaro consumption

		All	Coffee	Non-coffee	Non-poor	Poor
Total consumption per capita, 2003***	Tsh000	159.9	157.9	163.1	209.5	83.5***
Total consumption per capita, 2004[1)]***	Tsh000	160.6	164.2	155.1	218.0	75.9***
Food share, 2003	%	69.3	69.7	68.6	68.0	71.3***
Food share, 2004	%	71.5	71.9	70.8	70.5	72.7**
Consumer durables***	Tsh000	250.5	235.8	272.6	323.4	138.9***
Dwelling value***	Tsh000	1524.4	1847.5	1014.3***	1672.7	1297.5***
Improved water source***	%	64.64	72.79	52.38***	63.6	61.2
Electricity***	%	15.35	15.15	15.64	21.5	6.0***
Metal, stone, or concrete roof***	%	92.20	97.02	84.95***	94.1	89.4**

1) constant Tsh 2003. ***, ** and * indicate statistical significance of the difference in means at the 1%, 5% and 10% level respectively. Significance of difference between regional means is noted next to the name of the variable (left-most column). Means of each producer group and the poor are tested against the rest of the sample within the region.

Table 2.18: Ruvuma consumption

		All	Coffee	Cashew	Tobacco	Non - Cash	Non-Poor	Poor
Total consumption per capita, 2003	Tsh000	129.8	148.0***	104.1***	104.5	133.2	212.3	81.0***
Total consumption per capita, 2004[1)]	Tsh000	134.4	152.1***	108.9***	107.8	138.5	220.8	85.2***
Food share, 2003	%	70.3	71.1	70.2	66.2**	70.0	69.6	70.7
Food share, 2004	%	72.5	71.8	74.0	72.5	71.9	68.8	74.4***
Consumer durables (hh)	Tsh000	178.8	250.9	122.8**	149.6	156.2	200.1	107.5***
Dwelling value	Tsh000	298.7	470.2***	166.1***	200.5**	247.2*	349.9	269.0***
Improved water source	%	34.3	21.6***	26.2***	59.2***	47.70***	35.5	30.7
Electricity	%	0.1	0. 0	0.5*	0.0	0.0	0.4	0.0*
Metal/stone/concr. Roof	%	51.7	76.9***	28.8***	47.1	45.7	64.2	44.4***

1) constant Tsh 2003. ***, ** and * indicate statistical significance of the difference in means at the 1%, 5% and 10% level respectively. Significance of difference between regional means is noted next to the name of the variable (left-most column). Means of each producer group and the poor are tested against the rest of the sample within the region.

Within Kilimanjaro, welfare outcomes do not differ substantially between cash crop growers and others except in terms of housing quality. Dwelling value is almost twice as high among

[1] See Appendix 3 for a detailed description of the consumption aggregate.

coffee growers as others, and a higher proportion also have access to an improved water source and a roof made of metal, stone or concrete. Ruvuma on the other hand shows marked differences in the consumption expenditures of coffee and cashew farmers compared with other households. Coffee farmers enjoy higher levels of current consumption in both survey years, as well as double the dwelling values of non-coffee growers, while cashew growers are worse off by both of these measures.

In an attempt to compare our poverty measures with those from HBS, we have matched the means of household consumption expenditures per capita after adjusting for GDP growth and inflation and the ratio of underestimation between the two surveys as explained in detail in Appendix 3. After making this adjustment, any observed increase or decrease in poverty (using the same poverty line as the HBS) between the HBS and the first year of this survey is attributable to changes in the distribution of consumption around the mean as well as the shift in the mean as calculated based on overall gross domestic product (GDP) growth. In both regions, poverty has increased substantially since the period in 2000 and 2001 when the HBS data was collected. At that time, it was found that 32 percent of households in Kilimanjaro and 44 percent in Ruvuma were living below the poverty line. We find a striking 8 percentage points increase in poverty for Kilimanjaro and a 17 percentage points raise in Ruvuma from that level in the first year of the survey, and these proportions remain almost the same the second year of the survey. This striking difference reflects the facts that in our survey large plantations and most importantly households from urban areas were not surveyed. Research has extensively shown that poverty incidence in rural populations is usually much higher in comparison with urban sites. Finally one reason for the increase in poverty by 2 percentage points in Kilimanjaro during the second survey may be drought, reported as a shock by 40 percent of Kilimanjaro households in 2004.[1]

Table 2.19: Kilimanjaro poverty

		All	Coffee	Non-coffee
2003 Poverty line: 148.0 basic needs, 108.0 food				
Headcount ratio (basic needs poverty)***	%	39.9	40.4	39.2
Headcount ratio (food poverty)***	%	19.0	19.4	18.3
Average poverty gap among the poor (per capita)	Tsh000	17.1	17.9	15.9
2004 Poverty line: 139.9 basic needs, 102.2 food				
Headcount ratio (basic needs poverty)***	%	41.3	39.0	45.2***
Headcount ratio (food poverty)***	%	23.3	20.2	28.3***
Average poverty gap among the poor (per capita)	Tsh000	18.6	16.3	22.3

***, ** and * indicate statistical significance of the difference in means at the 1%, 5% and 10% level respectively. Significance of difference between regional means is noted next to the name of the variable (left-most column). Means of each producer group and the poor are tested against the rest of the sample within the region.

The differences in poverty rates among Ruvuma producer groups reflect the differences in mean consumption noted above. Poverty among cashew growers was over 40 percent as high as among coffee producers in 2003, a gap which narrowed somewhat in 2004. Not only was poverty more common among cashew growers, it was also more extreme. In 2003, 56 percent of poor cashew growers had food expenditures below what is necessary to achieve the recommended calorie intake, and the average expenditure level of these poor was 48.300 Shillings (about 50 USD) below the poverty line per capita. The significant decrease in

[1] Forty-eight percent of households in Kilimanjaro reported a drought shock in 2004; 48 percent reported “much below normal” rainfall on their cultivated land. The corresponding proportions in Ruvuma for either a drought shock or “much below normal” plot rainfall was about 4% in 2003 and 0% in 2004.

poverty incidence among tobacco producers can be associated with the signs of switch out of production reported earlier. The basic needs poverty rate in Ruvuma remained stable over the two survey rounds, though food poverty decreased slightly.

Table 2.20: Ruvuma poverty

		All	Coffee	Cashew	Tobacco	Non-Cash
2003 Poverty line: 151.2 basic needs, 110.3 food						
Headcount ratio (basic needs)	%	63.3	52.8***	75.8***	82.8	62.4
Headcount ratio (food poverty)	%	41.6	30.7***	55.9***	52.6	40.7
Average poverty gap among the poor (per capita)	Tsh000	35.2	26.6	48.3	45.2	33.2
2004 Poverty line: 159.7 basic needs, 116.6 food						
Headcount ratio (basic needs)	%	63.0	56.0***	75.5***	66.9	61.5
Headcount ratio (food poverty)	%	41.2	34.0***	52.7***	34.9	40.4
Average poverty gap among the poor (per capita)	Tsh000	36.9	29.0	48.4	29.8	37.4

***, ** and * indicate statistical significance of the difference in means at the 1%, 5% and 10% level respectively. Significance of difference between regional means is noted next to the name of the variable (left-most column). Means of each producer group and the poor are tested against the rest of the sample within the region.

While poverty increased in Kilimanjaro between 2003 and 2004, the proportion of households that were poor during both periods is relatively low, suggesting that much of poverty in that region is transitory rather than chronic. In fact, almost half of the poor in 2003 became non-poor in 2004, and only a third of the poor in 2004 had also been poor during the previous year. The picture in Ruvuma is similar: only 23 percent of the poor in 2003 were poor the following year. The apparent year-to-year unpredictability about a household's future wellbeing points to the importance of insurance mechanisms and safety-net interventions for welfare in rural Tanzania.

