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Maize Farming and Household Wellbeing:
A case study of Rukwa, Tanzania

Justin K. Urassa

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Abstract

Production of staples occupies an important part in Sub-Saharan Africa's crop production, and maize is its single most important food staple. This study mainly examines the role of maize in farmers' livelihoods and wellbeing in Tanzania, in the context of a long period of reforms that have affected both the maize market, agriculture more widely. It does so by exploring the role of maize in household's on and off-farm diversification, the determinants of crop productivity, and the relationship between diversification, commercialisation and' well-being. A number of specific issues are explored including the importance of factors such as farm size and education, access to key inputs such as seeds, fertilizers and agricultural extension services. The study uses data collected from three districts of Rukwa, one of Tanzania's major maize producing regions, and some secondary agricultural data from official sources. It can be concluded from the regression analysis that a lack of commercialization of maize production by households reliant on the crop as a source of household income were in danger of being trapped deep into poverty due to their lower incomes reported, relative to those commercializing their production or those diversifying into cash crops. Other factors that significantly affected a household's income, asset base or both were age of household head and location. Based on the logistic regression, the study concludes that households' perceived ability to meet their health, education and social activities costs and their ownership of a good quality house were driven by various factors. Number of livelihood strategies adopted by households was more important in households' ability to meet their health and education costs; as expected gender had an important role in the surveyed households' ability to own a good house. Lastly, it can be concluded that the influence of farm size on rural households' well-being was relatively much stronger and more consistent with expectations. These findings have important policy implications as many rural households continue to rely on agriculture, especially production of staples. Therefore, these results could help the central and local governments to formulate strategies geared towards improving rural well-being.

1.0 Introduction

Tanzania has for a long time experienced low levels of well-being. Despite a slight rise of 1.15% in her HDI from 0.436 (1990) to 0.530 (2007), based on the 2007 HDI the country ranks 151st out of 182 countries on which data is held. With an HPI-1 value of 30.0% the country ranks 93rd among 135 countries for which the index has been calculated[1] (UNDP, 2009). Policy changes since the 1980s would indicate the likelihood of some changes in well-being. This study aims to understand levels of well-being among rural households in Rukwa, the relationship between well-being and agricultural production, particularly the contribution of maize sales and other crops to household income and assets, and their ability to pay for key services such as health and education. Following the underperformance of Tanzania's agricultural sector and deteriorating living standards in the 1980s and 1990s, the government instituted various socio-economic reforms aimed at among other things improving well-being of rural and urban dwellers. Among the policies instituted was reform of the agricultural sectors that led to the liberalization of the maize market in 1986. According to literature (URT et al., 2004) maize production continues to have great importance in Rukwa. There has been an increase in land under its cultivation and an increase in output, which may lead us to the conclusion that income from maize has risen too. However, Appendix I shows that the expansion of land under maize production has not been matched with increases in yield, so incomes may not have risen accordingly.

The study pursues a number of hypotheses, one of which is to examine the role maize plays in Rukwa households' well-being. Commercialization is one way of ensuring households' food security and general well-being (Spring, 2000 and Hazel et al., 2007). Literature shows that commercialization at the farm level could take place in various ways by growing of cash crops, change in the share of marketed output or change in the share of purchased inputs per unit of output (Satyasai and Viswanathan, 1997). The study aims to examine how commercialization of crop production by households, especially of maize, was associated with their well-being. Secondly, diversification of livelihood strategies by households has been shown in literature (Chambers, 1997 and Barret *et al*., 2001) to be common amongst rural households; the study aims to examine how diversification of crop and LS is associated with general well-being.

Finally, the study explores a number of other features associated with well-being such as human capital. Generally, household heads' attributes, for example gender, education level and ownership of assets such as land, could influence a household's choice of LS and eventually their well-being. According to research by Ellis and Allison (2004) there is a possibility that well-being may differ between MHHs and FHHs, as differential access

[1] Using other measures of well-being such as the probability of not surviving to age 40 (%), adult illiteracy rate (% for ages 15 and above), and people not using an improved water source (%) puts the country in the lower ranks of 129, 111, and 137 respectively (UNDP, 2009).

to resources and gender stereotyping cause the two to have different LS, which may in turn influence their well-being. The study aims to examine this parameter. The study also intends to determine whether households with more educated heads are better placed in terms of the well-being measures being examined. Finally, the importance of land to rural livelihoods cannot be exaggerated, and as shown in literature (Immink and Alarcón, 1992; Block and Webb 2001; Ellis 2005; Hazel et al., 2007 and Wiggins, 2009) there is a debate on relationship of farm size to farm households' well-being. There is the possibility that households with larger farms could be able to get higher outputs, enabling them to diversify more; alternatively diversification of LS could enable households with less land to earn more income with which they could purchase more land leading to more output and income, other factors remaining constant. Thus, the study will also examine the association between farm size and households' well-being.

After presentation of the conceptual framework in section 1.1, the study in section 2 presents the study's objectives and section 3 covers the methodology. Thereafter section 4 presents the results and discussion and lastly section 5 the conclusion and recommendations.

1.1 Conceptual framework for determining well-being of the surveyed households

Use of the concept well-being in measuring people's welfare or way of life is a recent development after an increase in criticisms of the old approach of determining people's poverty only on the basis of income and material well-being. According to Gough et al. (2007) despite there being millions of poor people in the developing world it is important that they are looked upon from a perspective of how they are struggling to achieve well-being for themselves and their children rather than concentrating entirely on their poverty. Gough et al., citing Biswas-Diener and Diener (2001) further argue that poor men and women in developing countries should not be viewed from the poverty perspective only, as despite their deprivations, the poor are able to achieve elements of what they conceive of as well-being. According to Gough et al. the concept of poverty (or rather poverties) is faced with various limitations, and with time, literature around it has become very complex to the extent of becoming confused. Gough et al. (2007:4) also argue that there is a lot of debate "over many different types of poverty; from consumption to income poverty; to poverty defined in terms of the HDI or by social exclusion. Poverty can be relative or it can be absolute". To avoid all this, they advise the best way forward is the use of well-being, a wider concept, which covers and connects the various issues of poverty raised above. They caution that the approach does not abandon concepts of poverty altogether, but uses them in a wider discourse about well-being.

Determination of people's well-being has in the past been mainly based on income levels or expenditure levels of individuals or households (Townsend, 2006). Recently some researchers, for example Sen, (1993) cited by Gough et al. (2007), has argued that a multidimensional approach is necessary to accurately determine people's well-being. According to Townsend (2006) poverty has for a very long time been related to income and therefore

the latter has remained at the core of the concept's meaning. However, he argues that despite the advantages of maintaining income in the conceptualization of poverty, income as the case of poverty has various difficulties in conceptualization, so some scientists are trying other ways of conceptualizing income and poverty. For example he suggests inclusion of factors such as income equivalent of assets, free public services and subsidies to employment together with cash income so as to arrive at a comprehensive but accurate measure. He notes that these inclusions make the task of assembling an accurate measure daunting. Townsend further argues that poverty needs to be seen from the broader perspective of how individuals can fulfill the elaborate social demands and customs placed upon them by their society, rather than seeing the poor as victims of a misdistribution of resources. Such an approach is also adopted by Alkire and Deneulin (2009), who argue that well-being should be measured in terms of the *entire* distribution of individuals' achievements rather than just on one variable such as income.

Well-being according to Williams (1983) as cited by Gough et al. (2007:4) has its roots in the older English term of 'welfare' traceable back to at least the fourteenth century, during which it meant to journey well and could indicate both happiness and prosperity. In the twentieth century it gradually came to be associated with the assessment of and provision for needs in the welfare state, thus acquiring an increasingly objective, external interpretation. Gough et al. add that in the latter decades of the century, welfare was traced back to its original notion of well-being used as far back as Aristotle and Buddha, mainly due to the emergence of new discourses on agency, participation, and multidimensional views of poverty. As is the case with poverty, well-being as a concept does not have a single definition or conceptualization. Honderich (2005), cited by Gough et al. (2007) argues that even the new edition of the usually concise and parsimonious *Oxford Companion to Philosophy* defines well-being as "living and faring well" or "flourishing". On the other hand, the Research Group on Well-being in Developing Countries (WeD) defines well-being as; "a state of being with others, where human needs are met, where one can act meaningfully to pursue one's goals, and where one enjoys a satisfactory quality of life."(WeD, 2008:1).

According to Gough et al., well-being can be seen as an 'umbrella concept' embracing at least 'objective well-being' and 'subjective well-being' (SWB). Gasper (2008) notes that objective well-being can be taken to mean 'externally approved, and thereby normatively endorsed, non-feeling features of a person's life such as mobility or morbidity; SWB refers to 'feelings of the person whose well-being is being estimated'. Gough et al. notes that well-being being is a novel category in applied social science hence lacks a settled consensus on its meaning, but allows variety of related ideas and concepts to be included in its conceptualization. Vittersø (2004) shows that objective well-being includes measures such as freedom, justice, medical care, and standard of housing. And SWB comprises people's evaluative responses to their lives, and perceived or subjective experience of well-being.

The introduction to this section has shown that income and material assets are important in determining or enhancing well-being. The study aims to assess household income levels for 2005 and their 2006 asset base value. As shown in Table 4 the study only considers the actual cash inflows reported by households during the survey, which obviously limits the usefulness of the income measure as a measure of well-being, but does give insights into the importance of commercialization and integration into the cash economy. The asset value used by the study (Table 3.4) is based on respondents own valuation. A similar approach to assets consideration is reported by Deere et al. (2009), who point out that the importance of assets to households both in the rural and urban areas, particularly for those in the informal sector is that ownership of consumer durables such as a sewing machine, stove or refrigerator could constitute business assets, enabling a broad range of income generating activities. They argue that in addition to being means of production, some assets such as housing and land can generate rent. Others such as savings, land and business assets could generate some income through profit or interest paid. Assets according to Deere et al. (2009) are also an important buffer during emergencies as they can be pawned or sold to get income or service. Assets also act as an important indicator of a household's potential vulnerability to shocks and possibility of falling into chronic poverty[2]. According to Deere and Doss (2006), cited by Deere et al., assets are also important in generating status and social advantage.

Generally, research literature shows that evaluating well-being can be a difficult exercise. Bookwalter and Dalenberg (2004) argue that the tendency for economic policy in low-income countries to focus on the alleviation of poverty and deprivation on basis of low levels of income and wealth has many limitations, because most measures have focused on poverty from the relationship of money incomes or expenditures with well-being. In a need to broaden the way well-being is measured in Tanzania, the government adopted a new approach which uses a multidimensional approach to measuring well-being. The new approach determines a household's well-being by its ability to meet education, health, social capital costs and ownership of a good quality house with easy access to clean drinking water in the compound. The government further argues that improvement in the quality of life and social well-being depends on the provision, affordability and access to quality food and services like education, information, health, water, HIV and AIDS treatment and prevention, and social protection programmes, and by living in a clean and protected environment free from air and water pollution and mosquito breeding sites (URT, 2005).

Well-being can be determined in various ways; this study uses a range of indicators to address the multi-dimensionality of well-being and examines households' well-being along the wider approach of the Tanzanian government. The study also includes ability to afford a households health, education and social activities costs as perceived by the respondents (subjective well-being) and a household's ownership of a good quality house. This

[2] Addison, et al., (2008) cited by Deere, et al., (2009)

approach allows the study to overcome potential data problems around the measurement of income but also to use a broader range of indicators that may provide different insights into the nature of well-being.

1.2 Objectives of the Study

1.2.1 The general objective

The general objective of the study was to determine the contribution of maize farming to households' well-being in Rukwa region

1.2.2 Specific objectives

- To assess levels of well-being among rural maize farming households in Rukwa region.
- To determine the relationship between maize farming and households' well-being
- To determine socio-economic factors determining maize productivity and hence a households well-being

2.0 Literature Review

2.1 Conceptualization of key terminologies

This section defines or/and conceptualizes the key terminologies at the heart of the current study: rural areas; well-being; livelihoods and livelihood diversification; and trade liberalization. Getting together the different perspectives/conceptualizations is of importance particularly in giving explanations of the success or failure to improve the well-being of the surveyed farm households after many years of agricultural reforms and particularly the liberalization in the maize market.

2.1.1 What are rural areas?

Definition of rural areas varies depending on who is defining them and specific country situations. Its meaning differs significantly between developed countries, countries in transition and those in the developing world. The current study will mainly be based on a definition by the Tanzanian government, whose Rural Development Strategy (RDS) sees rural areas as "those including villages and small towns nearby urban centres" (URT/PMO, 2001:1). Other definitions have included other qualitative and quantitative characteristics. For example SARDF (1997:9) see rural areas as those with sparse populations who are dependent on natural resources, USDA (2005) describe them as areas comprising of open country and settlements with fewer than 2,500 residents; whereas Nwanze (2000) defines them as having population thresholds of between 5,000 to 10,000, who are primarily dependent on agriculture and/or natural resources for their livelihoods.

As compared to urban areas, rural areas are inhabited by people owning more 'rural-specific' assets such as farmland, livestock, and irrigation per person than urban people (IFAD, 2001). Conway cited by Ashley and

Maxwell (2001) points out additionally, that rural people are poor and isolated in every sense, and have few opportunities for off-farm employment, with labour demand being seasonal and insecure. Extension services are few and far apart and research on their specific needs is sparse too. The conditions of rural people can profoundly affect agricultural production and productivity, denying them opportunities to reduce their poverty or improve their living conditions.

Generally, individuals and governments define rural areas differently. However, major characteristics shared by the definitions include remoteness, low population densities and high dependence on agriculture and/or natural resources for livelihoods. Due to these characteristics people living in rural areas, particularly those in developing countries such as Tanzania, tend to own fewer human and physical assets.

2.1.4 What are livelihoods?

Defining the concept of livelihood is essential in order to develop understanding in discussions and conclusions to be reached by the study. According to Ellis (2000) livelihood as a concept has been widely used in contemporary writings on poverty and rural development. However, it has been defined differently by different observers. According to Ellis "A livelihood is defined as the assets, the activities and the access that determine the living gained by the individual or household" (p 22). Many other authors have tried to define the concept. Chambers and Conway (1992) cited by Ahmed and Lipton (1997:6) define livelihood as ".the ways in which people satisfy their needs or gain a living". According to Ahmed and Lipton a livelihood should be seen as "a set of flows of income, from hired employment, self-employment, remittances or (usually in developing rural areas) from a seasonally and annually variable combination of all these". They further stress that a livelihood should be able to assist those involved to avoid poverty, and preferably, increase well-being of the concerned person and his/her dependents.

