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Impact of Agroecology Adoption, Migration and Remittance Receipt on Household Welfare

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A thesis submitted in partial fulfillment of the requirements for the Master of Arts degree in Geography

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IMPACT OF AGROECOLOGY ADOPTION, MIGRATION AND REMITTANCE RECEIPT

ON HOUSEHOLD WELFARE

(Thesis format: Integrated Article)

by

Joseph Kangmennaang

Graduate Program in Geography

A thesis submitted in partial fulfillment of the requirements for the degree of Master

The School of Graduate and Postdoctoral Studies

The University of Western Ontario

London, Ontario, Canada

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Abstract

This thesis aims to examine the impact of two livelihood strategies on household wellbeing in Northern and Central Malawi. Specifically, the study aims to examine how agroecology adoption, migration and remittance receipt impact household food security and asset poverty levels. Prior research has revealed that agroecological farming methods and remittance receipt can increase productivity, increase yield stability and resilience of family farmers as well as increase their incomes and propel them out of poverty. Agroecology as an alternative agricultural approach has gained momentum through some high-level FAO meetings as well as reports highlighting its potential. Migration and remittances flows have also become vital components in the livelihood and development strategies of several households in the developing world. However, relatively few empirical studies link agricultural innovations adoption, migration and remittance receipt to household food security and asset levels, partly due to data unavailability and the complexities in data requirements. This study benefited from a longitudinal data and also adopted propensity matching scores techniques to gauge the effects of agroecology adoption, migration and remittance receipt on household food security and asset levels.

Results of our analysis reveal that households that adopt agroecological farming practices, adopt migration as a livelihood strategy or receive remittances were more likely to be food secure and reports high asset levels, compared to non-agroecology adopting households, households without migrants members and non-remittance receiving households, respectively. This study makes important contributions to theory, methodology and policy. Theoretically, this study demonstrates potentials of agroecology farming practices and remittance receipts towards enhancing household welfare in terms of improving food security and poverty reduction. It also reveals that household inequalities in terms of access to land, educational status and health of household head influence adoption of agroecology. Methodologically, it reflects the superiority of longitudinal data analysis

and propensity score matching techniques to establishing causality. Policy implications and directions for future research are suggested.

Key words: Agroecology, Migration, Remittance, Food Security, Assets level

Co-Authorship Statement

This thesis is made up of a collection of two papers which are being processed for publication. The study problem, objectives and the relationship among the various manuscripts are outlined in the introductory chapter and the study methodology is described in Chapter 2. The contributions to the thesis, policy implication and directions for future research are discussed in chapter 5. The research manuscripts are as follows:

Chapter 3: Kangmennaang, J., Bezner-Kerr, R., & Luginaah, I., Impact of agroecological practices and farmer-led knowledge exchanges on household wealth and food security in Malawi

Chapter 4: Kangmennaang, J., Bezner-Kerr, R., & Luginaah, I., Impact of Migration, and remittance receipt on household food security and asset levels in Northern and Central Malawi

While all the papers are co-authored with my thesis supervisor and others, as the first author I conducted the actual research that involved problem identification, literature review, data analysis, and writing.

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Chapter 1

Introduction

This dissertation examines two related aspects of livelihood strategies employed by family farmers to augment their household food security and income levels in Northern and Central Malawi. This chapter provides a brief background and organization of the thesis. It also summarizes relevant literature, and explains how this research is placed within the broader sub-discipline of Health Geography. This chapter concludes by outlining the historical conceptualisation of food security in the World and how this influenced Malawi's food and agriculture policy.

1.1 Background

Food security is commonly defined as prevailing 'when all people, at all times, have physical, social and economic access to sufficient, safe and nutritious food which meets their dietary needs and food preferences for an active and healthy life' (FAO, 2014). According to the Global Food security index scale, Malawi ranks 94/109 countries on overall food security, ranking 95th, 96th and 90th in terms of affordability, availability and quality and safety of food respectively (GFSI, 2014). Consequently, food insecurity remains a development and a health challenge, as Malawi still remains in the rank of countries that need improvement in their food security score. It is however important to note that Malawi is the third best improved country in terms of food security from 2013 to 2014 in the sub-Saharan Africa region with an average change of plus 4.9 points (GFSI, 2014). Central to Malawi's food insecurity problem is smallholder farmers who produce the bulk of the country's nutrition needs. In many developing countries, family farming remains the main source of livelihood, especially in rural communities. In the case of Malawi, the United Nations (UN Special Report, 2013) estimates that of those engaged in agriculture, 90% is at subsistence level. Hence in recognition of the importance of smallholder/family farmers and the need to improve their livelihood strategies, various policies have been implemented since Malawi's independence (Mellor, 1966;