Table 2.21: Kilimanjaro poverty transition between rounds (% of household)

		2004	
		Non poor	Poor
2003	Non-poor	42.8	16.1
	Poor	17.7	23.4

Table 2.22: Ruvuma poverty transition between rounds (% of household)

		2004	
		Non poor	Poor
2003	Non-poor	21.0	15.9
	Poor	15.5	47.6

The Gini coefficient is an index from 0 to 1 measuring the distribution of some asset or flow (typically income or consumption) across the population, with 0 indicating complete equality (each member has an equal level of the asset or flow) and 1 complete inequality (one individual owns all of the asset or receives all of the flow). Tables 2.23 and 2.24 show the Gini coefficient applied to productive assets, income, and consumption for Kilimanjaro and Ruvuma. The Gini coefficients for consumption per capita calculated for both Kilmanjaro and Ruvuma are comparable to that reported for rural mainland Tanzania as a whole in the HBS (0.33). This puts Tanzania among the 40 most equal countries for which Gini data are

included in the 2005 Human Development Indicators (UNDP). The low levels of inequality for consumption must be contrasted with the more unequal distribution of assets and income, the latter particularly for Kilimanjaro. The inequality of consumption expenditures increased between survey rounds in Kilimanjaro mainly, and appears responsible for most of the increase in poverty.

Table 2.23: Kilimanjaro inequality

Gini coefficient for:	All	Coffee	Non-coffee
Productive assets per capita, 2003	0.63	0.62	0.63
Net income per capita, 2003	0.58	0.56	0.60
Consumption per capita, 2003	0.32	0.32	0.32
Consumption per capita, 2004	0.37	0.37	0.35

Table 2.24: Ruvuma inequality

Gini coefficient for:	All	Coffee	Cashew	Tobacco	Non-Cash
Productive assets per capita, 2003	0.58	0.49	0.49	0.45	0.51
Net income per capita, 2003	0.51	0.53	0.48	0.34	0.51
Consumption per capita, 2003	0.33	0.32	0.32	0.26	0.35
Consumption per capita, 2004	0.33	0.32	0.31	0.16	0.34

2.6 Conclusion

Within both regions, and even more pronounced in Ruvuma, cash crop production is concentrated in certain districts, suggesting a high degree of spatial co-variation in the effect of cash crop price shocks. District-level poverty rates further suggest that cashew growers are at present suffering, whereas coffee growers within Ruvuma are better off and those in Kilimanjaro are not worse off than the other agricultural households.

Households in Kilimanjaro are much better endowed with assets, though part of this is due to the higher value of land in Kilimanjaro, indicating land pressure in this densely populated region. Kilimanjaro households also devote more time to non-agricultural activities than those in Ruvuma, and correspondingly earn a higher share of income from processing activities and wages. This may reflect both higher land pressure as well as better off-farm employment opportunities. Within Kilimanjaro, we see little difference between the productive asset endowments of cash crop growers versus other households. In Ruvuma, however, coffee growers have higher levels of assets while cashew growers are worse off, a pattern also reflected in the income and consumption levels of these groups.

Kilimanjaro farmers have been disinvesting in coffee production, a process which already started in the 1990s and accelerated in early 2000 following the precipitous decline in coffee prices. It is best illustrated by the small share of cash income currently derived from coffee even among coffee-producing households in Kilimanjaro (4 percent), compared with those in Ruvuma, where 20 percent of cash income among coffee and cashew farmers is made from sales of these crops respectively. Tobacco farmers earn 40 percent of their cash income from the crop. The stark decrease in coffee production over the past few years in Kilimanjaro went hand in hand with an increase in banana production, including production for export to

Dar-es-Salaam, a trend which is likely to affect the power balance within the households as bananas are traditionally cultivated by women and coffee by men. However, the opposite trend has been observed in Ruvuma, where coffee trees are generally younger than in Kilimanjaro and where coffee growers have even been planting more new coffee trees over the past couple of years than they have uprooted.

It is hypothesized that the better integration of Kilimanjaro in the national economy and its well established links with the markets in Dar-es-Salaam, together with its higher population density and the emerging land scarcity, have substantially raised the opportunity cost of coffee production in Kilimanjaro. In Ruvuma on the other hand, land is still relatively abundant (though there are signs of some tightening of the land market in Mbinga – the coffee producing region in Ruvuma) and alternative employment opportunities as well as access to markets are limited due both to limited infrastructure and distance, potentially rendering coffee production the more profitable activity, despite the recent slump in coffee prices. This very divergent reaction to the recent collapse of coffee prices deserves further investigation, especially since coffee producers in both regions do not appear to differ that much in their individual characteristics. Yet, infrastructure and service delivery is much more developed in Kilimanjaro compared with Ruvuma.

Credit for agricultural inputs is scarce in both regions. The limited access to credit is most likely linked to the liberalisation of the cash crop marketing systems during the mid 1990s. Cooperatives could no longer enforce repayment of the credit for inputs given that farmers were now also able to sell to private traders. As a result they have completely retreated from the provision of credit, a gap which has not been filled by the private traders for similar reasons. In the absence of interlinked markets, lack of collateral as well as the regulatory framework (registration procedures) further compound the provision of credit, while the savings and credit cooperatives (SACCO's) have a relatively short history. Lack of credit access is likely to be important in explaining the limited use of modern inputs (estimated at Tsh 40,000 per acre in Kilimanjaro and just Tsh 8,000 in Ruvuma) (Sarris, Savastano and Christiaensen, 2006).

The contrast in wealth levels between Kilimanjaro and Ruvuma is reflected in and likely exacerbated by much lower levels of infrastructure in Ruvuma. Access to paved roads, telecommunications, electricity, agricultural inputs and extension are all poorer in Ruvuma. Moreover, both in Ruvuma and Kilimanjaro, these services also tend to be more concentrated in the coffee-growing districts.

While average (nominal) consumption levels in Kilimanjaro remained constant from 2003 to 2004, poverty increased by 2 percent during this year, possibly due to low rainfall in the region. Poverty in both Kilimanjaro and Ruvuma has a large transitory component, with almost half of the poor in the first period becoming non-poor in the next. These observations suggest the importance of climate shocks to welfare, and indicate an important role for insurance mechanisms and safety net interventions in rural Tanzania.

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3. Risks and Coping Strategies

by Danford Sango, Vivian Hoffmann and Luc Christiaensen

3.1 Introduction

In this chapter we describe the risk environment of rural Tanzanian households and provide a qualitative account of how they cope with these risks.[1] We begin from the premise that rural households are exposed to a number of uncertain and risky events, which have the potential to disrupt their livelihoods. Specifically, we will address the following questions: (i) what risks affect households; (ii) which among these risks are most important; (iii) how frequently are rural households affected by these risk events, and (iv) what ex-post (coping) strategies do households employ in dealing with risks. Chapter 5 of this report then investigates the immediate welfare effects of these shocks through multivariate analysis.

3.2 Risks and shocks in rural Tanzania

We begin by identifying the different dimensions of risks and shocks followed by an empirical review of these dimensions in the Tanzanian context. We further analyze the way the risk environment differs across cash crop growers and food crop growers, and poor versus non-poor households.