Looking at the various ways in which livelihood has been conceptualized confirms Ellis' observation on the vagueness of the concept. Nonetheless, for more meaningful research work, especially that which involves the rural people's way of living, one needs to clearly state what a livelihood means in the particular setting, bearing in mind also the vagueness of the word rural as earlier explained (section 2.1.1). Hann and Zoomers (2005) have emphasized the importance of looking at livelihoods in a much broader way. They argue that a better understanding of livelihoods in a holistic way is critical in addressing poverty and the general livelihoods approach. In the writers' view a better understanding of both livelihoods and rural areas is important, as different people with different views of the concepts may find relevance in the findings of particular studies on rural livelihoods.

2.1.5 Diversification of rural livelihoods

This section examines definitions of the diversification of rural livelihoods, an understanding of which is especially relevant to Chapter Seven, which examines the well-being of rural households in Rukwa. Some definitions of diversification of livelihoods observe that rural households not only practice farming, but engage in an array of other ways to earn their living. Carswell (2002) argues that despite the contribution made by diversification of rural livelihoods, policy makers seem to only focus on agriculture. Ellis (2000:14) has tried to show a clear distinction between the words 'diversity' and diversification when the two are referred to livelihoods[3]. However, the terms are mainly used to mean multiple and multiplying income sources. Ellis defines livelihood diversification as" a process by which rural households construct an increasingly diverse portfolio of activities and assets in order to improve their standards of living" (2000:15). In their publications, Ellis (1998) and Carswell (2000:4) have used a modified version of diversification of rural livelihoods, which uses social support capabilities as an important measure of assisting rural people improve their living standards. Other authors writing on diversification have in principal worked in agreement with the definition of diversification of rural livelihoods or deviated from it by including other terms in their definitions. Ellis (1998) points out that even though he refers to rural livelihood diversification it doesn't mean there is no livelihood diversification in urban areas; citing various literatures[4] he shows that livelihood diversification isn't only a rural phenomenon for developing countries but also a survival strategy of urban dwellers in developing countries[5].

The importance of diversification of rural livelihoods is given weight by the fact that various researches have dealt with this area, describing a range of reasons why people in rural and as well as urban areas diversify. Reasons provided in this section will answer some of the questions that may arise in Chapter Five, concerning rural livelihoods strategies associated with well-being in Rukwa region. Chambers (1997) argues that the livelihoods of most poor people are more diverse and complex than professionals think, and that most people in the South (developing countries) and many in the North (developed countries) earn their livelihoods from a diverse array of activities. Barret *et al*., (2001:1) state,

> Diversification is a norm. Very few people collect all their income from any one source, hold all their wealth in the form of any single asset or use their assets in just one activity. Multiple motives prompt households and individuals to diversify assets, incomes and activities.

According to Barret *et al*., the major motives that push people into diversifying are 'push factors', which include risk reduction, responding to various constraints such as land fragmentation, and labour supply issues. The second major motive includes 'pull factors', which include involvement in complementary activities and

[3] Ellis defines diversity as "the existence, at a point in time, of many different income sources, thus also typically requiring diverse social relations to underpin them". p 14
[4] Barker and Pederson (1992); Rakodi, (1995) de Haan, (1997) and Moser, (1998)
[5] This can be seen to fit conceptualization of a livelihood which includes a broad array of sources of income as the definition by Ahmed and Lipton (1997).

specialization based on comparative advantage (Barret *et al*., 2001). Hart (1998) as cited by Ellis (1998) groups the motives into two major typologies. The first is the branch of literature predominantly concerned with diversification as a matter of survival, and the other sees diversification as a matter of choice and opportunity whereby households strive to improve their living standards. Ellis (1998: 8) sees diversification as being caused by a continuation of motivations, which are variable across families and time, and causes, which may in turn be location or disaster specific. Winters *et al*. (2001) in their review of literature of Latin America and the Caribbean, point out that diversification can occur as a result of the low profitability of agriculture and the withdrawal of the government from programmes. Bryceson (2002) sees income diversification as a sub-set of livelihood diversification and argues that income diversification in many areas of rural Africa is happening as a way of meeting individual needs in response to low returns from commercial agriculture. Ponte (2001) also acknowledges the role of market liberalization in encouraging increased diversification.

Diversification of rural households' livelihood strategies is driven by many factors. They include low profitability of agriculture or the need for a way of meeting individual needs caused by low returns from commercial agriculture, and the withdrawal of the government from support programmes, risk reduction, responding to various constraints such as land fragmentation and labour supply issues. The rural household is involved in complementary activities and specializations depending on comparative advantage.

3.0 Research Methodology

3.1 Description of the study area

This section includes a description of Rukwa, the study's area of interest, an understanding of the study area with regards to its physical, geographical and socio-economic strengths and limitations that may in one way or other influence rural households LS, crop production and well-being in the context of 20 years of agricultural reforms.

3.1.1 Geographic location

Rukwa is found in the south-western part of Tanzania on the shores of Lake Tanganyika (Figure 2). The region lies between latitudes 3^{o} and 9^{o} south of the equator and between longitudes 30^{o} and 33^{o} east of Greenwich (URT et al., 2004). Rukwa is bordered to the North by Kigoma and Tabora regions, to the East by Mbeya region, to the South by Zambia and to the West by Lake Tanganyika, which lies between the region and the Democratic Republic of Congo (DRC) (Figure 1 & 2). Rukwa is situated on the Central African Plateau and is bordered by the Western arm of the Great Rift Valley. Access to Rukwa region is a bit restricted when compared to the other three regions bordering it; as it lacks good all-weather roads. Whereas Mbeya to the South is connected by a tarmac road to Dar es Salaam, a major maize consumption centre, the road connecting Rukwa to Mbeya is unpaved, causing some inconvenience during the rainy seasons, particularly due to irregular or insufficient maintenance.

Kigoma and Tabora on the other hand are linked to Dar es Salaam by the Central rail line, which connects Dar es Salaam and Mwanza on Lake Victoria and Kigoma on Lake Tanganyika. Although there is a connection by rail between the Kigoma and Tabora rail line and Mpanda, the other parts of Rukwa, namely Sumbawanga and Nkansi lack this access and the only connection between Sumbawanga and Mpanda is a quite challenging 240 Km unpaved road whose passage is restricted during the rainy season.

3.1.2 Rukwa's administrative units

Rukwa is Tanzania's third largest region after Tabora and Morogoro (URT et al., 2004). The region has a total surface area of 75,240 sq kms of which 68,635 sq kms are land and 6,605sq water surfaces. Rukwa is divided into four administrative units; Sumbawanga urban, Sumbawanga rural, Nkansi, and Mpanda (Figure 2). According to URT et al. (2004) whereas Mpanda district occupies about two thirds of the region Nkansi district, which borders Lake Tanganyika, accounts for 60% of the region's water area. Sumbawanga Municipal Council, the region's administrative and business centre is located within Sumbawanga urban administrative area.

3.1.3 Rukwa's socio-economic characteristics

In 2002 Rukwa had a population of 1,141,743 of which 559,120 were male and 582,623 were female. The population distribution by the above mentioned administrative units was, 412,683 Mpanda district, 373,080 Sumbawanga rural, 147,483 Sumbawanga urban and 208,497 Nkansi district. The region had a total of 222,868 households and an average household size of 5.1 in 2002 (URT, 2002). According to the 2002 census the region had an integrated population growth rate of 3.6 % between 1988 and 2002, relatively higher than the 2.9% reported for Tanzania mainland during the same period.

Rukwa is home to a number of ethnic groups who have settled there at different times. According to URT et al. (2004) permanent settlement is thought to have first occurred in 1,700 AD by people from what is now northern Zambia and Eastern DRC; this is supported by the existence of strong cultural ties between the Wafipa, Rukwa's dominant indigenous group, and people in those areas. Other less dominant indigenous groups include the Wakunde, Wanyamalingo, Wapimbwe, Wanyika and Walungwe. In recent times there has also been an influx of Wasukuma immigrants from Shinyanga and Mwanza regions as they move South in search of both cropping and grazing land for their Zebu cattle. The region also has some long horned cattle that were introduced from Burundi in around 1750 AD. Since the 1960s Rukwa has long been offering refuge in camps to refugees from Burundi and recently from DRC. Some major refugee settlements include the Katumba and Mishamo settlements.

Agriculture is Rukwa's economic backbone and 90% of the region's economically active population is engaged in agriculture, which accounts for about 65% of the region's GDP (URT et al.). Major crops grown by households in Rukwa include maize, finger millet, beans and rice, which are mainly for food, and tobacco, sunflower,

groundnuts, coffee and wheat, which are cash crops. However, most of the region's cash income comes from maize, which accounts for 35% of the region's total annual food production (URT et al.). Proceeds from livestock production, which contributes about 20% of the region's economy, makes livestock keeping the second largest contributor to the region's economy (URT et al.). Fishing is another major source of employment, particularly to those living along the shores of Lake Tanganyika and Rukwa. However, URT et al. point out that even though the sector generates relatively good incomes through trade within the region and with neighbouring countries including Zambia, its importance is nevertheless small compared to crop and livestock production. Rukwa's industrial development is still in its infancy and is mainly concentrated in artisanal activities, whose share in the region's economy appears insignificant. Other livelihood sectors include those concerned with natural resources, mainly forestry and beekeeping. The region also has the Katavi National Park; however due to the concentration of tourism in the northern areas of Tanzania (Arusha and Kilimanjaro) the contribution of Katavi to Rukwa's economy is limited, partly due infrastructure limitations (hotels and transport) and insufficient advertisement (URT et al., 2004).

Rukwa faces major challenges with regards to living standards of her households. Many households live in sub-standard dwellings, many live far from banks, literacy levels are low for both men and women and less than half have access to safe water sources (NBS, 2002: Household and Budget Survey (HBS) of 2000/01). While primary schools are reasonably close to households, secondary schools are not. Rukwa region in 2000/01 had the lowest mean monthly consumption of all the 20 regions of mainland Tanzania; the region had the lowest rural per capita household monthly income and the lowest rural median per capita income. According to NBS et al. (2006) households in Rukwa on average own about three hectares of which two, or two-thirds is normally utilized for crop production. The HBS results further showed that the region had about one in ten inhabitants below the food poverty line and about one in three below the basic needs poverty line. Only seven other regions in Tanzania reported a level below that of Rukwa. Only 3% of households in rural Rukwa had dwellings with modern floor (cement, tiles for their first building) as compared to 55% of those in urban Rukwa. Moreover, only 8% had modern roofs (metal sheets, tiles, concrete cement and asbestos sheets) compared with 64% in urban Rukwa.

3.1.4 Agro-ecological characteristics

Rukwa region is found in the uni-modal rainfall areas (Central, Western, South-Western, Southern and South-Eastern coast regions) of Tanzania, and receives rain from November/December up to April/May. The average temperatures range between 10^0c and 20^0c during the cold and hot seasons respectively. Rukwa can be divided into five agro- ecological zones as shown in Appendix 1.

Rukwa's agricultural potential has made the region along with Iringa, Ruvuma and Mbeya the four major maize producing regions of Tanzania, commonly referred to as the "big four". However, Rukwa is more remote in

comparison with the others and two of her districts are almost totally dependent on maize as a major source of livelihood. The region has great potential for increased maize production; in the past Rukwa was well known to carry over harvests, particularly maize, from one agricultural season to the next, something that was uncommon in other regions of Tanzania with the exception of parts of Ruvuma. Even in situations of drought and low rainfall, as was the case in 2006, the region was still expected to receive rainfall up to mid April; the rains, according to Mhita (2006), the director general of the Tanzania Metrological Agency (TMA), were expected to be mainly normal with pockets of below normal rainfall. Therefore, this region if properly utilized could be a good contributor to Tanzania's food security.

Figure 1: Map of Tanzania (Source; http://geology.com/world /tanzania-satellite-image.shtml-4/5/2008)

Figure 2: Map of Tanzania Showing Administrative Regions (Source; http:// www.tanzania.go.tz/census/regions.htm-4/5/2008)

Figure 3: Rukwa region's Administrative Districts (Source; http://www.tanzania.go.tz/census/rukwa.htm-4/5/2008)

3.2 Methods of data collection

3.2.1 Research design

The study employed a mixed method design in data collection. In line with this a cross-sectional research design (Creswell, 2003) was adopted, whereby data was collected at one point and time. The choice of this method was partly warranted by its ability to meet the objectives of the study, but also due to constraints in terms of time and finance.

3.2.2 Data collection, analysis and presentation

Data was collected from the three rural administrative districts of Rukwa (Figure 3). Collecting data from the three districts aimed at ensuring a diversified understanding of the phenomena under study in a range of localities, because households in Sumbawanga and Nkansi districts more or less depend on the maize crop as a major source of livelihood, whereas households in Mpanda are also involved in tobacco farming.

3.2.3 Sampling and sample size

The current study involved a survey of 200 randomly selected farm households involved in the cultivation of maize from the three districts of Rukwa; 72 from Sumbawanga, 67 from Mpanda and 61 from Nkansi districts. The random sampling was based on official village registers made available to the researcher by leaders of the villages involved[6]. A list of all the heads of households was prepared and names were picked at random. However, to ensure representation of female headed households (FHHs) a count was normally made and where they were not represented some adjustments were made to ensure at least some FHHs featured in the study. In case of non-appearance of selected respondents replacements were picked on a random basis. For the Focus Group Discussions (FGDs) village leaders were requested to gather individuals in groups of between six and eight for all adult (above 35 years) men's and women's groups and for all youth (18 -35 years) male and female groups; these respondents were not involved in the individual interviews. A total of 16 focus group discussions were conducted, four each in Sumbawanga and Nkansi districts and eight in Mpanda district[7]. In each case only one village was selected to ensure a comparison of opinions between the different age and sex groups; a total of 107 individuals participated in the FGDs. Apart from individual questionnaires and the FGDs, in-depth interviews were also conducted with the district agricultural officers of the three districts. Therefore, the total number of individuals involved in the study was 310.

3.3.4 Primary data collection

Primary data was collected using pre-structured questionnaires. These were designed in such a way as to enable collection of information capable of answering the hypothesis pointed out in section 1.0. The questions aimed at determining whether the 1986 liberalization of the agricultural sector, particularly the maize market, had

[6] Villages and number of respondents per village are shown in Appendix 3.7.

[7] More FGDs were conducted in Mpanda district because some surveyed households cultivated both maize and tobacco. Four groups were composed of those growing maize and other crops but not tobacco, and the other four involved those growing maize, tobacco and other crops.

led to farm households' specialization in areas where they had a competitive advantage; whether the liberalization led to farm households adopting modern technologies in their production process; and how maize production fitted into households' LS, general crop production and well-being.