ReSAKSS, 2008) to support these farmers. Included in these policies have been several social and safety net programs such as fertilizer and seed subsidies designed to increase agricultural output and protect smallholder farmers from the perils of neoliberal market reforms instituted in the 1980s under the structural adjustment program (Harrigan, 2003). Even though these programs and policies were aimed at improving food security and income levels of family farmer, these farmers continue to be the most food insecure and in higher levels of poverty (ReSAKSS, 2008; Fisher & Lewin, 2013). It is under this background that I examine the impact of an agroecology agricultural intervention and other livelihood strategies such as migration and remittance receipt on the food security and asset levels of smallholder or family farmer.

1.2 Literature review

SFHC, MAFFA and income levels among farmers

There is an emerging need for interventions aimed at helping family farmers to confront increasing food insecurity due to poor yields as a result of environmental change (Altieri, 2002). In the case of Malawi, the United Nations is advocating the adoption of a ‘Brown Revolution’-assisting farmers to improve structural soil fertility as the most effective way to achieving food security (UN special report, 2013). Hence, the Soils, Food and Healthy Communities (SHFC) and the Malawi Farmer-to- Farmer Agro-ecological (MAFFA) projects were implemented to work directly with local farmers with the aim of using agroecology methods to improve food production and child nutrition. The SHFC and MAFFA have been working with more than 6000 poor farmers in the northern town of Ekwendeni (Northern Malawi) since 2000, and in the past two years expanded to Dedza in the central parts of Malawi (Figure 1.1). The project adopts a synergistic community based participatory agroecological approach in the context of climate change by introducing farmers to crop diversification, educational programs and links to market (Bezner-Kerr et al., 2007). According to Snapp et al. (2010), legumes production have significantly increased with legume residue incorporation rising from 15% in 2000 to 70% in 2010, and this simultaneously resulted in significant

improvement in child growth and nutritional levels within participating households (Bezner Kerr et al., 2010).

Although the program may have justifiably served to raise family farmers' productivity and child nutrition, its impact on household food security, income poverty reduction and asset levels remains uncertain. In Malawi, about 62% of the population lives on less than \$1.25 a day whilst 89% of the working poor remain below \$2 a day (HDI, 2014). As Pauw and Thurlow (2011) have demonstrated in Tanzania, rapid agricultural growth does not always translate into poverty reduction among farmers, and can sometimes result in some farmers adopting non-farm activities including migration and remittance receipt in order to survive. Chirwa (2005) also explains that the patterns of agricultural growth and changes in domestic poverty levels are as a result of complex interaction among various policies, institutions, history and geographies of specific countries. Similarly, the World Bank (2001) indicated that the extent to which agricultural growth will translate into poverty reduction is dependent upon initial local level inequalities in gender, income and assets levels which are directly influenced by whether countries have equitable access to opportunities that will allow poor farmers to participate in generating growth and asset accumulation. In most of these countries, the significance of non-farm income in the household income levels has been documented.

Figure 1.1: Map of study area



Importance of rural non-farm income and other livelihood strategies:

The extant literature on rural development points to the multifunctional and synergistic functioning of agriculture and other employment sources on rural households' income levels (Liverpool & Winter-Nelson, 2011). For instance, an increasing number of empirical evidence points to the importance of the rural non-farm economy in developing countries. According to Fernandez-Cornejo et al. (2007) and Wang, Tong, Su, Wei & Tao (2011), the role of off-farm income in the total

household income of subsistent families has increased in both developed and developing countries. Further, Poon & Weersink (2011) found that smallholder farmers use non-farm income as a farm household backup support system under crisis situations. Non-farm income may also be used to diversify and increase household incomes and compensate for their lack of scale from farm produce and to achieve consumption smoothing. Therefore, non-farm income must be an important consideration when dealing with farm performance, farm business decisions and overall income levels of farmers; and how this may translate into assets accumulation and sustainable poverty reduction.