3.2.1 Dimensions of risk and shocks

In this chapter, we use the term risk to refer to uncertain events that may result in welfare losses (Heitzmann *et al*., 2002; Holzmann and J∅rgensen, 2000). A shock is a risk event that can cause a significant negative impact. How large the impact of a risk event must be to constitute a shock depends in part upon the expected welfare level of the particular household. For households living at the edge of subsistence even a small drop in consumption may have a significant negative impact on welfare. For those comfortably above the poverty line, on the other hand, a larger absolute loss, and even a larger proportional loss, could have a relatively insignificant impact on welfare.[2]

Risks and uncertain events can be characterized along various dimensions: (i) the source of the risk, (ii) the correlation in occurrence of the risk event among individuals (idiosyncratic versus covariate), across time (autocorrelation) and across risk events (bunching), and (iii) the frequency, timing and intensity of the risk. First, risks relevant to the current study can be classified by source as follows: climatic (drought, heavy rainfall), other agricultural production risks (pest infestation and livestock disease), risks to human health (illness, injury and death), risks to assets (appropriation of land, theft or destruction of property) and economic risks (unemployment, staple or cash crop price shocks).

Second, it is especially important to consider the correlation among risk events. Depending on the extent to which different individuals are simultaneously affected, one can distinguish between idiosyncratic and covariate risks. Idiosyncratic risks usually only affect a single person/household or a few households in a community at any given time. They include events such as theft of household assets, non-epidemic diseases and unemployment. Covariate risks

[1] Risks could be thought of as the "known unknowns", while uncertainty refers to the "unknown unknowns".

[2] This statement is based on the assumption, generally accepted in economics, of diminishing marginal welfare gains to consumption.

on the other hand affect many households simultaneously in a community. Such risk events include drought, commodity price decline and crop failure. This distinction is important as households usually have a greater capacity to protect consumption from the effects of idiosyncratic risks through the use of informal social support networks while such networks are usually ineffective in protecting households' consumption from covariate shocks (Morduch, 1995; Dercon, 2004). Depending on whether risks are autocorrelated over time or not, risks can also be categorized as repeated or unrepeated risks. Finally, risks are referred to as bunched if they correlate with other risks and un-bunched if they don't. For example, droughts often go together with food price increases and livestock price declines and therefore the two risk events are said to be bunched.

Some risk events occur more frequently (droughts, health shocks), while others only happen once in a lifetime (e.g. earthquake). The effects of infrequent events may be much more catastrophic, though more frequently occurring risk events could turn out to be equally damaging (e.g. droughts, recurrent or chronic illness). In addition to the frequency and intensity of risks/shocks it is also critical to distinguish between sudden risks/shocks and slow onset shocks. This is especially important when considering price shocks. Future price expectations are usually based on past price experiences, i.e. prices tend to have some memory. As a result, a (gradual) decline in prices from one year to the other does not necessarily come as a surprise. However, this is not to say that medium term declines in prices do not constitute a shock. When there is a delay in the supply response to an investment (e.g. new coffee trees only bear fruits after 3 to 5 years), investments based on price experiences two or three years ago may no longer be profitable today. We thus distinguish slow onset and sudden price shocks which are different in nature, though potentially equally devastating in their effects given the irreversible nature of the investment.

3.2.2 Incidence of shocks

The incidence of (i.e. proportion of households affected by) various shocks provides an overview of the risk environment faced by a population. To gauge the shock incidence for different risk events, we asked respondents whether the living conditions of household members had been negatively affected by any of a list of shocks during the five years preceding the date of the survey. We further asked respondents how many times their household had encountered each of these shocks within those five years.

As a first indication of the riskiness of the environment, Table 3.1 presents the number of times households where hit by any shock over the past five years both in Kilimanjaro and Ruvuma and by cash crop and non-cash crop producers. Cash crop producer households in Kilimanjaro region are defined as those owning any coffee trees, whereas for the Ruvuma region, a household with any coffee or cashew trees, or a household which cultivated tobacco during the past year, is considered a cash crop producer.

Table 3.1: Number of shock occurrences between 1999 and 2003, by region and status as cash crop producer (all figures refer to percentages of households that have experienced the indicated number of shocks)

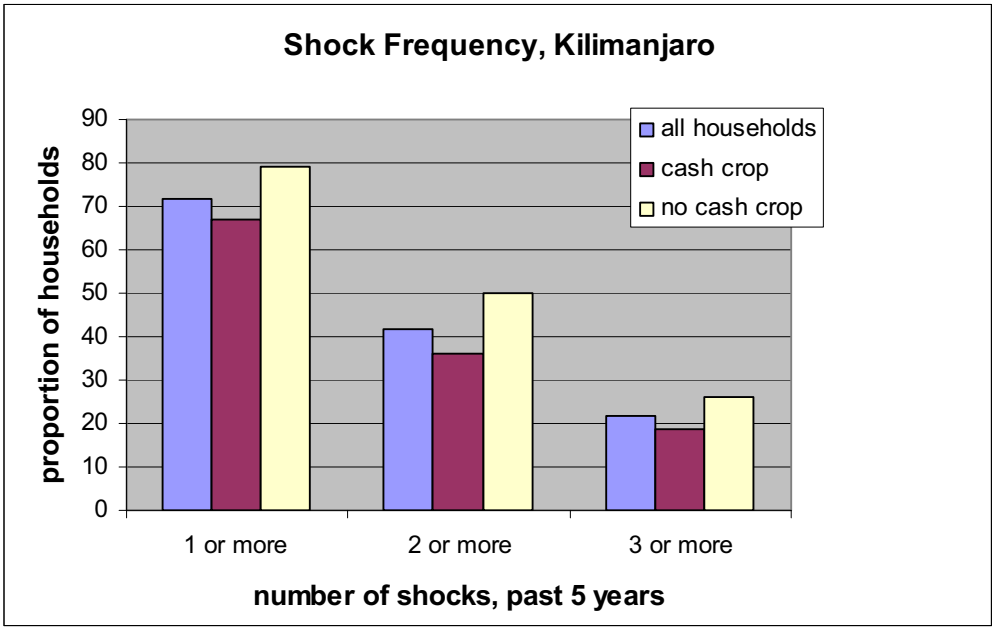
Number of shocks, past 5 years	Kilimanjaro		Ruvuma		Total
	Cash crop	No cash crop	Cash crop	No cash crop	
0.0	32.9	20.9	45.2	39.8	35.3
1.0	30.9	29.0	32.7	34.8	31.8
2.0	17.3	23.9	12.3	14.4	16.7
3.0	8.0	11.9	3.9	5.5	7.2
4.0	2.9	4.7	1.4	1.5	2.6
5.0	4.6	4.8	2.5	1.1	3.4
6.0	1.6	3.1	0.8	1.0	1.6
7.0	0.8	0.8	0.1	0.4	0.5
8.0	0.6	0.4	0.6	1.2	0.7
9.0	0.0	0.0	0.5	0.4	0.2
10.0	0.2	0.5	0.1	0.0	0.2
11.0	0.1	0.0	0.0	0.0	0.0

Source: Own calculations

About two-thirds of all rural households reported to have experienced at least one major shock to their livelihoods during the 1999-2003 period and those who incurred a shock were on average hit 2.1 times. Given that slow onset shocks including the collapse in commodity prices such as coffee and cashew were not fully captured by the administered shock module (see below), this most likely represents an underestimate. Results in table 3.1 above indicate that about a third (31.8 percent) of households affected by shocks in the study areas were affected by a single shock during the past five years. About 17 percent of all households reported to be affected by two shocks in the past five years, while 16 percent reported experiencing three or more shocks, indicating that some households are particularly exposed to risks. Clearly, rural Tanzanian households live in risky environments with shock incidence even more pronounced in Kilimanjaro than in Ruvuma.