To answer these questions the pre-structured questionnaire was designed to collect information on the socio-economic background of the farm households surveyed, including information about the head of household's education, main economic activity, household size, farm ownership and farm size. Apart from the listed items, information was also collected on the economic activities in which other household members were involved, the households' other sources of income, and 2005 annual cash income. This information was intended to show to what extent a household was diversified, what the encouraging and limiting factors to diversification might be, and the amount and quality of labour available at the household level that could actively be used in production and improvement of households' well-being. The questionnaire also sought information on the farm households' farming practices as well as types of crops, amount of land dedicated to each and whether a household had to hire land, labour or both for its production. This type of information aimed at determining among other things the surveyed households' ownership of the modes of production and the amount of diversification of their crop production. Knowing their crop diversification helps to reveal the degree of specialization in crop production. One would normally expect farmers to only grow crops for which they have a competitive advantage, to maximize their returns and profits, in short their income.

In attempting to explore the hypotheses posed by the study, the questionnaire gathered information on the use of modern technologies, including improved seeds and chemical fertilizers. It also sought information on extension-seeking behaviour of the surveyed households. These lines of enquiry were based on the prediction that open markets make access to technologies and innovations easier. With the help of agricultural extension officers the farm households should be in a better position to determine which technologies are appropriate to their production. The questionnaire also aimed to get information on the farm households' well-being in the context of the long period of maize market reforms. Questions were included on farm households' income earnings and whether these have increased or decreased, and on their assets value.

Other questions included households' access to markets (actual markets and market information), information on the households' general crop husbandry, and suitability of maize farming for households' well-being, to mention a few. The interviewing process was conducted by the researcher and two assistants; to make it easier and more uniform the questionnaires were translated from English to Swahili. A pre-testing of the questionnaire was done and some modifications were made before the actual use. The selected household heads were normally interviewed in the village government offices of their respective villages or nearby; however on one occasion we used an inhabited primary school teacher's house. To ensure respondents' confidentiality and freedom of expression, village government leaders were not allowed within listening distance; in most of the cases they were busy making follow-ups on selected respondents.

Answers to the study's hypotheses were also sought by using FGDs. These used a check list, a shorter version of the questionnaire administered to farm households. The FGDs mainly aimed at affirming the general information provided in the individual interviews, especially in such areas as the types of crops grown in the area, gender roles in the production of maize, the importance of maize to the local area, the possibility of maize farming being an engine for poverty reduction in their area, factors hindering higher maize productivity in their area and who were the poor, to mention a few. The FGDs participants were encouraged to discuss issues put before them without fear and with honesty. The FGDs mainly aimed at getting a better understanding of the issues explored in the individual interviews, especially to get a better conceptualization of rural dwellers' own understanding of 'poverty', their perception of the liberalized maize market, and whether maize farming in their respective areas had the potential to improve their well-being.

Lastly, in an effort to ensure reliability of collected primary data, the study conducted three in-depth Interviews with the district agricultural officers of the surveyed districts. The major aim of these interviews was to get a professional opinion of the subject under study and also to confirm what farmers and FGDs had reported in relation to maize market liberalization and well-being in Rukwa. The in-depth interviews were normally carried after finishing the farm household surveys and the FGDs, and employed a check list that was quite similar to that used in the FGDs with the exception of a few omitted questions. In general with the exception of the district agricultural officers, participation of respondents in the current study was voluntary and to ensure this, respondents were required to sign consent forms before participating. In a few instances some respondents were reluctant to participate and replacements were sought.

3.3.5 Secondary data collection

Secondary data on production, input use (fertilizer and hybrid seeds) and marketing of maize was obtained from the MAFC and the Ministry of Commerce and Trade (Agricultural Marketing Bureau) and from Rukwa regional offices' reports and other data sets (FAOSTAT). These data are normally compiled in booklet form[8]. Data from the 2002/03 National Agricultural Census was also used in the current study. Rainfall data covering the 1980s to 2005 for Rukwa was collected from the Tanzania Metrological Agency. Use of secondary data was aimed at bridging information gaps generated from the interviews, FGDs and the in-depth interviews. Some questions related to the current study could only be answered by secondary data rather than primary data alone. Use of the secondary data has also enabled the study to get a broader general picture of the performance of Tanzania's crop production, especially maize, following liberalization of the agricultural sector in 1986.

[8] The secondary data used are the accepted official statistics and according to Skarnstein although there have been many arguments about the reliability of sources of secondary data on Tanzania's agricultural sector, many experts (Bhanduri et al, 1993; Ponte, 1998 and Delgado et al. 1999), cited by Skarnstein (2005) agree that the data contained in the basic data for agriculture and the livestock sectors of Tanzania are the most reliable.

3.5 Study limitations

In this section the study discusses two major limitations relating the current study. The first regards use of recall data covered in sub-section 3.5.1 in which the use of recall data in social science surveys is briefly examined followed by an examination of the limitations of recall data and ways to improve its reliability. Sub-section 3.5.2 covers the second set of limitations, i.e. those related to the actual execution of the study.

3.5.1 Use of recall data in social science surveys, its limitations and how to improve the reliability of recall data

Use of recall data in social science research is quite common; according to Dex (1991) there has been a growing use of life and work histories of individuals by social science researchers, mainly due to an increased desire for systematic collection of large scale data on social and economic aspects of individuals' lives. In support of this point, Smith and Thomas (2002) argue that despite the increase in the quantity and quality of data collected in developing countries by use of household surveys, the vast majority of these have been cross-sectional, limiting how much can be learnt about the dynamics that have brought each society to its current status quo. Furthermore, regardless of efforts being made to conduct longitudinal surveys many developing countries are still far from having usable panel data to enable determination of changes over time. Panel surveys launched today can, at best, only tell us about the future and not the past. Smith and Thomas also argue that for a better understanding of the development process it is crucial that we capture the demographic and economic transitions of the past few decades, and the only realistic way to do this is to rely on recalling past events. The importance of recall data has also been pointed out by Gibson and Kim (2007) who argue that retrospective surveys are mainly used as a substitute of longitudinal data which involve high costs and are of limited availability. Gibson and Kim citing Deaton (1997), point out that although longitudinal surveys are costly they are often restricted to small, nationally unrepresentative samples. According to Freedman et al. (1988), cited by Gibson and Kim the above restriction has led to the need to retrospective surveys whereas a single interview can obtain a long-term or even lifetime history.

According to Dex (1991) retrospective or recall data can be collected either in a single cross -sectional survey or in conjunction with a panel survey. He argues that collection of data retrospectively allows for the continuous collection of information on particular variables as compared to discrete records obtained by asking only about current experiences. He cautions that despite the advantage of collection of retrospective data, especially by allowing a cheap way of collecting information which can then be systematically coded and analyzed, it nevertheless has the potential of bias due to its over-reliance on memory. However Dex argues that the problem of memory bias does not only affect retrospective data collection but also the collecting of current information. Despite the likelihood of errors arising from use of retrospective data he points out that no method of data collection is immune to errors although the degree and influence on the accuracy of the results does vary between the various methods.

There have been many debates on the reliability or accuracy of the data collected using the method particularly in relation to long-term recall data. For example, Jacobs (2002) and Kennickell and Starr-McCluer (1997) as cited by Gibson and Kim (2007:1), claim that analyses based on such data are "quite meaningless" and that it is a "poor substitute for panel data". However, on the other hand Campbell (2000), cited by Gibson and Kim (2007:1) suggest that when retrospective questions are asked carefully and interviewers are well trained, respondents can provide "accurate and detailed information". According to Dex, errors for example in labour/employment studies may occur in retrospective surveys because respondents either completely forget events or miss-date them. However, Dex in reviewing various studies that have employed the retrospective recall of data shows that while the consistency of the information reported varied on the basis of the recall period under consideration by the specific studies, it also varied on basis of the subject matter. For example while there was a consistency of 88% for a 10 years recall period on the subject matter of having had a will or not (Powers et al., 1978), there was only a 53% consistency for a similar recall period when the subject matter was whether one would quit work if they had annuity (Powers et al 1978). Again the review shows that there was a 72 - 76% consistency in reporting for 26 years olds' recall on the job training when 15 – 18 (Cherry and Rogers 1979) with a recall period of 8 – 11 years. However, when the subject matter was 26 years old men's reporting of nervous troubles at the age of 15-25 (Cherry and Rogers 1979) and the recall period of 1 – 11 years the consistency was 50%. The review also showed that although it is generally agreed that recall accuracy declines over time, there were nevertheless some instances when recall was shown to generally improve with an increase in the recall time. Dex (1991) cites a study by Mason et al (1976) which shows students recall of their parents schooling and social-economic characteristics improved with the increase in the length of the recall period.

Further evidence in support of the use of recall data despite its shortcomings comes from Berney and Blane (1997:1520). The two, citing Livson and McNeill (1962), show that simple physiological information has also been proved to be recalled with useful accuracy. The latter have shown that after a period of 17 years the age of menarche recorded in the medical notes of 43 subjects correlated at 0.75 with that recalled at interview. Citing Casey et al., (1991) Berney and Blane report that a study on recalling body weights of 95 respondents at ages 18, 30 and 40 years and at age 50 years showed that the recalled weight correlated at 0.95 with recorded weights after 10 years and 0.87 after 32 years. Citing Krall et al, (1989) they point out that even though the accuracy of recall of ingested substances presents a less straight forward picture, tobacco smoking appears to be recalled with useful accuracy and that Krall et al., have reported an accuracy of 87 percent between the historical record of their respondents and their respondents' recall of their smoking status 20 years previously and 71% accuracy on smoking level; however the figures for a recall period of 32 years were 84% and 55% respectively.

According to Dex (1995) improvement of recalled data's reliability can be achieved by using bounded or aided recall methods, by using clues and other landmark events and context to help date events, and by focusing on particularly salient or noteworthy events. Other ways are by placing the events of interest within a temporal

frame of reference, by ordering the questions in a logical or chronological sequence, and by keeping the task as simple as possible. Dex also points out that dates of events have generally been found to be the most difficult facts to remember and should be asked about last in the sequence of questions related to an event. The current study tried to assist the respondents recall their 1986 socio-economic and production data by reminding them that 1986 was the first year of Tanzania's second president Hon Ali H. Mwinyi. Use of the start of the presidency was hoped to stimulate the respondents thinking as this had marked the move from a socialist economy that had been marred towards the end with a shortage of most of the day to day household necessities' such as soap, cooking oil, sugar to mention a few. As Hon Mwinyi started his presidency his government adopted the free market economy which allowed import of goods which then allowed shops and local markets to be adequately supplied with not only household necessities but also other goods that had been previously been seen as luxury goods for example cars, motorcycle, refrigerators and Television sets to mention but a few. Following Hon Mwinyi's liberalization of the economy he was nicknamed *Mzee Ruhksa* literally translated as the man who allowed everything. During the interviews the name of Mwalimu (Teacher) Julius K. Nyerere was also used to prompt recall of the respondents' farm and socio-economic characteristics of those in maize production in 1986. Nyerere was quite popular due to him being Tanzania's first president; his presidency lasted between 1961 and 1985. Therefore, by using both of the above names it was hoped respondents would be able to refresh their memory and hence provide some relatively accurate data. And the above approach proved quite useful during the interviews.

3.5.2 Actual field limitations

Some limitations were encountered in the execution of the study. Some were expected, but others were quite unexpected. A prior understanding of these limitations may help in understanding the shortfalls that may arise in later chapters and also on conclusions drawn at the end of the study. The study failed to interview the planned number of about 360 respondents through individual interviews, FGDs and in-depth interviews with government officials. Due to distance between districts and selected villages only a total of 310 were eventually interviewed. The lower than planned figure was caused by a number of factors. Dispersal of the villages involved within the study area at times led to the interviews starting at mid-day. Respondents were sometimes reluctant to participate when approached by the village authorities, or when briefed about the actual study by the researchers.

The study also encountered limitations in relation to both primary and secondary data. The limitation on primary data was based on the fact that some of the information required needed a memory recall of farm households' income and crops produced and sold in 1986, when the maize market was liberalized. The exercise of recalling information proved to be quite challenging to some respondents and therefore the validity and reliability of the data collected need to be taken with great caution. However, some of the trends, especially those related to maize production generally tally with the published secondary data used in the study, supporting the assumption that the information provided by the respondents is reliable and can be trusted. Further limitations were

encountered in the secondary data used due to a lack of disaggregation of the data, especially that related to chemical fertilizer use per individual crops and per region. As a consequence, the current study had to rely on findings of other studies and many assumptions about the effect of the decline in fertilizer on Rukwa's maize productivity after liberalization of the agricultural sector in 1986.

The vastness of the coverage area, coupled with poor road conditions and the high costs involved, made it difficult to make prior appointments in the villages. Although in Sumbawanga district letters were sent in advance, the selection of respondents at random still had to wait until we arrived at the respective villages. Hence no real difference was seen in this district in comparison to the other two. Another limitation was the fact that household heads and other members were preparing for the next cropping season; this made it difficult at times to get the selected respondents. Some of them were unavailable as they were busy in their farming plots, which in some cases were far away from the village where interviews were being conducted. Lastly, another limitation was more or less coincidental; when we reached our chosen study village (Ntumbila) we found out that village leaders were cracking down on individuals who had not contributed money towards construction of their ward secondary school. This scared respondents away from coming to the village offices, our meeting point, and consequently only three successful interviews occurred out of the planned 30, the village leaders had been able to call out seven respondents but due to the tense situation it was seen proper not to continue with interviewing the other four[9].

4.0 Results and Discussion

4.1 Socio-economic characteristics of surveyed households

An understanding the various socio-economic characteristics of the surveyed households involved in the study may help in understanding the empirical findings. The respondents' major socio-economic characteristics are shown in Table 1. Respondents to the current study were distributed across all age groups, as may be suggested by the overall average and those for the specific districts (Table 1). The distribution of household heads across all age groups emanates from the fact that in Rukwa like many other Tanzanian rural areas the adult working population consists of individuals aged eighteen years old and above: in some cases younger individuals are also involved. Many males as soon as they are mature tend to separate from their families and start up their own households either in preparation for marriage or after marriage. However, the same is not true of many females as they only separate after getting married.