Rural-urban Migration and international out migration have also been used by rural farmers as a mitigation strategy amidst loss of soil fertility and dwindling in farm yields (Kalipeni, 1996). In Malawi, migration is shaped by colonial influences and the desire to earn income from the relatively better off economies that surround Malawi and this out-migration is supported by the Southern Africa Development Corporation (Beegle & Poulin, 2013). Migration in Malawi is motivated mainly by two factors: to earn money with which to supplement subsistence agriculture, and also at the beginning or end of marriages (Anglewicz, 2012). Male labor migration has been an important source of income in Malawi with migration been predominantly international, with only a recent trend in rural-urban migration occurring in the later part of the 1990's (Anglewicz, 2012; Beegle & Poulin, 2013). The history of urban growth in Malawi is has not been steady like most sub-Saharan African countries (Preston, 1979). This is as a result of the restriction of rural-urban migration imposed by President Banda during his long reign from 1963-1994 (Anglewicz, 2012). However, a trend in rural-urban migration emerged after a new government was elected in 1994 (England, 2004) even though international out migration remains the most prevalent (Anglewicz, 2012). International migration has been described as a life-cycle event for most young Malawian men as they seek better opportunities in the mining or agricultural estates sectors in South Africa, Zambia, and Zimbabwe (Kalipeni 1992; Kydd & Christiansen 1982).

The role of assets and sustainability in poverty reduction:

A parallel strand of literature that has received considerable attention within rural development is the livelihood approach (Sen, 1981; Zezza, Carletto, Davis, Stamoulis & Winter, 2009). This approach emphasises the link between assets and economic activities, as well as the role of institutions in determining the use of and return to assets (Sen, 1981). The recognition here is that households use a wide range of assets in a variety of agricultural and non-agricultural activities as part of their livelihood strategy in order to move out of poverty (Zezza et al., 2009). This paradigm acknowledges the role of agriculture as a key component in overall economic growth whilst acknowledging the important roles of other livelihood strategies. Zezza et al (2009) argued that both commercial and smallholder farmers are rational economic agents who can take advantage of new agricultural technologies and innovative ideas to improve production without neglecting the key roles of household assets in ensuring poverty reduction (Ellis & Biggs, 2001). Invariably, commercial agriculture and the application of bio-technology have been noted to negatively affect rural smallholder farmers (Lee, 2005). These effects include the inequitable distribution of the benefits of agricultural productivity, impoverishment of rural farmers, affordability and inaccessibility of inputs to small holder farmers and the environmental effects of modern agriculture such as pesticide contamination, deforestation, degradation of ground and surface water resources that threaten environmental quality and human health (Lee, 2005).

Sustainable agriculture, on a smallholder basis is therefore being proposed as a panacea to these problems (Sonnino, 2014). The concept of sustainability is mainly aimed at ensuring resource conservation (land, water, plant, and genetic resources), environmentally non-degrading, technically appropriate, and economically and socially acceptable agricultural practices (FAO, 1998) are adopted by farmers. Participatory approaches that encourage farmer to share knowledge and indigenous technology are also incorporated in these sustainability principles. Participatory approaches to development projects, community-driven development, decentralization, and a territorial approach

(Schejtman & Berdegue', 2004), have increasingly been promoted and applied as mechanisms that, at different levels, would ensure greater responsiveness of interventions to the needs of the intended beneficiaries as well as ensure greater accountability and sustainability.