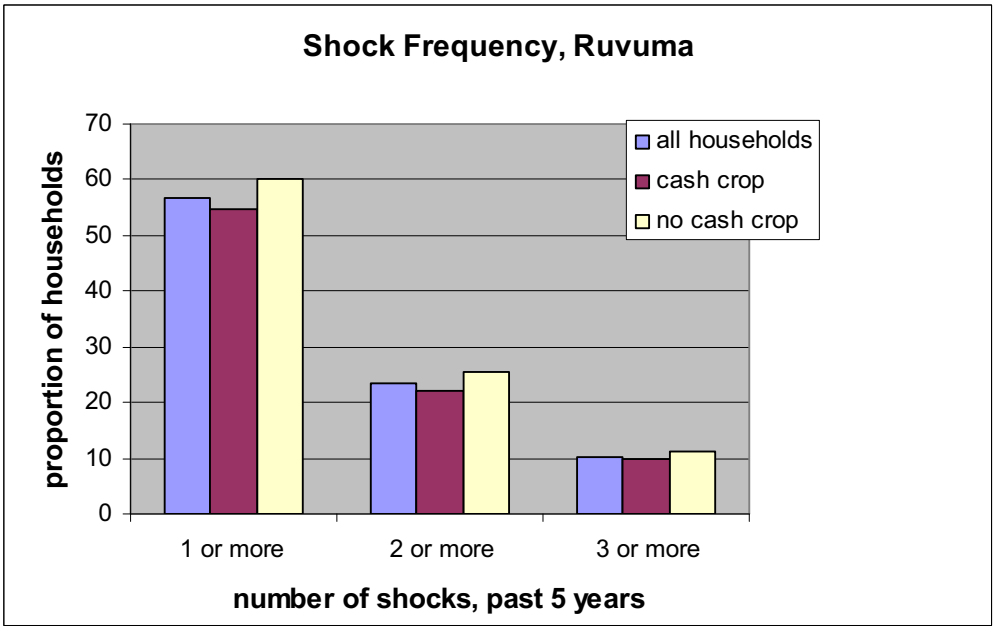
As shown in Figures 3.1 and 3.2, the number of shocks suffered by cash crop growers is slightly lower than the number of shocks reported by non-cash crop growers in both regions, though these numbers must be interpreted with caution as they do not account for the slow onset coffee and cashew price declines which affected all cash crop growers. The difference in shock incidence between poor and non-poor households is not statistically significant in either region.

Figure 3.1: Number of times shocks affected households in Kilimanjaro Region within the past five years, by status as cash crop producer



Source: Own calculations

Figure 3.2: Number of times shocks affected households in Ruvuma Region within the past five years, by status as cash crop producer



Source: Own calculations

Table 3.2 presents the percentage of sample households that experienced a particular type of shock at least once between 1999 and 2003.[1] Health related shocks (death and illness) emerge as the predominant risk households face both in Kilimanjaro and Ruvuma. Drought shocks feature as the second most important risk in Kilimanjaro, though drought incidence does not appear as a major risk factor in Ruvuma. Others shocks are much less frequent.

Table 3.2: Percentage of households affected by each shock type between 1999 and 2003, by region

	Kilimanjaro	Ruvuma	All
Health			
Death	25.9**1)	17.4	21.8
Illness	23.1**	18.7	21.0
Climatic			
Drought	32.7**	4.4	19.2
Excessive rain/floods	7.2**	3.4	5.4
Agricultural production			
Harvest loss	6.5	5.4	6.0
Livestock loss	6.4**	4.0	5.3
Post harvest maize loss2)	-	1.7	0.8
Economic			
Cash crop price shock2) 3)	-	4.6	4.6
Cereal price shock2) 3)	-	2.5	2.5
Unemployment	0.9*	0.1	0.5
Property			
Theft	5.4	4.9	5.2
Fire/house destroyed	0.7	3.3**	1.9
Land loss	0.5	0.1	0.3

Source: Own calculations.

1)**Indicates that the proportion of households that experienced the shock type is significantly different between the two regions at the 99% confidence level; * indicates significance at the 95% level; + at 90%.
2) This information was not collected in the Kilimanjaro survey. The total (final column) applies to Ruvuma only.
3) Price shock is defined as an unexpected decline in the price compared to the previous year.

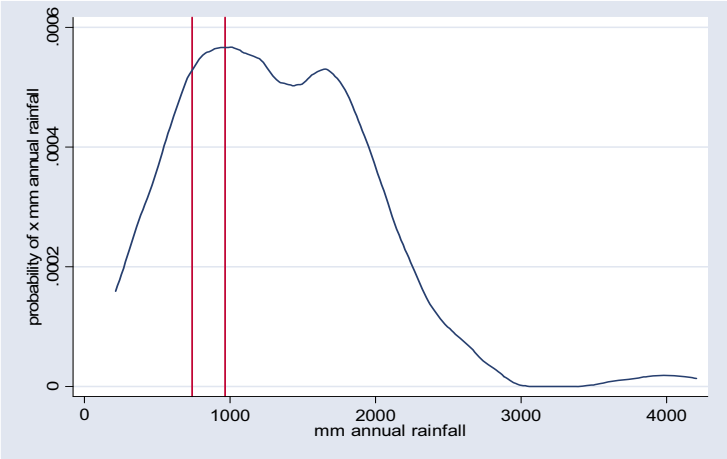
The emerging pervasiveness of health and drought risks in rural livelihoods is consistent with the evidence from other studies. Thirty and seventeen percent of the households in Kagera identified death and illness respectively as a shock with a major negative effect on their welfare over the past decade, while 18 percent identified weather related harvest failure as a major shock (World Bank, 2005). Respondents' rankings of different shocks in two villages in the Kagera region reveal drought and illness respectively as the first and second most important shocks (Kessy, 2004). From the nationally representative HBS we learn that 27 percent of Tanzanians are ill at least once every month. These findings are also consistent with those from neighboring countries. Dercon *et al*., (2005) for example identify drought and illness as the major risk factors in Ethiopia.

While these findings are based on households' subjective assessments and recall of shock events, analysis of the distribution of rainfall patterns in Kilimanjaro and Ruvuma lends supports to the emerging picture. Figures 3.3 and 3.4 show the distribution of total annual

[1]The reported results do not change qualitatively if we use the average number of times a household experienced a particular shock over the past 5 years instead (attributing zero if they did not experience the shock).

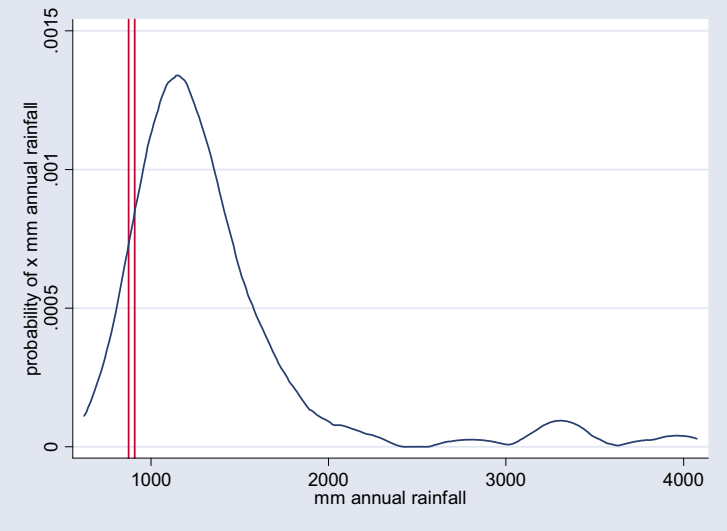
rainfall from 1970 to the present for 10 meteorological stations in Kilimanjaro and five stations in Ruvuma.[1]

Figure 3.3: Kernel density of annual mm rainfall in Kilimanjaro Region



Source: Own calculations using data from the Tanzania Meteorological Agency

Figure 3.4: Kernel density of annual mm rainfall in Ruvuma Region



Source: Own calculations using data from the Tanzania Meteorological Agency

It is clear from these graphs that that while the average rainfall level for the two regions is similar (1,289.7 mm for Kilimanjaro and 1,211.5 for Ruvuma) the distribution of rainfall in Ruvuma is much less dispersed than that for Kilimanjaro. To better understand people's own definition of a rainfall shock, respondents were asked in how many of the past ten years was rainfall "much below normal", and further whether they would consider rainfall at one-tenth, one-quarter, one-third, and one-half below normal "much below normal". Using their responses, we derive two definitions of a rainfall shock.