[9] Despite the inability to interview the 30 originally planned respondents in the said village the author believes that this has no major influence on the overall findings of the study as the interviewed respondents from the replacement village had a similar distribution of characteristics as those I was able to interview in the other 4 villages of the district. Furthermore the village (Kanazi) where the replacements were sought was within the same administrative division of the same district (see Appendix 3.2). In addition data analysis in the current study was mainly based on districts and the regional level and not villages *per see*.

Observations (Table 1) show that about three quarters of the respondents were male; however the actual number of male headed households (MHHs) was far greater than this. The lower number of female headed households (FHHs) was caused by the fact that some of the female respondents interviewed were only representing their spouses who could not be available for the interviews, and by the current study's use of the random sampling method, whereby names were drawn at random from village registers. The low percentage of FHHs observed in the current study is contrary to other observations of rural Tanzania, where higher percentages have been reported. For example FAO (1997) reported 30% of FHHs for Ileje district in Mbeya, 32% for Mvumi division in Dodoma and 25% in Zanzibar north. They have also reported that in Tanzania mainland 17.5% of the households are female headed. Observations from the study also show a lack of marked difference in the sex of the household heads between Sumbawanga and Nkansi districts; however, these two differed significantly from Mpanda (Table 1). The occurrence of female headed households can be caused by many factors including divorce, separation, death of spouses, and out-migration of spouses in search of income in the urban areas or other rural areas. According to IFAD (2007) there has been a significant increase of FHHs in many areas of Africa and elsewhere, and the causes apart from those already mentioned may include civil conflicts and wars, un-partnered adolescent fertility and family disruption. IFAD in their poverty assessment of eastern and southern Africa noted that an estimated 25-60% of rural households were headed by women when all causes of FHHs were taken into consideration.

Generally, Table 1 shows that a very small proportion of the household heads had attained secondary education, many were primary school leavers, one in five had attended primary schools without completing and ten percent of household heads lacked formal education. The observed education levels suggest households may be disadvantaged. Much literature shows that education can influence a households/individuals choice of a livelihood strategy[10] and that an increase in an individual's years of education is expected to increase one's range of work-related skills and hence the ability to acquire new skills (Minot et al., 2006). According to Minot et al., a higher level of education is expected to be associated with the production of higher value crops, more commercially oriented agriculture, and greater participation in non-farm activities.

Table 1 also shows that crop production was the surveyed households' main occupation and this is in line with what has been reported for Rukwa by URT et al., (2004), in Nkansi district it was the main occupation of all the household heads. The results conform to official estimates for Rukwa, according to NBS et al. (2006) 99.8% of the region's households generally grow crops, with about 34% growing crops and keeping livestock. Table 1 further shows that average household size was relatively higher than the 5.1 and 4.9 averages reported for Rukwa and Tanzania respectively by NBS (2002). The results also show some relative differences between the districts, with Sumbawanga having the smallest and Mpanda the highest household sizes respectively.

[10] Unni, 1996; Winters et al., 2001; Abdulai and CroleRees, 2001; Marzano, 2002 and Galab et al., 2006, Davis et al., 2008

According to Table 1 the average 3.19 ha of land owned by households was in conformity with the official estimate of about 3.0 ha observed for Rukwa in the 2002/03 National Sample of Agriculture (URT, 2006). And the same is true for the amount of land utilized as the census showed that households in Rukwa were on average utilizing about 2.0 ha of the land they had access to which is not very different from what the study observed as shown in Table 1. However, at the district level households in Mpanda owned relatively more land compared to the other two districts, Sumbawanga having the least. On ownership of cropping land by gender of household head, ANOVA results (Appendix 5.2) show the presence of a significant (0.05 level) variation between the two sexes; FHHs on average owned less compared to MHHs. This observation is in line with the actual situation in most parts of Tanzania; land ownership is mainly a male right as a result of the highly entrenched patriarchal system[11].

Socio-economic characteristics of household heads and their household members are quite important in answering the major hypotheses asked by the study in section 1.3 and in giving a better understanding of rural livelihoods, crop production and well-being. For example a household's income could be very crucial in determining how households could invest in new technologies and also in meeting their well-being needs. And according to Table 1 a wide range in households' cash income was observed, with some households reporting an income of as low as 9000 Tanzanian shillings and some as high as around 5,000,000 million shillings as regards the per capita cash income this ranged from about 1,500 to 2,000,000 shillings and the average was about 117,000. It should be noted that these figures are total household cash income, and that income here refers to cash income thereby excludes the value of income received in-kind such as the value of own-produced food, gifts and subsidies. As such, this is not an ideal measure of household welfare but was determined in large part due to study constraints[12].

Table 1: Socio-economic characteristics of households

Characteristic		Rukwa region n=200	District		
			Sumbawanga n=72	Mpanda n=67	Nkansi n=61
Household head's average age		44.4	43.6	45.1	44.4
Respondents' Sex	Male	153 (76.5)	53 (73.6)	57 (85.1)	43 (70.5)
	Female	47 (23.5)	19 (26.4)	10 (14.9)	18 (29.5)
Household head's gender	Male	169 (84.5)	59 (81.9)	61 (91)	49 (80.3)
	Female	31 (15.5)	13 (18.1)	6 (9)	12 (19.7)
Household head's	Primary school leaver	121 (60.5)	47 (65.3)	46 (68.7)	28 (45.9)

[11]However, in some Tanzanian tribes some matrilineal societies exist where land is controlled by daughters/aunts or uncles on the daughters' behalf. As regards general land ownership, FHHs are still disadvantaged despite efforts by the government to ensure equal access to this very important production asset between the sexes as acknowledged by the 1995 Land Policy and 1999 Village Land Act, whose objectives were to ensure women in Tanzania have the same access to land distribution as men.

[12] In the study, this variable is used for analysis of household well-being, it is compared and contrasted with other measures of wellbeing, such as ability to cover health and education costs, and the value of household assets, which are probably more robust estimates of household welfare. In addition, in order to minimize the influence of very large values on results, the regression analysis uses the natural logarithm of household income.

Educational Level	Secondary school leaver	6 (3.0)	3 (4.2)	1 (1.5)	2 (3.3)
	Adult education	9 (4.5)	6 (8.3)	0 (0.0)	3 (4.9)
	No formal education at all	24 (13.0)	10 (13.9)	4 (6.0)	12 (19.7)
	Lower levels of Primary School (< std 7)	38 (19.0)	6 (8.3)	16 (23.9)	16 (26.2)
Household head's main occupation	Crop farming	193 (96.5)	67 (93.1)	65 (97.0)	61 (100)
	Salaried employment	6 (3.0)	4 (5.6)	2 (3.0)	0 (0.0)
	Other (e.g. fishing)	1 (0.5)	1 (1.4)	0 (0.0)	0 (0.0)
Household size	Average household size	5.88	5.29	6.22	6.21
Household's land ownership (ha)	Average land owned	3.19	2.45	4.24	2.93
	Average farmed land	2.29	2.10	2.35	2.45
Household income (Tsh)	Average Household income (2005)	521,947.00	475,069.00	704,411.00	376,867.00
	Income range (2005)	9,000 – 5,284,000.00	9,000-3,000,000.00	10,000-5,284,000.00	12,000 – 2,670,000.00

Source: Survey data 2006 *NB*: Number in brackets indicate percentage

4.2 Well-being in Rukwa

As pointed out in section 3.1.3 Rukwa faces major challenges with regard to living standards of households, with many living in sub-standard dwellings and lacking basic services. About one in three households live below the basic needs poverty line; only seven regions in Tanzania reported a level below that of Rukwa (NBS, 2002). According to NBS only 3% of households in rural Rukwa have dwellings with a modern floor (cement, tiles for their first building), compared to 55% of those in urban Rukwa; and only 8% had modern roofs (metal sheets, tiles, concrete, cement and asbestos sheets) compared with 64% in urban Rukwa.

Table 2 shows that well-being was low on several indicators although almost all households thought they were capable of meeting social activities costs. However, the claim by the households to be able to meet their education costs may been made easier by the Tanzanian government's introduction of public schools' grants through PEDP (Primary Education Development Programme)[13]. Terme (2002) points out that the introduction of primary school enrolment fees in 1995 due to the gradual introduction of cost sharing in Tanzania's education throughout the 1980s and 1990s led to a decline in school enrolment. Although the fee never amounted to more than Tsh 2,000 (about 1£) per year, its removal in 2000 led to a doubling of the number of students enrolled in primary education in 2001/2002. These fees were comparatively onerous to the poor, who tend to have more children as well as fewer resources to pay for them. According to Wedgwood (2005) Tanzania attained almost 100% enrolment during the 1980s when universal free education was provided; however, introduction of cost sharing led to less than 60% of primary school-aged children being in schools by the end of the 20th century.

[13] Through this project the government provided exercise and text books to pupils while also paying for schools' recurrent and development expenditures which would have otherwise been met by parents paying school fees and other contributions.

Therefore, it is difficult to explicitly credit the affordability of education costs entirely to the surveyed households as the study found that only a handful of them had children attending secondary school, many aged between 13 and 18 years were staying at home helping with farming and other household income generating activities. The cost of secondary schools is not high in public schools[14], though relatively high in private secondary schools. However, entry into the public schools is by selective examination.

It is not surprising that most households were capable of meeting their social activities costs, because maintaining good social relations is very important in many parts of rural Tanzania where modern financial services like banking and insurance are nonexistent or limited. As a consequence a household's continued involvement in social events of other community members including those requiring monetary contributions, for example send-off parties, marriage and funeral ceremonies, is very important for re-affirming of future mutual support in similar matters or any other calamity that may befall the household. Forgues (2004), cited by OCOL (2007) argues that networks and social ties are a means by which individuals or communities can gain access to resources (economic, political, cultural or human) that are required to achieve certain objectives.

The relatively higher proportion of households not able to meet their health costs comes as no surprise; reasons are twofold. First, most Tanzanians between 1967[15] and the 1990s were not paying for such services. However, this changed in the 1990s after the government adopted the health sector reform (HSR) which led to the introduction of cost sharing in public hospitals in 1993. Secondly, the production levels reported in Appendix 4 and the annual cash income levels reported (Table 2) suggest households were truly unable to meet their health costs. This finding is supported by the REPOA's (2003) policy and services satisfaction survey (PSSS) cited by URT (2005) in which 73% of the respondents reported health care to have become less affordable in Tanzania in the past five years. Reduction in access to health care after the introduction of user fees has also been reported by Hutton (2002), who argues that many studies in Tanzania have reported a general reduction in health care take-up and that the poor are the most severely affected. Sahn and Stifel, (2003) point out those consumers in Tanzania are highly responsive to the price of health care and that this effect is even greater for individuals at the lower end of income distribution.

According to Table 2 a relatively higher percentage of households in Mpanda unable to meet their health and educational costs is surprising as about 45 percent of the households were involved in tobacco farming, a cash crop. Although not of immediate concern to the current study, the relatively low ability of households in Mpanda to meet their health and education costs raises the question as to whether their tobacco productivity was high enough to offset the costs involved in its production and obtain a profit margin high enough for households to use in access to social services like health and education. Hammond (1997), and Rweyemamu and Kimaro (2006)

[14] This refers to schools owned and operated by the Tanzanian government.
[15] In the 1967 Arusha Declaration Tanzania was declared a socialist state, with public services costs including those on health and education being incurred by the government.

argue that smallholder tobacco farmers are not benefiting as much as hoped from their production and the liberalization of the tobacco market respectively. The latter add that the lack of real benefits emanates from inefficiencies in both the production process and the marketing, and that these farmers' overall benefits are meagre in relation to the international market prices. Although their study showed tobacco production to be potentially profitable based on the international market, smallholder tobacco producers are paid less than the actual value of their product.

Table 2 also shows that despite Nkansi reporting a lower 2005 household cash income the district had a higher asset value. This may partly be due to a significant number of households in the district owning cattle, compared with those in Sumbawanga or Mpanda districts. A few households had more than a 100 cows and this could be a cause of the inflated asset value. The higher average annual 2005 income observed for Mpanda district is mainly explained by the fact that about 45 percent of the households surveyed in the district sold tobacco, which boosted their incomes relative to those reliant on sale of maize and other food crops only.

Table 2: Well-being indicators

Characteristic		Rukwa region	District		
			Sumbawanga	Mpanda	Nkansi
Ability to meet health service costs		n=188	n = 69	n = 58	n = 61
	Yes	73(38.8)	30(43.5)	12(20.7)	31(50.8)
	No	115(61.2)	39 (56.5)	46(79.3)	30(49.2)
Ability to meet educational costs		n = 150	n = 61	n = 43	n = 46
	Yes	88(58.7)	36(59)	23(53.5)	29(63)
	No	62(41.3)	25(41)	20(46.5)	17(37)
Ability to participate in social activities requiring cash		n=199	n=72	n=66	n=61
	Yes	179(89.9)	62(86.1)	61(92.4)	56(91.8)
	No	20(10.1)	10(13.9)	5(7.6)	5(8.2)
Quality of house owned		n=199	n = 71	n = 67	n = 61
	Good	69(34.7)	23(32.4)	23(34.3)	23(37.7)
	Poor	130 (65.3)	48 (67.6)	44 (65.7)	38 (62.3)
		n = 200	n = 72	n = 67	n = 61
Average 2005 cash income (Tsh)		521,947.00	475,069.40	704,411.00	376,866.60
Average 2006 assets value (Tsh)		1,690,738.00	734,693.00	1,290,489.60	3,258,801.60

Source: Own survey 2006, *NB*: Numbers in brackets indicate percentage[16].

4.3 The relationship between maize farming and households' well-being

This section examines the contribution of maize farming to the surveyed households' well-being. Ellis and Mdoe (2003) have shown from their Morogoro study that maize has an important role in rural farm households' well-being: maize accounted for 40.5%, 30.1%, 27% and 7.8% of the households' consumption for the I, II, III and IV

[16] The difference in n for each well-being measure is a result of the number of respondents that answered the question related to the measure. For example some households did not have children in school at the time of study so were unable to respond to the question on affordability of education.

income quartiles respectively. The study further showed that the overall household income share of maize was 27.1, %, 21.5%, 15.1% and 7.9% respectively for the above-mentioned income quintiles. In Rukwa, Ashimogo (1997) reporting showed that income from maize sales in Sumbawanga accounted for over one-third of total household cash income. RATES (2003) point out that about 85 % of Tanzanians depend on maize as an income-generating commodity. Based on reported household income contributions and the fact that previous chapters showed some households only grew or sold maize, the study examines the extent to which maize was important to households. Sub-section 4.3.1 examines the role of maize; as a source of income, in assets and maize farming and households' ability to meet costs for health, education and social activities. Lastly, sub-section 4.3.2 looks at the factors influencing the surveyed households' income, assets value and their ability to meet costs for health, education and social activities.