1.2 Theoretical underpinning

This study is informed by the Sustainable Livelihood Approach (SLA) to development and political ecology framework. SLA can be understood as a means of making the connection between humans' day-to-day living and means to sustaining lives without detrimental effects on future generation's prospects of a decent life. This approach is premised on the notion that development is multifunctional, people-centred and also appreciates the complexities of poverty and the set of principles and actions needed to alleviate or overcome poverty (Morse & McNamara 2013). It's multifunctional nature encompass the environment, the economy as well as the social aspects of human interactions whilst ensuring sustainability of chosen livelihoods and the ability of households to diversify their livelihoods in the face of shocks and risk (Carney, 1998, Ellis & Biggs, 2001; Rigg, 2006; Morse & McNamara, 2013). According to Morse & McNamara (2013, p. 22), a livelihood is sustainable "when it can cope with and recover from stresses and shocks and maintain or enhance its capabilities and assets both now and in the future, while not undermining the natural resource base." The approach also acknowledges the agency of people to put into practice actions to ameliorate their poverty levels rather than depending on external support and supports evidenced-based community action instead of top-down development approached and aims to improve the livelihoods of rural populations (Ashley & Carney, 1999; Ellis & Biggs, 2001; Morse & McNamara 2013). Households diversify into a set of capital or assets (Natural, human, social, physical or financial) if they deem them more appropriate for their livelihood strategies and may reverse the bundle depending on the returns they derive from ownership of the combination of assets (Bebbington 1999; Morse & McNamara 2013). These livelihood capitals or assets have been suggested as a multidimensional and

inverse measure of poverty (Erenstein, 2011). This theoretical underpinning of the study informed the research questions:

- What are the impacts of agroecology adoption (natural capital) on household welfare; and
- What are the impact of some social relation such as migration and remittance receipt on household asset levels and food security?

The study is also informed by theoretical constructs from political ecology. Conceptions from political ecology underscore how environmental, political and economic processes shape human–environment interactions and people access to various livelihoods strategies (Forsyth, 2013; Robbins, 2011). Using a historical analysis of agricultural policies in Malawi, I seek to understand how the current context of food insecurity evolved. I focus on family farmers and how wider macro-economic, environmental and social processes affect their access to land, fertilizer subsidies, seeds and other means of production (Zimmerer & Bassett, 2003; ReSAKSS, 2008). We examine social relations of power to reveal how macro politics influenced farmers’ choices of which agricultural crops to cultivate and by extension the availability of maize-the staple crop of Malawi. With a focus on family farmers, we underscore how local policy processes limit or empower different types of farming practices.

Our analysis is similar to studies that have adopted political ecology framework to analyze how state policies affect household access to food and other resources. For example, Watts (2013) used political ecology approach to explain how food production and famine were instigated by state policies and patterns of surplus extraction in northern Nigeria while Nyantakyi-Frimpong & Bezner Kerr (2014) also used this approach to explain the trajectories of food security policies in Northern Ghana. This thesis builds upon these studies to argue that in order to understand the current food problems in Malawi; we must understand the connexion of local environmental practices, power relations and the macro-economic framework within which family farmers operate and how that affects their access to resources (see figure 2.1).