On average, respondents in Kilimanjaro reported that rainfall had been very low in 2.5 of the past 10 years, whereas in Ruvuma the average number of very low rainfall years was only

[1] Years with any missing months were dropped from this analysis, leaving a total of 248 annual observations for Kilimanjaro and 124 in Ruvuma.

0.65. We therefore define a rainfall shock in Kilimanjaro as an annual total below the 25th percentile of observations in Kilimanjaro during the past 10 years. The threshold for Ruvuma is the 6.5th percentile over the same period within that region.

From the second set of questions, we can define a rainfall shock as the minimum level which a majority of people define to be a shock. In both regions a majority of respondents (63.7 percent in Kilimanjaro and 59.7 percent in Ruvuma) considered a quarter below normal to be "a lot below normal". Assuming that respondents view the long-term median rainfall level as "normal", we multiply this amount by 0.75 to define the second shock threshold. For Kilimanjaro, the probability of a rainfall shock using this definition is 14.8 percent; for Ruvuma it is 8.8 percent.

The two vertical lines in each of Figures 3.3 and 3.4 represent these two definitions of a rainfall shock. In each case, the definition taken from the proportion of low rainfall years of the past 10 yields a lower threshold, though the difference is much more pronounced for Kilimanjaro. More importantly, droughts are clearly much less frequent in Ruvuma than in Kilimanjaro, consistent with the reported drought shock incidence in each region.

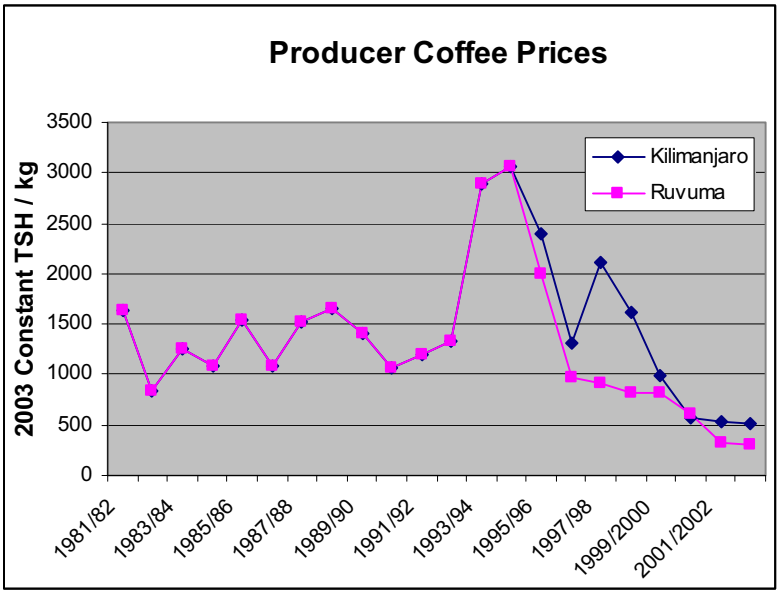
Respondents were asked about the relative amount of rain received on each of their cultivated parcels of land over the past year, on a scale of 1 to 5, with 3 being normal/average, 1 much above normal and 5 much below normal. Weighting these by parcel size and defining a rainfall shock as an average of 4.5 or higher, the shock incidence in Kilimanjaro in the first year of the survey was 20.7 percent, whereas for Ruvuma it was much lower, at 3.6 percent. These figures are comparable to the incidence of drought as reported in the shock section of the questionnaire, with 32.7 percent and 4.4 percent of households reporting a drought at least once over the past 5 years in Kilimanjaro and Ruvuma respectively. The low reported incidence of cash crop price shocks (2 to 4 percent) is of particular interest, especially given the steady decline in world coffee price since 1999.[1]

However, it is important to note that price shocks were defined to respondents as an unexpected decline in price compared to the previous year.[2] Price shocks to commodities that have been slow in their onset are not fully captured by this definition. As shown in Figures 3.5 and 3.6, both coffee and cashew prices have fallen significantly over the five years prior to the time of the survey. These sharp drops in price followed historically high prices for both crops. Coffee from Kilimanjaro experienced another (smaller) price peak in 1998-1999, but this was not mirrored in the prices for Ruvuma coffee beans, suggesting that Ruvuma coffee growers have had a longer time in which to adjust their livelihood strategies to the low prices.

[1] Since 2004, coffee prices appear to be rising again.

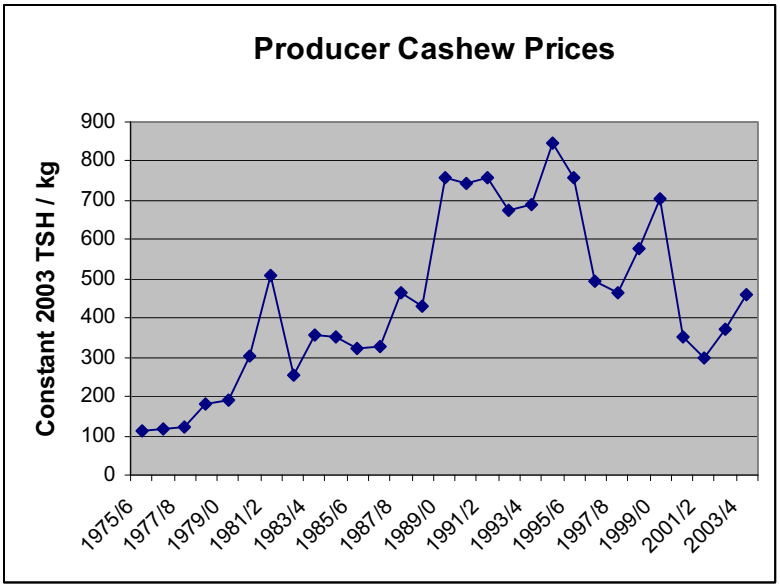
[2] Such shocks could be effectively managed through participation in existing commodity futures markets. See Chapter 6.

Figure 3.5: Real producer prices for mild coffees, Kilimanjaro and Ruvuma Regions, 1981-2003.



Source: Tanzania Coffee Board data.

Figure 3.6: Real producer prices for cashew nut, Tanzania, 1975-2004



Source: Tanzania Cashew Board data.

When asked about the occurrence of coffee price shocks at the village level, without explicitly stating that this only concerned an unexpected deviation from last year's price, leaders of the surveyed villages representing 35.6 percent of Ruvuma households and 82.8

percent of those in Kilimanjaro[1] reported that their community had suffered a coffee price shock. A cashew price shock was reported by communities in Ruvuma representing 24.5 percent of the region's population. Coffee and cashew tend to be highly geographically concentrated within both regions, and within those villages in Ruvuma reporting a price shock, an average of 84.8 percent and 94.9 percent of households were believed to have been affected by the coffee and cashew shock respectively. In Kilimanjaro, 95.3 percent of households in the communities affected by a coffee price shock were thought to have suffered. The tobacco price shock was not as covariate, with only about half (46.5 percent) of households within affected villages, which represented 25.1 percent of Ruvuma's population, believed by village leaders to have experienced the shock directly.