The above examinations will enable a better understanding of the importance of maize to rural farm households, but also give some clues as to what could be done by policy makers and agricultural extension staff to raise smallholders maize yield and hence income, in order to improve the well-being of the millions reliant on maize production as a livelihood strategy. The contribution of other crops to the surveyed households will be measured by either the regression or logistical regression models used in determining the households' capabilities to meet their education, health, social capital costs, households' income and their asset values for 2005 and 2006 respectively.

4.3.1 Maize farming as a source of household cash income

Apart from being a major food crop maize is sold by many households to earn income to spend on other needs, such as other food stuffs (meat, fish, rice, cooking oil, sugar, salt), kerosene for lighting, clothes, and building materials to mention but a few. Therefore, it's imperative to examine the relationship between cash income accrued from maize and its produces' well-being. An understanding of this could enable policy makers and agricultural extension staff to devise appropriate initiatives aimed at raising smallholders' maize yields from the current low levels as observed in Appendix 4 and 5. Such a move would enable smallholders to earn more cash income which could then be used for improvement of rural lives not only in Rukwa, but in other parts of Tanzania too.

Appendix 6 shows that about three quarters of the respondents normally sell part of the maize they produce and households selling maize were generally more productive than those that did not. Table 3 shows that income from maize sales contributed on average about 25% of the surveyed households' 2005 annual cash income; the contribution was highest in Nkansi and lowest In Mpanda. This observation is consistent with the official Rukwa estimate that maize sales represent around a third of household income. The observed 'inverted U relationship between households' incomes and share of income from maize sales could be a result of two factors at work; poorer farmers having less land and needing to consume more of the harvest, and the richest farmers growing less maize so having less to sell. Somewhere in the 3rd quartile farmers are producing less maize. Ashimogo

(1997) has reported observations similar to the above for Sumbawanga, where income from maize accounted for about one-third of total household cash income.

Table 3. The contribution of maize sales to household income in 2005 (n =200)

	Characteristic	Maize income from sales as a % of household income	Households average income(Tsh) in 2005
Quartile	I	24.06	72,000
	II	27.38	200,720
	III	33.87	407,137
	IV	12.21	1,407,960
District	Sumbawanga (n = 72)	27.48	475,069
	Mpanda (n = 67)	12.13	704,411
	Nkansi (n = 61)	34.17	376,867
Overall average		24.38	521,947

Source: Own survey 2006

In relation to other variables that measure the importance of maize, results in Table 4 show that households allocating up to a third of their farm to maize production reported a higher 2005 average income compared to those allocating more land. Furthermore, more commercialized maize producers i.e. those selling more than two thirds of their produce, had a higher average income relative to those selling less. Lastly, the Table shows that the greater the number of crops grown by a household, the higher its income was in 2005. Generally, these observations seem to suggest that commercialization of crop production by households was associated with higher incomes and that a greater reliance on maize is associated with poorer outcomes. As pointed out by Spring (2000) commercialization of agricultural production is key to a household's food security and general well-being.

4.3.2 Maize farming and asset ownership

Asset ownership by a household is a good proxy indicator of wealth[17] as determining a household's actual income can be a difficult exercise[18]. Therefore, estimating their assets gives a clue as to how households have utilized income earned. Furthermore, assets' value can potentially be used by households as collateral for loans which could at times be necessary for enhancing a household's well-being, either for production purposes, or to address emergency needs such as illness or calamities such as floods and droughts (Deere, et al., 2009). Therefore, knowing a households asset base gives a better picture of the capacity of individuals to manage their vulnerability to poverty. This section aims to examine the relationship between maize farming and the surveyed households' ownership of assets in 2006 so as to establish how households perform on the basis of amount sold.

Table 4 shows that farmers who were more commercialized and less reliant on maize for their livelihood had a higher mean asset value. Households that allocated more than one third of their land to maize had a lower mean asset value. Asset values in 2006 varied on the basis of the surveyed household's district of residence, and their sale of crops. The observations suggest two things. First, households receiving a large part of their cash income from maize sales were poor (had low asset values); secondly, that those who had no maize sales were also poor, so presumably had no maize surplus. This might be because they were poor or had little land so could only grow enough maize for their own needs. On the other hand they could in theory be farmers who chose to only grow a small amount of maize because they had income from other sources. Observations also show that a higher asset value was reported by households growing three other crops in addition to maize as compared to those growing less or more than three. In sub-section 4.3.3 the study examines the relationship between maize farming and a household's ability to meet costs of basic services such as head and education.

Table 4: Households' income (2005) and assets (2006) (n = 200)

Characteristic		Households average income value (Tsh) 2005	Households average assets value (Tsh) 2006
% of land allocated to maize in 2005	0% (n = 9)	515,111	455,567
	0.1 to 33.33 % (n = 31)	699,000	4,313,336
	33.4 % to 66.67 % (n = 100)	603,614	1,230,583
	More than 66.67 % (n = 36)	295,383	1,287,930
% of maize sold by household income	0% (n = 97)	539,495	1,282,597
	0.1 to 33.33 % (n = 29)	371,517	656,017
	33.4 % to 66.67 % (n = 58)	446,007	1,581,112
	More than 66.67 % (n = 16)	963,497	6,437,919
Maize income as a % of household income	0% (n = 97)	539,495	1,282,597
	0.1 to 33.33 % 2005 (n = 44)	618,250	2,681,225

[17] According to URT (2001) a proxy indicator like asset ownership can be a valid indicator for income poverty. Proxy indicators can provide estimates for impact and outcome indicators that are difficult and expensive to measure as they correlate strongly with the latter.

[18] Setboonsarng (2005) has argued that use of income levels as an indicator of poverty, though practical, could be limited by problems of reliability, cost effectiveness, timeliness, and comparability across countries.

	33.4 % to 66.67 % (n = 29)	522,462	2,013,735
	More than 66.67 % (n = 30)	323,465	1,245,450
Number of crops grown by household	0 (n = 2)	90,000	326,396
	1 – 2 (n = 93)	349,790	750,181
	3 (n 60)	620,859	3,235,855
	More than 3 crops (n = 45)	765,053	1,879,891
Crop sales	Household sells maize only (n=18)	472,500	694,750
	Household sells other crops only (n=36)	642,432	1,754,314
	Household sells both maize and other crops (n=133)	510,010	1,933,609
	Household does not sell any crops (n = 13)	378,885	408,985

Source: Survey data 2006

4.3.3 Maize farming and households ability to meet costs for health, education, social activities costs and their ownership of a good quality house in 2006

This sub-section examines how maize farming is related to households' ability to meet their health services, education and social activities costs and their ownership of a good quality house in 2006. Examining the above attributes by mainly focusing on maize farming to reveal how households are performing in the context of twenty years of agricultural reforms that included liberalization of the maize market in 1986. Major emphasis will be placed on percentage of land allocated to maize farming, the percentage contribution of income from maize sales to household income in 2005 and households' general sale of crops.

Generally, Table 5 shows that more commercialized households were better able to meet their health and education costs. For example a higher proportion of households selling more than 50 % of the maize they produced thought they were more capable of meeting the above costs as compared to those selling less. Surprisingly, the Table further shows that a relatively higher proportion of households selling maize only thought they were more capable of meeting their health costs compared to those selling both maize and other crops, or those selling other crops or no crops at all. This observation seems to suggest that with the commercialization of maize production households could be capable of meeting their needs. It is further supported by the 2009 HDR by UNDP (2009), which reports that Tanzanian farm households that diversified their crop production to food crops for their own consumption and other non-traditional cash crops (vegetables, fruit, and vanilla) were the most successful in moving out of poverty. Therefore, households that had commercialized their maize production were not only able to meet their food needs but also to earn cash income necessary for other household needs, such as meeting health and education costs.

The capacity for maize farming to be relied upon by households in Tanzania has also been reported by Maghimbi (2007) who states households in Kilimanjaro have been reported to be foregoing production of coffee a long established cash crop in the region, for maize and rice production. Section 4.4 also shows that respondents from the current study were confident that maize farming could be a way out of poverty. It also

shows that households' ability to meet their health and education costs was relatively high for those to whom cash from selling maize contributed more than 50 % of the household's 2005 cash income, compared to those where income from maize contributed less.

Generally, commercialization of maize production was also observed to be important in households' ability to meet their social activities costs. Table 5 shows that households selling a higher proportion of the maize they produced claimed to be more capable of affording these costs. Commercialization into other crops was also associated with households claiming to be capable of meeting their social activity costs. Households selling both maize and other crops thought they were capable of meeting the above costs compared to those selling maize only, other crops only or those selling no crops at all.

Table 5 shows that commercialization of crop production both in terms of maize production or crop diversification was associated with ownership of a good quality house in 2006. A relatively higher proportion of households selling more than 50 % of the maize produced and those selling both maize and other crops owned a good quality house in 2006, as compared to those selling less maize, selling either maize only, other crops only or those not selling crops at all.

In summary, the results show that commercialization of crop production both in terms of allocating less land to staples or increase in the share of marketed output is important to households' general well-being. Those allocating less land to maize production and those growing many crops were generally seen to be more able to meet their health, education, social relations costs and to own a good house. Diversifying crops grown could be a coping strategy by households against fluctuating market situations ensuring that they have a means of survival in case of failure of one crop in the event of either output or market failures. These households were also less poor in terms of assets owned and cash income earned.

Table 5: The contribution of maize farming to households' well-being in Rukwa

Characteristic		Households' ability to pay for health		Households' ability to pay for education		Households' ability to pay for social activities		Households' ownership of a good house in 2006	
		No	Yes	No	Yes	No	Yes	No	Yes
% of land allocated to maize in 2005	0% (n = 9)	5 (55.6)	4 (44.4)	5 (71.4)	2 (28.6)	2 (22.2)	7 (77.8)	7 (77.8)	2 (22.2)
	0.1 to 33.33 % (n = 31)	21 (77.8)	6 (22.2)	11 (55.0)	9 (45.0)	1 (3.2)	30 (96.8)	24 (77.4)	7 (22.6)
	33.4 % to 66.67 % (n = 100)	52 (55.9)	41 (44.1)	20 (28.6)	50 (71.4)	9 (9.1)	90 (90.9)	59 (59.0)	41 (41.0)
	More than 66.67 % (n = 36)	37 (62.7)	22 (37.3)	26 (49.1)	27 (50.9)	8 (13.3)	52 (86.7)	40 (67.8)	19 (32.2)
% of maize sold by household income	0% (n = 97)	67 (76.1)	21 (23.9)	35 (47.3)	39 (52.7)	13 (13.4)	84 (86.6)	71 (73.2)	26 (26.8)
	0.1 to 33.33 % (n = 29)	15 (57.7)	11 (42.3)	8 (44.4)	10 (55.6)	5 (17.9)	23 (82.1)	20 (71.4)	8 (28.6)
	33.4 % to 66.67 % (n = 58)	25 (43.1)	33 (56.9)	15 (32.6)	31 (67.4)	1 (1.7)	57 (98.3)	31 (53.4)	27 (46.6)
	More than 66.67 % (n = 16)	8 (50.0)	8 (50.0)	4 (33.3)	8 (66.7)	1 (6.2)	15 (93.8)	8 (50.0)	8 (50.0)
Maize income as a % of household income	0% (n = 97)	67 (76.1)	21 (23.9)	35 (47.3)	39 (52.7)	13 (13.4)	84 (86.6)	71 (73.2)	26 (26.8)
	0.1 to 33.33 % 2005 (n = 44)	26 (61.9)	16 (38.1)	13 (39.4)	20 (60.6)	5 (11.4)	39 (88.6)	29 (67.4)	14 (32.6)
	33.4 % to 66.67 % (n = 29)	15 (51.7)	14 (48.3)	6 (28.6)	15 (71.4)	0 (0.0)	28 (100.0)	17 (58.6)	12 (41.4)
	More than 66.67 % (n = 30)	7 (24.1)	22 (75.9)	8 (36.4)	14 (63.6)	2 (6.7)	28 (93.3)	13 (43.3)	17 (56.7)
Number of crops grown by household	0 (n = 2)	2 (100.0)	0 (0.0)	2 (100.0)	0 (0.0)	2 (100.0)	0 (0.0)	2 (100.0)	0 (0.0)
	1 – 2 (n = 93)	59 (64.8)	32 (35.2)	34 (44.7)	42 (55.3)	11 (12.0)	81 (88.0)	67 (72.0)	26 (28.0)
	3 (n 60)	27 (50.9)	26 (49.1)	15 (35.7)	27 (64.3)	5 (8.3)	55 (91.7)	35 (59.3)	24 (40.7)
	More than 3 crops (n = 45)	27 (64.3)	15 (35.7)	11 (36.7)	19 (63.3)	2 (4.4)	43 (95.6)	26 (57.8)	19 (42.2)
Crop sales	Household sells maize only (n=18)	6 (35.3)	11 (64.7)	3 (25.0)	9 (75.0)	3 (16.7)	15 (83.3)	12 (66.7)	6 (33.3)
	Household sells other crops only (n=36)	22 (73.3)	8 (26.7)	8 (38.1)	13 (61.9)	2 (5.6)	34 (94.4)	27 (75.0)	9 (25.0)
	Household sells both maize and other crops (n=133)	77 (59.2)	53 (40.8)	43 (40.6)	63 (59.4)	12 (9.1)	120 (90.9)	78 (59.1)	54 (40.7)
	Household does not sell any crops (n = 13)	10 (90.9)	1 (9.1)	8 (72.7)	3 (27.3)	3 (23.1)	10 (76.9)	13 (100.0)	0 (0)

Source: Survey data 2006

4.3.4 Factors influencing the surveyed households' income, assets and their ability to meet costs for health, education and social activities.

This section examines in detail household well-being using simple regression analysis models (Table 6). The models are based on the hypothesis that some farm characteristics, household characteristics and location may have influenced households' annual income and assets. This allows the hypotheses elaborated on in the introduction to be explored in a multivariate way. Two models are estimated for income and assets, using ordinary least squares[19]. The first model uses households' natural logarithm of their annual income, while the second model uses the natural logarithm of the surveyed households' asset value as its dependent variable. A common set of independent variables is used. The use of the natural logarithm of income and assets value was mainly based on the fact that the relationship between the above dependent variables is not linear; in addition there is a likelihood that natural limits could be in operation for both income and assets value. The section also uses binary logistic regression analysis to determine the association between some farm characteristics, household characteristics and location to the surveyed households' claim of ability to meet their health services, education and social capital costs and their ownership of a good quality house in 2006. The first model aims to investigate the importance of farm, household and location characteristics on households' ability to meet their health costs; the second model uses ability to meet household's education costs as its dependent variable. The third and fourth use ability to meet social activities costs and a household's ownership of a good house in 2006 as their dependent variables respectively, the logistic models use the same set of independent variables applied in the regression models above.

First a set of farm characteristics and farming method variables are specified. These include:

- Total farm size (in ha), which is intended to shed light on the influence of farm size on rural households' well-being.
- Three further variables, the proportions of land dedicated to maize production and to cash crops, and whether the household sells maize, capture the extent to which farms rely on maize or have access to other forms of incomes. It might be expected that households with a large part of land dedicated to cash crops put less effort into their production of maize as they do not rely on income from selling maize. Conversely farmers with a large part of land dedicated to maize may have higher output, hence more surplus to sell.
- Number of crops grown and livelihood strategies adopted by households are also included as these may also mean farmers are less reliant on maize production for their well-being.
- A set of variables that capture input use are also included: use of fertilizer, type of maize seed, use of extension staff, and use of oxen for tilling land, aiming to capture the benefits of improved farming practices that are associated with higher yields elsewhere. Higher outputs would also mean more crop

[19] The models use OLS simply because the aim is to examine correlations and associations, rather than conduct a formal econometric analysis. It is possible that some of the independent variables are correlated with each other and that some are endogenous, for example high yields or high output levels may actually determine if a household sells maize.

is available to sell, hence more income and presumably more ability to invest in assets and meet other well-being needs.

The second set of variables includes key household characteristics such as age, gender and education of the household head and household size. These aim at capturing their influence on the households' income, assets value and the ability to meet their health, education, social activities costs and their ownership of a good house. For example literature shows that education can determine what types of LS a household can access and also determines the efficiency in their execution; gender on the other hand has also been shown to influence access to assets and type of LS. Household size aims to capture the influence of large sized rural households on well-being; while they may be able to easily supply the labour required for their crop production their needs are also higher.

The final set of variables of district dummies aims to capture other characteristics that are not measured by the above, for example access to non-farm income generating activities, or input and output prices or price of other household necessities. Results of the simple linear and binary logistic regressions are presented in Table 6.

The first point to note is that the fit of the asset model is relatively lower compared to the income model. This suggests that there are other factors determining variations in asset ownership that are not included in this model. Nevertheless, the F statistics show that the models are useful for shedding light on both household income and their assets value. Regarding farm characteristics and farming methods, several appear to be significantly associated with income, but not assets. These include proportion of farm land allocated to maize production, proportion of maize sold, and the contribution of maize sales to household income; the influence of these on income was statistically significant. On the other hand number of crops grown by households was only significant for assets value but not income.

The observation that households allocating more land to maize production have lower incomes and a low asset base comes as no surprise given the yield and output levels reported in Appendices 4 and 5. Observations in that study showed that the level of commercialization of food crops was relatively low, as increase in land under maize production did not in itself translate into higher yields so households may not necessarily have got enough for their own consumption and surplus to sell to earn income. In this situation those reliant on maize sales as their major source of household income were hit hardest. Surprisingly, the regression results also show that an increase in the percentage of farm land allocated to cash crops was significantly (0.05 level) associated with lower 2006 household asset values. The only explanation for this based on the study's data limitations is that observations in Appendix 5 show that households' crop yields were relatively low and this meant lower outputs overall. Given the low proportion of farm land allocated to cash crops, the negative impact on assets may be unavoidable, as some cash crops, for example tobacco, require a lot of investment in inputs and labour. In addition in section 4.2 evidence from literature questioned the profitability margin of tobacco, the major cash crop

in Mpanda (Hammond 1997 and Rweyemamu and Kimaro, 2006). In addition households producing less food would need to buy food from the markets, sometimes at higher prices, and this may have been a cause of a lack of positive influence of cash crops on a household's asset base.

It is a general assumption that with increase in age one should have more assets and wealth (Green et al., 2009). Surprisingly, observations from the regression analysis show that household income declined with increase in the age of a household head. This observation may partly be explained by the nature of LS available in the study area, given the fact that the major source of livelihood was crop production; considering the poor technologies used by households (see Appendix 7) and the drudgery involved, households with older heads and fewer youngsters may find it hard to produce enough for both their own consumption and surplus to sell and so earn less. Lastly, the location dummy was only significant for a household's asset value, confirming the summary statistics (Table 5).

In relation to the logistic regression analysis to check for the association of farm, household and location on a household's ability to meet their health, education, social activities costs and to own a good house, a general observation from the four logistic models estimated (Table 6) is that the strength of association between the independent variables and the dependent was not very high as measured by the Nagelkerke's R^2. This suggests that there are other factors associated with the surveyed households' ability to meet their health, education, social capital costs and ownership of a good house which are not included in the models. One important omission could be the governments' subsidization of education and health costs, but how to determine the cost of this was unfortunately beyond the scope of the current study. Nevertheless, all the Model χ (chi) show that the models are useful for shedding light on the surveyed households' ability to meet the above mentioned costs and their ownership of a good house in 2006.

On farm characteristics and farming methods, results show that a household's farm size was associated with both a household's ability to meet their social activities costs, and their ownership of a good house in 2006 with association with the latter being very strong. On the other hand income from maize was positively associated with a household's ability to meet their health costs. Observations from the study (Table 6) further show that the number of livelihood strategies adopted by households was significantly and positively associated with their ability to meet their health costs and education costs. A household's tillage method was, according to the results, also positively and significantly associated with its ability to own a good house. This observation means that less tedious methods of land preparation can allow households to expand their farms in a less exhausting way and to save energy for other farming operations such as weeding or even other livelihood strategies that could increase household income. Due to the very strong association between farm size and ownership of a good house shown above, the assumption is that use of oxen does enable households to easily expand their farms and greater ability to grow a bigger crop (in the case of monoculture) or several crops grown. In this way households can ensure larger harvests and either more surpluses to sell or different crops for sale, giving a higher income base,

which can be used to address the various needs of a household including construction of a good quality house. Furthermore, increases in sales of other crops such as tobacco, sunflower, oil seeds and beans enable households to earn more cash, and because these crops fetch a better price, households involved in their sale stand a better chance of earning enough cash for investment.

Regarding household characteristics, several appear to be significantly associated with a household's ability to meet health costs, but not education and social capital costs. Nevertheless, household heads gender was significantly associated with ownership of a good house; the likelihood of male headed households owning a good house in 2006 was higher than for the female headed households. This observation confirms other findings (FAO 2007 and Horrel, 2008) which show that women's access to resources, particularly in the developing countries, is limited.

The logistic regression results (Table 6) have also shown household heads gender was associated with a household's ability to meet education needs; MHHs thought they were on average less able to meet their education costs despite the government subsidization of the services pointed out earlier. The results also suggest that a unit increase in a household head's age was negatively and significantly associated with the likelihood that a household would be less capable of meeting their health and education costs.

Finally, the district dummies show the presence of a statistically significant association between a household's district of residence and their ability to meet their health costs and ownership of a good quality house. This observation confirms earlier claims by households in Mpanda that they were less able to meet their health costs. This observation is contrary to expectations as with many households in Mpanda growing tobacco as their main cash crop the general expectation would be for them to be able to meet their needs and even own a better house.

Generally, observations from the regression are consistent with expectations. For example, literature shows that commercialization of agricultural production is vital for rural households well-being for it enables them to produce higher output more efficiently, and earning more income, which is vital for their well-being be it meeting health or other needs. This is supported generally by the regression results on percent of maize sold and percent of land allocated to cash crops; the percentage of maize sold was highly significant to a household's income, suggesting that farmers who had commercialized their maize production were able to earn higher incomes. However, the proportion of farm allocated to cash crops was only slightly significant: the slightly significant contribution of cash crops to household income may be due to the fact that overall these were allocated less than twenty percent of the farm, minimizing their contribution. Furthermore, the low yield levels observed in Appendix 5 means outputs were also low, and income similarly low.

The regression analysis further suggests that households with many LS were more capable of reporting higher incomes and meeting their health and education costs. This does not necessarily imply causation but is suggestive of the importance of various livelihood strategies to a household's well-being. Households with alternative sources of income are capable of playing the waiting game before selling their crops, which allows them to get better prices and hence more income compared to those who sell just after harvesting when there is plenty of produce and prices are low. Farm size is also a very important factor associated with a household's well-being. Some of the results confirm expectations, whereas others are more surprising, for example the lack of a significant positive association of age to income, and ability to meet households' needs of health, education, social relations and ownership of a good house. Regarding income levels however, the results are much stronger and more consistent with expectations.

It can be concluded from the regression analysis that a lack of commercialization of maize production by households reliant on the crop as a source of household income were in danger of being trapped deep into poverty due to their lower incomes reported, relative to those commercializing their production or those diversifying into cash crops. Other factors that significantly affected a household's income, asset base or both were age of household head and location. Based on the logistic regression, the study concludes that households' perceived ability to meet their health, education and social activities costs and their ownership of a good quality house were driven by various factors. Number of livelihood strategies adopted by households was more important in households' ability to meet their health and education costs; as expected gender had an important role in the surveyed households' ability to own a good house. One surprising result however was the relatively lack of ability by households in Mpanda to meet their health needs and ownership of good houses despite the fact that the district grows tobacco as a major cash crop. Lastly, it can be concluded that the influence of farm size on rural households' well-being was relatively much stronger and more consistent with expectations.

Table 6: Simple linear and binary logistic regression analysis results for some household well-being indicators (n= 200)

Characteristic	Ln income 2005[a]	Ln asset value 2006[b]	Ability to meet/own			
			Health costs[c]	Education costs[d]	Social relation costs[e]	A good house 06[f]
	B (SE)	B (SE)	B (SE)	B (SE)	B (SE)	B (SE)
Households farm size (ha)	.213*** (.051)	.234*** (.072)	-.062 (.132)	.180 (.161)	1.136** (.464)	.756*** (.172)
% of a household's farm land allocated to maize production	-.009** (.003)	-.006 (.005)	-.006 (.009)	.012 (.011)	-.009 (.014)	.006 (.010)
% of a household's farm land allocated to cash crops	.007* (.004)	-.014** (.006)	.006 (.011)	.018 (.014)	-.014 (.016)	-.023** (.012)
Households sells maize only (1=yes; 0=no)	-.176 (.284)	-.351 (.397)	.945 (.757)	.958 (.990)	-1.218 (1.049)	.510 (.830)
Household's sells both maize and other crops (1=yes; 0=no)	-.303 (.196)	-.030 (.274)	-.250 (.565)	-.021 (.591)	-1.069 (.771)	.142 (.571)
Maize income as a percentage of 2005 household income	-.010** (.003)	-.002 (.004)	.025** (.008)	.004 (.010)	.004 (.015)	.006 (.008)
% of produced maize sold by household	.015*** (.004)	.007 (.005)	.001 (.010)	-.005 (.012)	.008 (.019)	-.010 (.010)
Number of crops grown by household in 2005	.052 (.083)	.197* (.116)	.031 (.214)	-.135 (.250)	-.251 (.450)	.050 (.227)
Number of livelihood strategies adopted by household	.127** (.066)	-.172* (.093)	.468** (.183)	.526** (.223)	.422 (.309)	-.140 (.186)
Household's use of fertilizer in maize production (1=yes; 0=no)	.331** (.158)	.370* (.221)	.415 (.424)	-.528 (.522)	-.358 (.695)	.378 (.429)
Household's use of improved maize seeds (1=yes; 0: no)	-.041 (.158)	-.083 (.221)	.321 (.422)	-.677 (.584)	.194 (.676)	.398 (.408)
Household use of extension services (1=yes; 0 = no)	-.102 (.145)	-.133 (.202)	.033 (.393)	-.500 (.457)	-.729 (.637)	-.474 (.401)
Household's tillage method (1=oxen; 0= hand hoe)	-.126 (.182)	.367 (.255)	.117 (.477)	.276 (.558)	.490 (.783)	1.557** (.523)
Household's head age	-.015** (.006)	.006 (.008)	-.028* (.017)	-.036** (.019)	-.027 (.023)	-.001 (.017)
Sex of household's head (1=male; 0=female)	-.038 (.191)	-.201 (.267)	-.752 (.535)	-1.302** (.599)	-.273 (.700)	1.255** (.507)
Actual school years of household's head	.030 (.030)	.067 (.042)	-.047 (.084)	.126 (.084)	.096 (.127)	.116 (.086)
Household size	.010 (.026)	-.010 (.037)	-.020 (.074)	.061 (.087)	-.038 (.110)	.021 (.074)
Sumbawanga district (1= Sumbawanga; 0= otherwise)	-.100 (.194)	-.786** (.272)	.901* (.545)	.264 (.601)	-.763 (.846)	-.924 (.565)
Nkansi district (1:Nkansi; 0= Otherwise)	-.136 (.220)	-.347 (.308)	1.057* (.599)	.433 (.658)	-.070 (.940)	-1.540** (.640)
(Constant)	12.595***(.618 F= 8.067***	12.819***(.863) F= 4.605***	-.464 (1.727)	.133 (1.936)	3.085 (2.728)	-4.308** (1.745)

NB: ***Significant at 1% (0.001) level, **Significant at 5% (0.05) level and * Significant at 10 % (0.1) level

[a] Linear regression model for Ln 2005 household income [a] Linear regression model for Ln 2006 household assets value

[c] Binary logistic regression model: Note R^2 =0.243 (Cox & Snell R^2), 0.330 (Nagelkerke R^2). Model χ^2 (19) = 52.356***

[d] Binary logistic regression model: Note R^2 =0.258 (Cox & Snell R^2), 0.347 (Nagelkerke R^2). Model χ^2 (19) = 44.668***

[e] Binary logistic regression model: Note R^2 =0.155 (Cox & Snell R^2), 0.323 (Nagelkerke R^2). Model χ^2 (19) = 36.449 **

[f] Binary logistic regression model: Note R^2 =0.269 (Cox & Snell R^2), 0.371 (Nagelkerke R^2). Model χ^2 (19) = 62.338***

4.4 Maize farming as a poverty escape

In the last two sub-sections we have seen the importance of income from maize sales to a household's cash income and general well-being, for example to meet food, health and asset build up. In this section the study tries to assess maize farmers' views on maize farming's potential for rural poverty reduction or its contribution towards further improvement of rural households' well-being. Farmers' opinions on the socio-economic importance of crops or products they produce are an important indicator of the importance attached and/or commitment to the particular product. Opinions offered on maize production by the respondents of the surveyed households can offer an insight into the actual effectiveness of the crop on the well-being of the households. According to ODI (2002) agriculture can be an engine for rural growth and poverty reduction, though this may not be uniform in all places. Describing a study on Ethiopia, Diao and Pratt (2006) have shown that agriculture can play an important part in decreasing poverty and increasing growth, and that staples (cereals, root crops, pulses, and oil crops) have great potential as income sources for the majority of small farmers. The above situations will for a long time be applicable to many of the rural residents in Sub-Saharan Africa, Tanzania included. In reality, this part of the continent lacks suitable alternative sources of livelihood due to lack of industrialization and the underdevelopment of the financial and social service sectors, especially in the rural areas. Therefore, opinions from the surveyed farmers could help shape strategies by Tanzanian policy makers and agricultural extension staff in their quest to improve rural farm households' well-being.