Table 3.2 further shows that short-term food price shocks are relatively unimportant, affecting less than 3 percent of the households. Mahul (2005) and evidence from Kagera (World Bank, 2005) also indicate that food price fluctuations are not a major issue in Tanzania.

Given the importance of health related shocks, we further explored which illnesses or injuries most seriously affect households (Table 3.3).[2] In line with findings in the 2000/01 HBS, malaria is the most frequently reported cause of ill health and death in Kilimanjaro. This is followed by respiratory and intestinal infections. Tuberculosis, an opportunistic infection common among AIDS patients, is also among the top five. This is consistent with the URT (2002), which reports that communicable diseases make up about half of the total burden of disease in Tanzania. It further suggests that HIV/AIDS is taking a heavy toll in rural areas. Addressing communicable diseases of largely preventable nature emerges as an important vulnerability reducing agenda in Tanzania (see also Hoogeveen, 2005).

Table 3.3: Reported causes of death or serious illness in Kilimanjaro Region

Illness or injury	% of cases
Malaria/fever	12.6
Respiratory	10.6
Intestinal infections	9.6
TB	7.3
Accident	6.6
AIDS	4.9
Pregnancy related	3.1
Mental illness	2.4
Diarrhoea	1.3
Skin infections	0.8
Cholera	0.5
Measles	0.4
Other	40.1

Source: Own calculations

[1] For 3 of the 45 communities in Kilimanjaro Region, the community questionnaire was not completed. The percentage reported here reflects only those villages for which the questionnaire was completed.

[2] To understand which illnesses or injuries most seriously affected households, we asked respondents who had experienced the death or serious illness of a household member(s) over the past 5 years to report the cause of death or type of illness. Note that these responses do not reflect all deaths or illnesses, but rather only those which were reported as shocks.

Table 3.4: Percentage of households affected by each shock type between 1999 and 2003, by region and status as cash crop grower

	Kilimanjaro		Ruvuma		Total
	Cash crop	Non-cash crop	Cash crop	Non-cash crop	
Health					
Death	23.1	29.9*** 1)	16.3	19.0	21.8
Illness	23.3	22.8	18.5	19.1	21.0
Climatic					
Drought	27.8	39.9**	2.8	7.1*	19.2
Rains	4.3	11.5**	4.2	2.2	5.4
Agricultural production					
Harvest loss	5.2	8.6*	6.1	4.4	6.0
Livestock loss	5.1	8.5*	3.1	5.4*	5.3
Post harvest maize loss2)	-	-	0.9	2.9***	1.7
Economic					
Cash crop price shock2) 3)	-	-	5.8**	2.7	4.6
Cereal price shock2) 3)	-	-	0.8	5.1**	2.5
Unemployment	0.3	1.7*	0.2	0.0	0.5
Property					
Theft	4.4	6.9***	3.7	6.9*	5.2
Fire/house destroyed	0.2	1.4**	3.0	3.7	1.9
Land loss	0.2	0.9***	0.2	0.0	0.3

Source: Own calculations

1) ** Indicates that the proportion of households that experienced the shock type is significantly different between cash crop producing households and others within the region at the 99% confidence level; * indicates significance at the 95% level; *** at 90%.

2) These shocks were not included in the Kilimanjaro module; final column applies to Ruvuma only.

3) Price shock is defined as an unexpected decline in the price compared to the previous year. This information was not collected in the Kilimanjaro survey.

Abstracting from the incidence of slow onset price shocks to which cash crop growers are much more exposed than non-cash crop growers, we recall from Table 3.1 that non-cash crop growers appear more prone to shocks than cash crop growers. This holds across the different shocks, and is statistically significant for many of these, as indicated in Table 3.4.

In contrast, poor households appear to experience shocks with no more or less frequency than others. The incidence of drought, harvest and livestock losses is slightly lower for poor households in Kilimanjaro, though richer households experienced more deaths, potentially AIDS related.

Table 3.5: Percentage of poor and non-poor households affected by each shock type between 1999 and 2003 by region

	Kilimanjaro		Ruvuma		Total
	Poor	Non-Poor	Poor	Non-Poor	
Health					
Death	20.9	29.1*	15.7	17.2	21.8
Illness	24.1	22.4	18.3	18.1	21.0
Climatic					
Drought	37.1	29.8*	4.4	4.5	19.2
Rains	8.8	6.1	3.2	1.8	5.4
Agricultural production					
Harvest loss	8.2	5.5***	5.6	4.7	6.0
Livestock loss	9.1	4.7*	3.4	4.9	5.3
Post harvest maize loss[2)]	-	-	1.9	1.4	1.
Economic					
Cash crop price shock[2) 3)]	-	-	4.9	3.5	4.4[3)]
Cereal price shock[2) 3)]	-	-	2.5	2.3	2.1[3)]
Unemployment	0.9	0.9	0.2	0.0	0.5
Property					
Theft	5.4	5.5	5.3	4.2	5.2
Fire/house destroyed	0.7	0.7	2.7	3.3	1.9
Land loss	0.3	0.6	0.0	0.3	0.3

Source: Own calculations

1) ** Indicates that the proportion of households that experienced the shock type is significantly different between poor households and others within the region at the 99% confidence level; * indicates significance at the 95% level, *** at 90%.

2) These shocks were not included in the Kilimanjaro module; final column applies to Ruvuma only

3) Price shock is defined as an unexpected decline in the price compared to the previous year. This information was not collected in the Kilimanjaro survey.

3.2.3 Correlation of risks

As discussed in section 2.1, whether a risk is idiosyncratic or covariate has bearing on the ability of households to effectively manage the risk through formal or informal insurance mechanisms. Covariate risks are generally assumed to require a greater degree of external intervention than idiosyncratic shocks. On the other hand, idiosyncratic shocks may have also serious consequences for welfare, particularly for socially marginalized households who may be excluded from the social networks mediating informal insurance. Given that covariate and idiosyncratic risks require different interventions, knowing the extent to which particular shocks tend to be idiosyncratic or covariate in nature is important to the design of safety net programmes.

Respondents were asked to estimate the number of other households in the village (apart from their own) affected by shocks. Responses to this question by shock are presented in Table 3.6 below.

Table 3.6: Percentage of each shock type considered covariate according to respondents' perceptions of who else was affected

Type of shock	Respondents' perception of who else was affected by the shock in the community (percent of respondents that gave indicated answer)	
	Many/almost everybody (Covariate)	Only this/few households (Idiosyncratic)
Drought	94.8	5.2
Cash crop price shock	88.6	11.4
Rains	83.3	16.7
Harvest loss	79.2	20.8
Cereal price shock	73.5	26.5
Land loss	36.4	63.6
Livestock loss	21.4	78.6
Theft	5.5	94.5
Death	5.2	94.8
Post harvest maize loss	3.8	96.2
Fire/house destroyed	3.8	96.2
Illness	3.0	97.0
Unemployment	0.0	100.0
Total	34.8	65.2

Source: Own calculations

Findings in Table 3.6 clearly indicate that climatic and price shocks, as well as major harvest loss are covariate shocks typically affecting many households at a time. However, depending on its cause, harvest loss may also be idiosyncratic. Other major shocks, namely loss of livestock, death of a household member, and major illness are primarily idiosyncratic. Idiosyncratic shocks constitute a majority of all reported shocks. These findings suggest that geographic targeting would be appropriate in tackling weather (rainfall), crop performance and price shocks. Health shocks on the other hand require more specific targeting at the household level.

3.3 Household coping strategies

Households employ *ex-ante* (prevention and mitigation) and *ex-post* (coping) strategies to smooth their consumption following a shock event (Heitzmann *et al*.,2002; Holzmann and J∅rgensen, 2000; Alwang *et al*., 2001; URT, 2004). Here we focus on coping strategies. Documenting the type of strategies used to cope with shocks is useful as it also reflects the severity of a shock's impact on household welfare. For example, drawing down savings, receiving assistance, or generating additional income are shock mitigation strategies to preserve the consumption level of the household which do not come at the immediate expense of future consumption. The sale of productive assets can put households on a long term lower earning path. Again, we explore whether cash and non-cash crop producers cope differently with shocks and whether coping strategies differ among poor and non-poor households.

3.3.1 Coping strategies adopted by households to cope with shocks

Table 3.7 exhibits the different coping strategies used by rural households in Kilimanjaro and Ruvuma. Somewhat surprisingly, almost three quarters of all rural households who experienced a shock over the past five years used savings or sold assets to cope with at least one shock, with assistance from others emerging as the second most important coping strategy. About half of shock-affected households in Ruvuma received assistance from family

members, friends or state and non-state institutions and about 60 percent of households in Kilimanjaro. In both regions about 30 percent of shock-affected households tried to generate additional income. Consistent with our earlier observations that poverty incidence in Ruvuma is higher than in Kilimanjaro, households in Ruvuma tend to revert more to a reduction in non-food expenditures. The proportion of households affected by a shock that resorted to reducing food expenditures is quite high, and statistically indistinguishable in both regions: food security is substantially affected by risk in both Kilimanjaro and Ruvuma. Both migration and borrowing were much less frequently observed responses to shocks.

Table 3.7: Percentage of shock affected households in Kilimanjaro and Ruvuma using strategy to cope with at least one shock between 1999 and 2003

	Kilimanjaro	Ruvuma	Both Regions
Used cash savings	72.6	74.5	73.4
Received aid	59.7[1)]	51.7	56.3
Generated additional income	30.6	31.2	30.8
Reduced non-food consumption	25.0	29.3[1)]	26.8
Changed dietary patterns	24.2	28.2	25.9
Migrated / split up household	6.0	7.9	6.8
Borrowed	5.8	4.6	5.3

Source: Own calculations

1) Indicates that the proportion of households using the strategy is significantly different between regions at the 90% confidence level.

Results in Table 3.7 indicate that disposition of savings/assets is the most frequently used strategy to cope with shocks. Use of liquid savings does not disrupt households' productive resource base, though the precautionary savings required for such a strategy to be used may tie up scarce assets in unproductive or low-productivity assets. Nonetheless, overall it could suggest that households are quite able to weather the shocks, i.e. they are not so vulnerable. Liquidation of productive assets on the other hand has implications for the households' future productive capacity. Households presumably only resort to these strategies in case of deep stress and large-scale liquidation of productive assets would suggest that households are much more vulnerable. For this reason, further disaggregation can shed light on the vulnerability status of rural households in rural Tanzania. Table 3.8 shows the proportion of households which used or sold the particular asset to cope with at least one shock.

Table 3.8: Of those households which used savings or sold assets, percentage that used particular asset at least once, by region[1]

	Kilimanjaro	Ruvuma	Both Regions
Cash savings	73.5	68.0	71.1
Foodstocks	15.9	22.7[**1)]	18.8
Livestock (other than cattle)	16.2	19.3	17.5
Cattle (other than oxen)	10.3[**]	2.0	6.8
Jewelry or household items	6.6	5.7	6.2
House or land	4.1	3.8	4.0
Oxen	2.5[***]	0.9	1.8

Source: Own calculations

1) [**] Indicates that the difference in proportion of households that used the asset between regions is significant at the 99% confidence level; [*] indicates significance at the 95% level, and [***] at 90%.

Almost three-quarters of all households who use savings or assets in case of shocks draw down their cash savings. This shows that households keep savings in cash and would suggest

[1] Columns do not add to 100 because households may have liquidated assets in more than one category.

that they are overall well able to cope with most shocks. Only about one-quarter of the studied households using assets to cope with shocks sold livestock. More broadly, the role and effectiveness of livestock in coping with shocks is still poorly understood in Sub Saharan Africa (Fafchamps, *et al*., 1997; Christiaensen and Subbarao, 2005; Kazianga and Udry, 2006). In understanding the effectiveness of livestock in smoothing consumption it is also important to distinguish between more liquid and less productive small ruminants (goats/sheep) and the less liquid and more productive cattle. Less than 7 percent of households selling assets, constituting only 4 percent of all households, sold cattle or oxen. Less than 5 percent of the households using assets (2 percent of all households) were forced to sell their land or house to cope with the shocks. Together the evidence suggests that households are overall quite capable to deal with shocks and that they were thus not so vulnerable.

Further analysis of the sources of assistance (Table 3.9) shows that the overwhelming majority of households which received assistance were aided by family members, and to a much lesser extent, their fellow villagers/friends and neighbours. The proportion of shock-affected households receiving assistance from either public or private institutions is very low. This observation underscores the continuing predominance of traditional methods in handling risks in rural Tanzania. Formal risks management instruments are virtually unavailable to rural households.

Table 3.9: Of those households which received aid, percentage that received aid from a particular source at least once

	Kilimanjaro	Ruvuma	Both Regions
Family	92.9	91.0	92.3
Neighbours / villagers	13.7**1)	5.0	11.0
Friends	5.8	1.6	4.5
Government	5.4**	1.9	4.3
Religious	3.9	1.5	3.1
(Inter) national NGO	0.6	1.0	0.7
Local NGO	0.5	0.0	0.4

Source: Own calculations

1) ** Indicates that the proportion of households using the coping strategy is significantly different between regions at the 99% confidence level.

Third on the list of coping strategies used by households is the generation of additional income. Around 30 percent of shock-affected households employed this strategy to contend with the effects of shocks. The observation that households have opportunities to generate additional income is good.

Table 3.10: Of those households which generated additional income to cope with a shock, percentage that used particular strategy at least once

	Kilimanjaro	Ruvuma	Both Regions
Increase agricultural labour	63.5	59.2	61.7
Non-farm enterprise	29.2	37.5*1)	32.7
Food for work	2.0	4.5	3.1

Source: Own calculations

1) ** Indicates that the proportion of households that experienced the shock type is significantly different between cash crop producing households and others within the region at the 95% level.

Findings presented in Table 3.10 indicate that rural households rely primarily on agricultural labour, either through intensification of work on their own farm, or through employment on others' land. Non-farm enterprise such as making of handcrafts and fishing is also an important income-generating strategy, used by about a third of households, with a slightly higher proportion in Ruvuma than Kilimanjaro. This is a much higher proportion of engagement in non-agricultural activities compared with Chapter 2, indicating that returns may be relatively lower for non-agricultural enterprise, but that these activities nevertheless constitute an important emergency source of income. It should also be kept in mind that while opportunities to generate additional income are certainly welcome, these do not come for free. Longer hours at work imply that income-earners have less time to attend other household duties such as caring for children. Alternatively, the increase in agricultural labour could be the result of increased child labour. Engaging in off-farm employment to generate cash for immediate needs reduces the availability of household labour for own farm production, which may have a higher return but involve a time lag before crops can be harvested.