Approximately three quarters of the respondents considered maize farming to have the potential of enabling improvement of households' well-being (Table 7). At the district level Sumbawanga had the highest positive response followed by Nkansi. The relatively lower response by respondents in Mpanda district may be caused by many farmers in Mpanda being able to grow tobacco as their cash crop; tobacco has a higher income earning capability than maize. Furthermore, many households only saw maize as a food crop rather than a cash crop (See respondents' quotations below). Such a view is also popular amongst politicians, who during electoral campaigns or parliamentary sessions promise farmers or demand the government to introduce cash crops to their areas. Consequently, maize is only seen as a food crop, and less effort is directed to support maize production as a potential income earner. However some few projects aiming at making rural households food secure have been executed. On the other hand there have been numerous extension efforts directed to export crops such as cotton, tobacco, coffee and cashew nut; enabled by these crops having boards that closely monitor production and marketing. Although most respondents were confident that maize farming has potential for households' poverty reduction, most added some preconditions to this, as presented in the next paragraph[20].

[20] The respondents' and the FGDs participants' definition of poverty suggests that it may be very hard for a government or NGOs to help in reducing rural poverty. Although empirical evidence from the current study suggests most of the surveyed farm households fall into the poor category, most respondents and FGDs participants saw the poor as either people with disabilities (including the blind, deaf, and crippled), the elderly, those in poor health, those without farming equipment and/or development. Though some did mention lack of assets, income and development as characteristics of the poor, many seemed to see poverty from a very different angle to that of development agencies and governments. This perspective might hinder efforts to fight

Generally, farmers optimistic that maize farming had the potential of getting households out of poverty thought this could only be achieved if it was carried out more efficiently. They argued that it was only through use of modern technologies such as chemical fertilizers, improved seeds and professional advice from extension staff that poverty reduction or general improvement of maize farmers' well-being could be achieved. Nevertheless, they were worried that without a rise in maize prices their efforts could still end in vain. They thought that for maize production to make the necessary contribution towards poverty reduction, the government should; play an active role, ensuring that buyers do not pay too little for their produce and that farmers can access inputs at affordable prices, in contrast to the current situation. Below are a few quotes that reflect the respondents' optimism and worries:

"Yes, it's possible for maize farming to reduce poverty in our area, for example if one gets a good price for the maize, then one can be able to build a good house and even educate his/her children." (A farmer in Sumbawanga district)

"Yes, maize farming can reduce one's poverty if one is knowledgeable and seeks agricultural advice from qualified extension staff. This could enable one to produce surplus to sell and earn income to overcome poverty". (A young male farmer in Mpanda district)

"Yes, maize farming can enable one to get out of poverty in our area; for example due to maize farming, one farmer has been able to build a modern house using burnt earth bricks and corrugated iron sheets and he expects to build another house after the rainy season" (A farmer in Nkansi district).

The quotations above are supported by observations from the FGDs and in-depth interviews with the concerned districts' agricultural officers (DAOs), in which participants generally agreed that there was a possibility of reducing poverty through maize farming. They added that for this to happen, efforts needed to be in place to educate farmers on modern farming techniques and the inputs needed to be available at the right time and at affordable prices. The FGDs participants fully agreed that with the current maize yields it was quite impossible to reduce households' poverty through maize farming. Generally, observations from the surveyed households, the FGDs and DAOs indicate that households may have not responded adequately to a liberalized maize market, through lack of resources and/or knowledge. While liberalization has assured availability of buyers it has made access to inputs more difficult than before.

Respondents were very pessimistic about maize farming's potential to improve rural well-being in Rukwa, mainly because most of them saw maize as a food crop rather than a dual purpose crop. They also argued that in comparison to other crops like sunflower, beans or tobacco (in Mpanda) maize fetched a low price in relation to the production costs incurred. They added that overdependence on one crop could risk the family's well-being, especially in relation to food security. Since most of the respondents saw maize as a food crop, doubts about its ability to contribute to well-being improvement were based on fear of being food insecure if they rely on maize farming as a

individual farm households' poverty.

livelihood option (see last quotation below). This view deters many households from taking advantage of the opportunities provided by the liberalized maize market. Rather than respondents thinking how best to raise their yields to cater for their households' needs and the market, their main concern was their subsistence. It's argued that both the 'pessimistic' and the 'optimistic' respondents implicitly or explicitly agree that maize production has the potential to reduce poverty or improve rural well-being in Rukwa. Furthermore, some issues raised by the pessimistic group are the same as those of the optimistic group. For example both urge adoption of improved technologies and a close monitoring of input and output markets by the government. The following quotations, to support the above:

> "No, maize farming is not sufficient for the reduction of one's poverty. My experience for the past ten years shows me it's impossible unless changes happen."(A farmer in Sumbawanga district)
>
> "No, maize farming cannot help one reduce his/her poverty, particularly due to lack of needed inputs like fertilizers. People in our area are used to growing tobacco. Furthermore, even the fertilizer we apply to our maize is a result of tobacco farming." (An old male farmer in Mpanda district)
>
> "No, one crop for example maize alone is not adequate to reduce one's poverty, unless perhaps you mix with other crops like beans, sunflower, Irish[21] or sweet potatoes. Maize is mostly a food crop and we only sell a very small portion. If I were to totally rely on maize to meet all my needs, I would definitely be food insecure at a later stage." (A farmer in Nkansi district)

The above quotations are supported by observations from the FGDs and in-depth interviews with the concerned districts' agricultural officers (DAOs): although FGDs participants and DAOs believed maize farming is capable of improving rural well-being in Rukwa, they were cautious that current husbandry practices and lack of access to inputs were hindrances. The surveyed households' views are supported by Hazel et al. (2007) who have argued that small farms still remain the main ways through which poverty can be reduced in the developing world. However, for this to be possible they argue that improvements should be put in place with regard to input and output markets and the operation of financial services. Policy makers in Tanzania, agricultural extension staff, local authorities and the central government need to take the above observations onboard and see how best they could help rural households, particularly those who rely on maize farming as their main source of livelihood, to improve their well-being in line with the MDGs.

Many respondents think households could fight poverty or improve their well-being through maize farming, though not at current yield levels. Respondents' dismissal of maize farming for potential poverty reduction and well-being improvement is mainly because the crop is perceived as a food crop rather than a dual purpose crop with potential to meet not only households' food needs but also their cash needs. There is a strong possibility for maize to be a worthwhile cash crop if yield levels are raised, especially with the current rise in international prices of cereals/grain.

[21] In Tanzania this refers to white/round potatoes

Lastly, for the surveyed households and others in Tanzania to benefit from maize farming in a liberalized market, a change in mind set is needed; otherwise poverty levels may continue in the absence of suitable alternative opportunities. The quantitative analysis results show that relying too much on maize is associated with bad outcomes, but clearly the farmers think that given the right conditions maize is a way out of poverty. This may show why it was able to replace traditional staples such as millet and beans following its introduction in the 1970s (URT et al.., 2004).

Table 7: Respondents' opinions on maize farming's potential for poverty reduction in their area

Characteristic		Rukwa region n = 163	District		
			Sumbawanga n = 36	Mpanda n = 66	Nkansi n = 61
Can maize farming reduce poverty?	Yes	123(75.5)	32(88.9)	46(69.7)	45(73.8)
	No	40(24.5)	4(11.1)	20(30.3)	16(26.2)

Source: Own survey 2006, *NB*: Numbers in brackets indicate percentage

4.5 A comparison of household well-being between 2005 and 1986 for households in crop production in 1986

The main objective of the agricultural reforms carried out in Tanzania in the 1980s was to enable rural households to improve their well-being. Other socio-economic reforms were also introduced following the underperformance of Tanzania's approach to development using '*Ujamma na Kujitegemea'* (Socialism and self reliance) adopted by the government in 1967 through the Arusha Declaration. Despite the good intentions of the ideology, Tanzania went through severe economic crisis from the late 1970s onward and as a consequence availability of ordinary day-to-day necessities such as soap, cooking oil, sugar and many household goods items such as TV sets, radios, refrigerators, foam mattresses and many more were in short supply. Some day to day household necessities were mainly available in black markets at high prices. During that period ownership of things such as radios, televisions, a motorbikes and cars were seen as luxuries out of the reach of many. As a result Tanzania had to sign an agreement with the World Bank and the IMF in 1986 to adopt SAPs, and following this the government introduced programs including the Economic Recovery Programme One (ERP I) in 1986, ERP II, Economic and Social Action Plan (ESAP) and the Priority Social Action Plan (PSAP) in 1989 (Lugalla, 1997).

This section briefly examines the well-being of those households that were in maize production when the maize market was liberalized in 1986. The main aim of the examination is to see whether liberalization of the agricultural markets and the subsequent expansion of the market players enabled households reliant on maize as an income source to improve their well-being. The study does acknowledge the complexity of establishing the direct causal relationship between the liberalization of the maize and other markets and households' well-being, due to the variety

of other factors involved in the day-to-day living of rural households. This complexity is further compounded by the limitations associated with recall data. Therefore, observations from the study are not conclusive but suggestive as the study cannot really test if households are better-off or worse-off due to trade liberalization. However, the surveyed households' testimonies and observable indicators such as type of house owned, income and value of assets owned shed some light on the section's objective.

Generally, there has been an improvement in well-being over the time period 1986 and 2006 according to some of the well-being measures used by the study. Table 8 below shows an increase in number of households owning good houses from below five percent in 1986 to forty percent in 2006, and also that both annual income and households' asset value has increased[22]; whereas the increase in income is comparatively small the value of assets tripled.

Table 8: A comparison of real annual incomes, asset value and ownership of good quality house for households in maize production in 1986 and 2006

Characteristic		Year	
		1986	2006
Quality of house owned by surveyed household in 2006 (n = 85)	Good	2 (2.35)	34 (40)
	Poor	83 (97.65)	51 (60)
Average household income (Tsh)[23]		401,770.00	494,689.00
Average households asset value for 2006 (Tsh) (n = 87)		456,145.00	1,442,994.25

Source: Own survey 2006, NB: Numbers in brackets indicate percentage

Improvement in households' well-being is further supported by Table 9, which shows that more than half of the respondents had experienced an increase in household income and more than three quarters experienced an increase in their households' assets value between 1986 and 2006. According to the surveyed households' interview testimonies, these increases occurred as a result of factors such as increase in crop sales, maize included, and involvement in other income earning activities such as petty trade. However, a paired sample test (t-test) (Appendix 8) shows that the only significant difference was between the households' assets value in 2006 and 1986; this was significant at the 0.05 level. This observation suggests that households in maize production in 1986 were able to significantly increase their assets between 1986 and 2006. However caution needs to be used when interpreting the income and asset values because of recall problems. None the less households ability to increase their overall assets value was evident during the survey, some respondents reported they had used income from maize to buy farmland, build houses, buy livestock and many other things that added up to their total asset value. The observations suggest that many of the surveyed households were able to increase their household's asset value,

[22] Incomes and asset values reported for 1986 have been converted to 2005 and 2006 values to enable the comparison with 2005 and 2006 income and asset values respectively.
[23] Number of responses for 1986 and 2005 is 81 and 87 respectively.

partly due to the liberalized maize market which opened up the market to many buyers. Through competition they may have caused a rise in the price of farmers' maize, thereby raising their incomes. As observed in Study Six, most households sold their maize to other buyers apart from the Strategic Grain Reserve (a unit under MAFC) which is responsible for buying staples for storage for future release in case of food insecurity threats in Tanzania. Freeing the markets from the traditional monopoly of government parastatals also meant that farmers had an assured market and there was no possibility that they would be stuck with their produce; hence their income was assured for spending in the improvement of the household's well-being, including the asset build up as described in Table 9. It can be generally concluded from the above that many households in maize production in 1986, at the onset of the liberalization of the maize market, benefited in one way or the other from it.

Table 9: Income and assets value increase for households in maize production in 1986

Characteristic	Households income increase (n = 82)	Households asset value increase (n= 87)
Yes	48 (58.5)	69 (79.3)
No	34 (41.5)	18 (20.7)

Source: Own survey 2006, NB: Numbers in brackets indicate percentage

The other measures of well-being considered by the study were ability to afford health, education and social activities costs. Households surveyed seem to have only made improvement in the last category but not the other two (Table 10). With the exception of ability to afford social activities households thought they were more able to afford their health and education costs in 1986 than 2006. The reduced ability to meet health costs is not surprising many households in Tanzania were reporting hardships in meeting their health costs following the introduction of cost sharing brought in by the government's reform of the sector. The diminished ability to meet education costs is more surprising given that Table 2 has shown most respondents thought they were capable of meeting the costs, and the government is subsidizing primary school education. It is assumed that households are facing hardships in meeting other educational costs such as costs of uniforms and other items that the government does not provide. Another assumption is that some respondents may been considering secondary school education, where the level of government subsidy is lower; for pupils going to private schools the costs are much higher.

Table 10: A comparison of ability for households in maize production in 1986 and 2005 to afford their health, education and social activities costs

Characteristic	Ability to afford household costs in		
	Health (n = 84)	Education (n = 71)	Social services (n = 83)
Less ability in 2006 as compared to 1986	55 (65.5)	36 (50.7)	30 (36.1)
No change in ability between 1986 and 2006	2 (2.4)	1 (1.4)	8 (9.6)
More ability in 2006 as compared to 1986	27 (32.1)	34 (47.1)	45 (54.2)

Source: Survey data 2006, *NB*: Numbers in brackets indicate percentage

4.6 Conclusions

The study began by comparing indicators of well-being across households and districts, then examined the role of maize in well-being, and in particular explored a number of hypotheses relating to commercialization and diversification. The study also looked at changes in the context of 20 years of reform. The well-being of households in rural Rukwa was measured using six basic criteria: ability to meet health, education, and social costs, ownership of a good quality house, cash income, and assets. The capabilities to meet costs in education, health and social activities were assessed on the basis of the respondents' perception. The relationship was examined between a household's well-being and maize production, based on percentage of land allocated to maize farming and the percentage contribution of income from maize sales to a household's cash income in 2005. The study also examined opinions by respondents as to whether maize production could be relied upon as an escape route out of poverty.

The study concludes that commercialization of agricultural production, both in terms of maize production and crop diversification, is vital for rural households' well-being for it enables households to produce more output in a more efficient way and earn more income which is vital for their well-being, be it meeting health or other needs. Observations from the study have shown that the more commercialized households were better were able to health and education costs. Commercialization of crop production was also associated with ownership of a good quality house and a higher mean asset value. The results are supported by Spring, 2000 and Hazel et al., 2007, who argue that commercialization of crop production is a good way of ensuring households' food security and general well-being.

It is also concluded that households diversification of their livelihood strategies was very important to their general well-being. Both quantitative analysis and summary statistics showed that such households did report higher cash incomes and ability to afford health and education costs. This does not necessarily imply causation but is suggestive of the importance of various livelihood strategies to a household's well-being. The observations seem to be in line with literature arguing that diversification of livelihood strategies is common amongst rural households, and is driven

by many factors, such as low profitability of agriculture, as a way of meeting individual needs caused by low returns from commercial agriculture, the withdrawal of the government from support programmes, risk reduction, responding to various constraints such as land fragmentation, and labour supply issues. Observations from the study showed that households in Rukwa saw diversification as a way to improve their well-being.

The study further concludes that several household characteristics were associated with a household's well-being. However, some seemed to be associated with one measure but not the other. For example a household head's gender was significantly associated with a household's ability to meet its education needs; MHHs thought they were on average less able to meet their education costs relative to FHHs. On the other hand the likelihood of MHHs owning a good house in 2006 was higher than for FHHs. The observation that FHHs were less likely to own a good house may be because as reported in literature (FAO 2007 and Horrel, 2008), women's access to resources particularly in developing countries is limited. The differences in access to resources could also lead to adoption of different LS which may then affect inflows of cash income to the households and therefore their well-being. The present study has also shown that a households head's age was negatively and significantly associated with a household's capability of meeting their health and education costs, age was also negatively associated with a household's ability to afford social activities costs and ownership of a good house. This observation suggests that households headed by older heads may on average be poorer compared to those with younger heads. Farm size was also shown to be significantly associated with a household's well-being; households with larger farms were generally able to report higher mean cash income and assets value, afford social activities costs and own a good house.

Finally, some substantial gains were made by those households that were in maize production in 1986 when reforms in the agricultural sector were undertaken, including liberalization of the maize markets. The proportion owning good houses went up substantially and they also experienced increases in mean income and asset value. Though the increase in income is apparently small there was a tripling of the mean asset value. Due to data limitations the study is unable to show clearly how trade liberalization may have contributed to the above achievements. Nonetheless, before the 1980s reforms both the agricultural sector and availability of goods were seriously affected by the state's control of markets (Sijm, 1997 cited by URT *et al*., 2000). According to Sijm availability of consumer goods is necessary to motivate farmers' production. Based on this point and observations from the study it may not be wrong to assume that liberalization of the agricultural and other markets have enabled the farmers to sell their surplus food crops and other cash crops, earning cash income with which to buy goods/assets that are readily available and increase their assets value.

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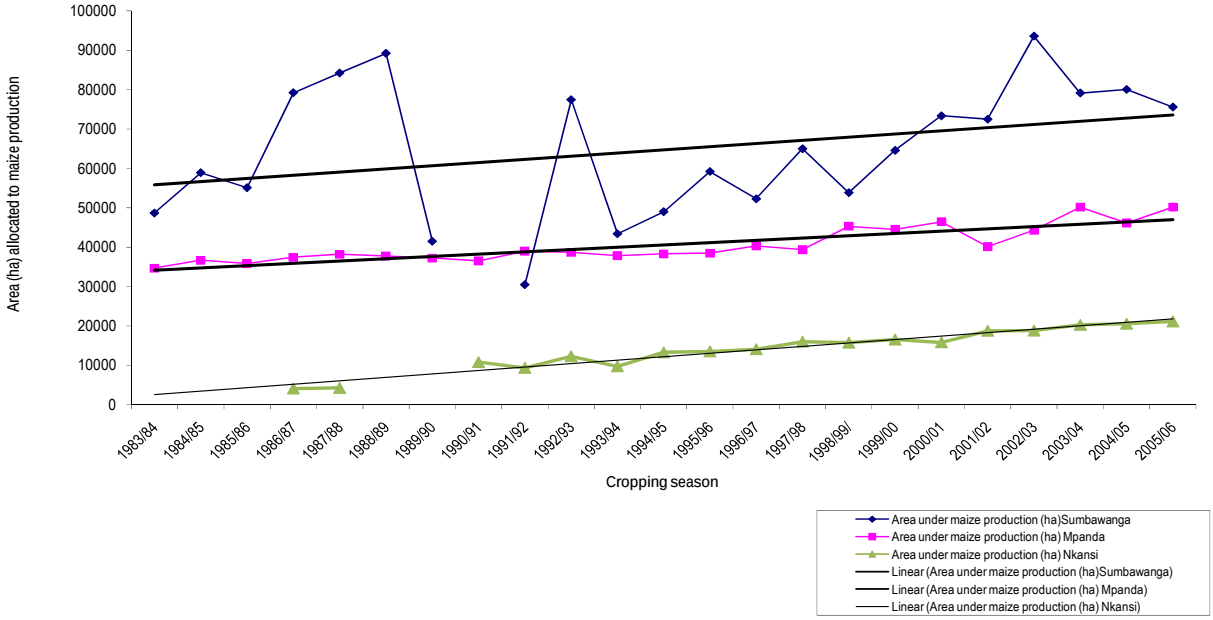
Appendix 1: Rukwa's maize Iproduction trend for the period 1983/84 - 2004/05



Appendix 2: Rukwa's agro-ecological/economic zones

Agro-ecological zone	Ecological characteristics	Economic/Agricultural potentials/characteristics
Ufipa Plateau	-500-2200 m.a.s.l , -almost deforested plateau with open grassland vegetation -Isolated hill, and ranges -soils are predominantly leached, acidic and ferralitic with loamy or sandy top soils becoming more clayey by depth, -densely populated	-Cattle keeping common for cash, meat and as a source of draught power -Important for maize growing -other traditional crops are finger millet and beans -Fallowing and rotational cropping widely practiced
Rukwa Valley	--800-1000 m.a.s.l , -partly consists of Acacia woodland with areas of grassland vegetation -alluvial soils, predominantly sandy with high fertility levels -poorly drained cracking clays and saline soils also present in some areas -Area densely(medium) populated	-Grazing value high hence the presence of high wildlife numbers -Has potential for both rain fed and irrigated farming, -major crops maize and rice -Receives erratic rainfall ranging between 700 to 1000 mm per annum -main economic activities include crop production, cattle keeping and fishing
Lake Tanganyika Shore and escarpment	-Lake shores 700 m.a.s.l , -Alluvial soils with sandy soils also being common -Soil erosion serious due to deforestation -Vegetation mainly Miombo woodland -Rainfall ranges between 900–1000 mm p.a. -Less densely populated	- Main crops, cassava, rice, millet and beans - Fishing is an important source of income and food
Katumba-Inyonga plain	--1000-1200 m.a.s.l, -Tsetse infested Miombo woodland -Sandy soils with very low fertility -Rainfall ranges between 900– 000 mm p.a. and -Sparsely populated	-Important crops cassava, maize and groundnuts -Beekeeping and lumbering of hard wood are also important economic activities
Mpanda –Mwese dissected plateau	--1000-1200 m.a.s.l, -Hill ranges and minor plateau area -Miombo woodland -Loamy and ferralitic soils -Largely sparsely populated	- Suitable for cereals (maize and finger millet), beans , cassava, sweet potatoes and rice -Groundnuts, sunflower, tobacco the major cash crops -livestock restricted to tsetse free areas -Use of oxen quite common -Beekeeping also a major economic activity

NB; Information in this Table comes mainly from pages 39 -41 of Rukwa's 2004 Socio-Economic Profile (URT ET AL., 2004)

Appendix 3: Villages and Number of Households Involved in the Study on Maize Market Liberalization and Poverty Reduction; A Case Study of Rukwa Region, Tanzania

District	Division	Name of village	Number of respondents
Sumbawanga	Mpui	Sandulula	22
	Mtowisa	Kalumbeleza	6
		Muze	10
	Mwambi	Ninga	19
	Kasanga	Muzi	15
	Mpui	Sandulula(FGDs)	26[a]
		Total	98
Mpanda	Karema	Kapalamsenga	20
	Kabugu	Igagala	11
		Ifukutwa	10
	Mpibwe	Kibaoni	11
	Nsimbo	Mtapenda	15
	Kabungu	Ifukutwa (FGDs)	27[b]
	Mpibwe	Kibaoni (FGDs)	28[c]
		Total	122
Nkansi	Namanyere	Kanazi	12
		Ntumbila	3
	Chala	Londokazi	16
	Kirando	Katongolo	16
	Kate	Nkundi	15
	Chala	Londokazi (FGDs)	26 [d]
		Total	87
		Grand Total	307

NB: [a] this comprised of 12 females (six aged below 35 years and six above) and 14 males(7 aged below 35 years and 7 above),
[b] This comprised of 14 females (9 aged below 35 years and 5 above) and 13 males (7 aged below 35 years and 6 above),
[c] This comprised of 14 females (7 aged below 35 years and 7 above) and 14 males (8 aged below 35 years and 6 above) and
[d] This comprised of 13 females (7 aged below 35 years and 6 above) and 13 males (7 aged below 35 years and 7 above)

Appendix 4: Crop yield levels of selected food crops in Rukwa and the surveyed households for the 2004/05 season

Characteristic		Average yield (kg/ha)	
		Rukwa[24]	Surveyed households
Food crops	Maize	1203.32	1057.00
	Rice	1761.95	1535.68
	Beans	679.91	446.55
Cash crops	Groundnuts	473.61	552.50
	Sunflower	784.54	634.20
	Tobacco	1073.32[a]	794.05

Source: Data for Rukwa comes from the Basic Data Agriculture and Cooperatives Sector 1998/99 – 2004/05 (URT, 2006), and surveyed households data is from own survey 2006. *Nb*: [a] This is an estimate from the district agricultural office in Mpanda.

[24] Figures for Rukwa also include data from Sumbawanga Urban district, which was not covered by the study.

Appendix 5: Productivity (kg/ha) of selected food and cash crops for selected regions of Tanzania for the 2004/05 season

Characteristic	Crop	Tanzania	Arusha	Kilimanjaro	Iringa	Mbeya	Ruvuma	Rukwa*	Surveyed households
Food Crops	Maize	1007.08	1195.95	1264.52	1483.40	1338.59	1387.14	1203.32	1057.48
	Rice	1534.28	4051.96	5204.14	1750.19	2170.50	1403.89	1761.95	1535.68
	Beans	772.30	927.14	574.85	814.89	648.72	716.57	679.19	446.55
Cash Crops	Groundnuts	717.95	-	365.38	1020.83	662.80	540.82	473.61	552.50
	Sunflower	927.83	733.33	311.83	839.18	518.87	6.14.41	784.54	634.20
	Tobacco++	858.32	1000.00	600.00	-	1000.00	600.00	1000.00	794.05

Source: Own survey 2006, ++data from district agricultural offices (Sumbawanga, Mpanda and Nkansi) and basic agriculture and livestock data booklet for 2005. * Rukwa's average for 2001/02 (848 flue cure and 350 fire cured

Appendix 6: Maize marketing by surveyed households in 2005

Characteristic		Rukwa Region n = 191	District		
			Sumbawanga n = 66	Mpanda n = 66	Nkansi n = 59
Households selling maize in 2005 as a % of those who produced it[25]		53.93	59.1	30.30	74.58
Average amount sold (kg) in 2005[a]		713.04	833.33	297.73	1,043.05
Amount sold as a % of maize produced in 2005[a]		26.96	34.53	12.07	35.15
Households general sale of maize	(Yes)	150(75)	56(77.8)	38(56.7)	56(91.8)
	(No)	50(25)	16(22.2)	29(43.3)	5(8.2)

Source: Own survey 2006, *NB*: [a] Calculations have been made on basis of all households growing maize in 2005.

[25] Observations from the study showed that about 75 % of the 191 households that produced maize in 2005 normally sell maize. However, the percentage actually selling maize in 2005 was found to be just above 50%. Unfortunately, the available information the study does not reveal why fewer households sold maize in 2005 than to those reporting that they usually sell it.

Appendix 7: Rukwa households' use of modern technologies in maize production in 2005 by numbers and percentage

Characteristic		Rukwa Region (n = 191)	District		
			Sumbawanga (n = 66)	Mpanda (n = 66)	Nkansi (n = 59)
Tillage method used	Hand hoe	109 (57.1)	35 (53.0)	61 (92.4)	13 (22.0)
	Ox-plough	82 (42.9)	31 (47.0)	5 (7.6)	46 (78.0)
Use of fertilizers in maize production	Yes	57 (29.8)	9 (13.6)	23 (34.8)	25 (42.4)
	No	134 (70.2)	57 (86.4)	43 (65.2)	34 (57.6)
Maize seeds used	Traditional/Local seeds	134 (70.2)	50 (75.8)	46 (69.7)	38 (64.4)
	Hybrid seeds bought from input shops every year	19 (9.9)	3 (4.5)	10 (15.2)	6 (10.2)
	Hybrid seeds recycled from previous season	38 (19.9)	13 (19.7)	10 (15.2)	15 (25.4)
Household's use of extension services	Yes	73 (38.2)	19 (28.8)	35 (53.03)	19 (32.2)
	No	118(61.8)	47 (71.2)	31(46.97)	40 (67.8)

Source: Own survey 2006, *NB*: Numbers in brackets indicate percentage

Appendix 8: Paired samples test for adjusted 1986 and 2005 household's annual income and adjusted 1986 and 2006 assets value

		Paired Differences					t	df	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
					Lower	Upper			
Pair 1	Household's total asset value in 2006 - adjinc1986	1.14142E6	4.30830E6	4.78700E5	1.88773E5	2.09406E6	2.384	80	.019
Pair 2	Household's income in 2005 - adjinc1986	1.34419E5	8.41775E5	93530.53811	-51713.18069	3.20550E5	1.437	80	.155