Other methods of handling shocks identified in this study include the reduction of non-food expenditure, consumption of less expensive foods, and sending household members away to work or migration of the entire household. It is clear that the cost of implementing these strategies, particularly the latter three, is high. Consumption of less expensive foods, which often include lower-protein foods, can lead to malnutrition and associated illnesses. This strategy was employed at least once over the past five years by 26 percent of households that experienced a shock, or 17 percent of all households, a disturbingly high number. The proportion of households reducing food expenditures was slightly higher in Ruvuma, the poorer of the two regions.

3.3.2 Coping strategies by cash crop and non-cash crop growers

To explore the difference in coping strategies (and by extension shed light on differences in their vulnerability status) of cash crop producers versus others, we consider next the coping strategies employed by each group.

Table 3.11: Percentage of shock affected households using strategy to cope with at least one shock between 1999 and 2003, by region and status as cash crop grower

	Kilimanjaro		Ruvuma		Total
	Coffee growers	Non-coffee	Cash-crop growers	Non-cash crop	
Used cash savings / sold assets	76.3*	68.0	76.4	71.8	73.4
Received aid	59.5	60.0	69.2***	60.0	56.4
Generated additional income	28.7	33.0	27.8	36.2	30.8
Reduced non-food consumption	30.0**	18.7	32.0*	24.9	26.8
Changed dietary patterns	27.5*	20.0	30.3	24.7	25.9
Migrated / split up household	5.1	7.2	7.8	8.0	6.8
Borrowed	4.4	7.5***	2.3	7.8**	5.3

Source: Own calculations

** Indicates that the proportion of households that experienced the shock type is significantly different between cash crop producing households and others within the region at the 99% confidence level; * Indicates significance at 95% confidence, and *** at 90%.

Results in Table 3.11 indicate that cash crop producers and non cash crop producers largely use the various coping strategies with similar frequency. Interestingly however, cash crop

producers tend to use more of the low-cost coping strategies (significantly higher use of savings in Kilimanjaro, and receipt of aid in Ruvuma), but they also tend to use more of the costly coping strategies such as reduction in non-food expenditures and substitution into less expensive foods. This suggests a diversity in responses, reflecting the diversity of wealth levels among coffee growers as discussed in Chapter 2, with the larger coffee farmers able to weather the coffee and cashew price declines quite well, and the smaller farmers having to revert to more painful coping strategies.

We next turn to the coping responses of the poor versus non-poor households. Households are classified as poor if their total consumption expenditures in the year preceding the survey fell below the basic needs poverty line as defined in Chapter 2.

Table 3.12: Percentage of poor and non-poor shock affected households using strategy to cope with at least one shock between 1999 and 2003, by region

	Kilimanjaro		Ruvuma		Total
	Poor	Non-poor	Poor	Non-poor	
Used cash savings / sold assets	66.0	77.2*	73.3	76.5***	73.4
Received aid	51.1	65.8*	50.4	54.2	56.4
Generated additional income	33.3	28.7	32.6	28.9	30.8
Reduced non-food consumption	31.6	20.3**	29.4	29.1	26.8
Changed dietary patterns	29.9	19.6**	29.1	26.5	25.9
Migrated / split-up household	5.1	6.7***	7.8	8.2	6.8
Borrowed	7.9	4.3**	4.2	5.3	5.3

Source: Own calculations

** Indicates that the proportion of households that experienced the shock type is significantly different between poor households and others within the region at the 99% level; * Indicates significance at 95% confidence; *** at 90%.

As expected, poor households, who typically have fewer savings and assets to draw on, are less likely to use these to cope with a shock. In Kilimanjaro poorer households are also less likely than others to receive assistance from others. Evidence of exclusion of the poor from informal social insurance networks has been documented by Santos and Barrett (2005). Not surprisingly, in both regions poorer households are more likely to modify dietary attitudes towards less expensive food baskets. Poor households in Ruvuma appear to be rather similar with richer ones with respect to reducing non-food consumption as a shock coping mechanism. This may reflect that these households have few non-essential expenses to start with.

3.3.3 Coping strategies by type of shock

As discussed above, households' options for coping with shocks is expected to differ according to the nature of the shock. Specifically, if a shock affected others on whom the household would normally rely for assistance, the probability of receiving such support is diminished. Table 3.13 shows evidence of this effect. Over 65 percent of the times households suffered an idiosyncratic[1] shock, they received assistance from others; this drops to just 34 percent if the shock was described by the household as affecting many or most other households within the community.

[1] Defined as in Table 3.6.

Table 3.13: Percentage of shocks idiosyncratic and covariate for which a particular strategy was used

	Idiosyncratic	Covariate	All Shocks
Used cash savings / sold assets	68.3	68.4	68.3
Received aid	65.4**1)	33.1	54.3
Generated additional income	22.8	33.9**	26.6
Reduced non-food consumption	24.3	26.1	24.9
Changed dietary patterns	22.6	26.8**	24.0
Migrated / split up household	5.3	5.5	5.4
Borrowed	7.5***	4.8	6.5

Source: Own calculations

1) ** Indicates that proportion of times the strategy was used is significantly different between idiosyncratic and covariate shocks at the confidence 99% level; * indicates significance at the 95% level; *** at 90%.

We also see in Table 3.13 that households are more likely to respond to a covariate shock by attempting to generate more income. Unfortunately, this may reduce the effectiveness of the strategy. If the labour supply increases sharply in response to a covariate shock, wages may decrease or unemployment arise unless the demand for labour is concurrently increased. Likewise, if many non-farm enterprises start up or expand in response to a covariate shock, markets for the goods they sell may be quickly saturated. Government food for work or other public works programme that expand the demand for labour in times of widespread crisis can provide one response to this problem. The degree to which households suffer more greatly from covariate shocks is seen in the higher proportion of households decreasing their food expenditures in response to these shocks.

3.4 Conclusion and recommendations

The overall objective of this chapter was to assess rural households' risk environment in Tanzania using Kilimanjaro and Ruvuma as case study regions. Specifically, the paper was meant to (i) identify and characterize shocks to which households are exposed, (ii) identify and characterize coping strategies used by farm households and (iii) deduce some relevant hypotheses regarding policy which may be of use in helping to secure the livelihoods of farm households in rural Tanzania. We have seen that in addition to slow onset commodity price declines, health risks and climatic shocks are the most pervasive risks affecting farm households in rural Tanzania. The prevalence of health shocks stems largely form the high incidence of preventable communicable diseases such as malaria.

Aside from the price volatility that plagues coffee and cashew growers alike, households who do not grow coffee appear slightly more exposed to risk than those who do. The poor and non-poor suffer from shocks with approximately the same frequency.

In order to survive during periods of crisis, households in rural Tanzania rely heavily on the use of, primarily liquid, assets. Many also rely on support from kin and, to a lesser extent, non-kin social networks. Households have few coping options available aside from self- and informal social insurance due to the inexistence of formal insurance or safety net programmes through the government, non-governmental organizations or the private sector. The existing informal mechanisms exclude many of the poor, who have fewer savings to draw on, and, in Kilimanjaro, are also less likely to receive assistance from others.

These observations indicate that efforts to contain the spread of communicable diseases in rural Tanzania, and to develop mechanisms through which households can better manage health and weather risks could have a significant impact on welfare. Our findings further

suggests that of all the risks faced by farm households in Tanzania, weather, price, and crop performance shocks are the most difficult to manage through informal mechanisms due to their covariate nature. Finally, it is clear that formal safety nets and insurance mechanisms have as yet unrealized potential to help rural households manage risk more effectively. We explore the immediate welfare losses associated with drought, health and commodity price shocks in more depth in Chapter 5 using a multivariate framework.

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