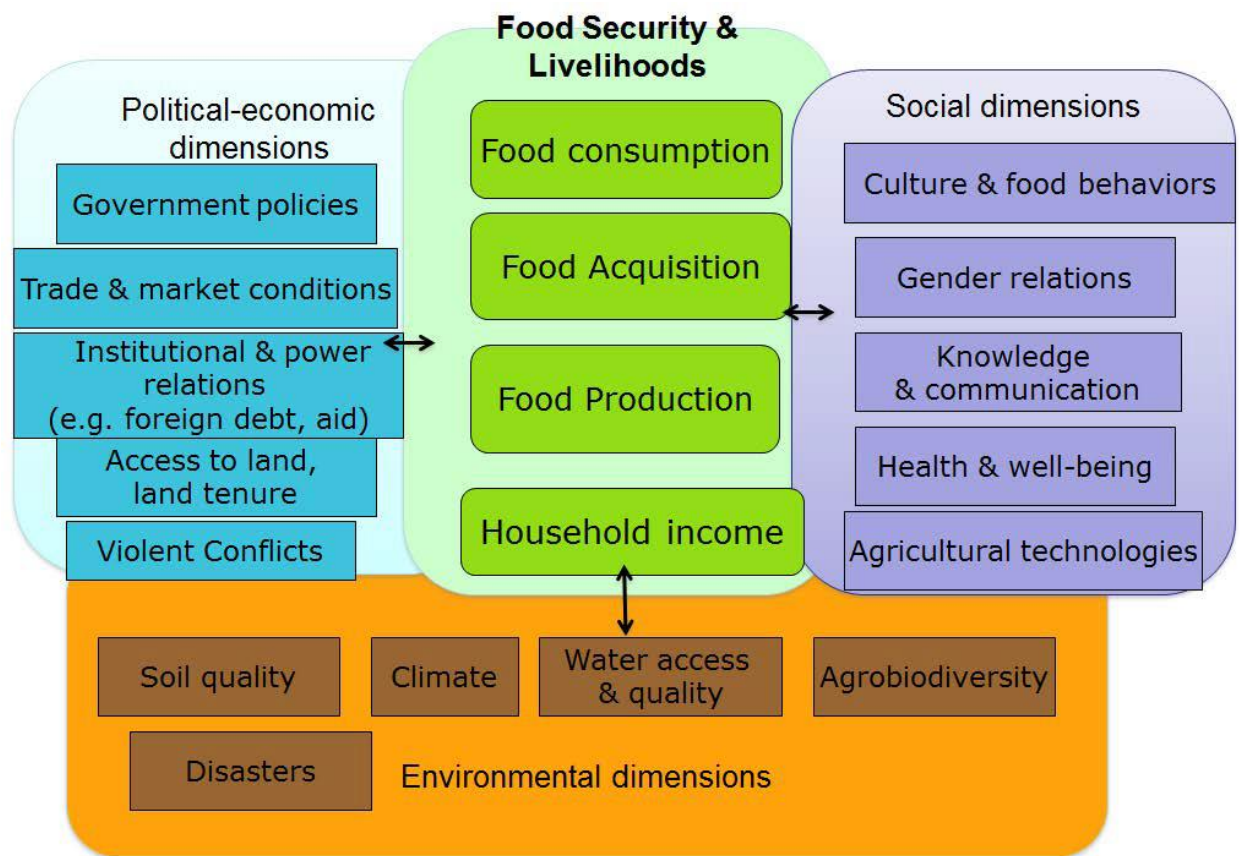


Figure 1.2: Theoretical framework

Adapted from: IAASTD. 2008. and Black, R. E., et al., 2008.

1.3 Study Objectives

The research findings presented within this thesis are guided by the following four objectives:

1. To examine the impact of agroecology adoption on household food security and asset levels of family farmers in Northern and Central Malawi,
2. To examine the factors associated with agroecology adoption in Northern and Central Malawi,
3. To examine the average treatment effect of migration on household food security and asset levels in Northern and Central Malawi, and

4. To examine the average treatment effect of remittance receipt on household food security and asset levels in Northern and Central Malawi.

1.4 Food security and the geography of health

The use of geographical perspectives to investigate health outcomes of populations can be categorized into three main broad areas. The first component involves the analysis of spatial variations in human health outcomes including food security, morbidity and mortality (Gatrell & Elliott, 2014). This perspective requires the identification of environmental and social factors that are closely related to health. The concept of human disease ecology provides useful contexts for understanding how disparities in cultural and socio-economic status interact with environmental factors to enhance or inhibit the susceptibility of particular populations to a disease (Gatrell & Elliott, 2014). The second aspect concerns itself with how formal and informal practices affect management of human health outcomes (Brown, McLafferty & Moon, 2008). This domain focuses on the organisation of health care services and food policies, their distribution in space and how the social patterning affects health (Gatrell & Elliott, 2014). Through this, health planners are able to ascertain populations which are in need of interventions and identify potential sites for siting of health facilities or for interventions by means of spatial techniques such as location-allocation modelling in order to improve geographic access and improve food security (Brown et al., 2010).

The third and recent strand of health geography that seeks to examine inequalities in health outcomes among population is regarded as an offshoot of the earlier paradigms. This is premised on the fact that the structural organisation of society influences access to resources with which to achieve health outcomes such as quality care and an improved standard of living and may lead to disparities in health outcomes among populations (Curtis, 2004; Marmot & Wilkinson, 2005; Brown et al., 2009; Gatrell & Elliott, 2014). As such, there is an inclination for a higher incidence of peculiar diseases in certain populations than in others. For instance, food insecure and poor households maybe highly vulnerable to disease as their immune systems are weakened due to lack of

vitamins and other protein-rich nutrient in their diets. This social and spatial patterning of morbidity and mortality can be causally associated with differences in access to health care, nutrition or exposure to disease pathogens, incomes, employment, toxins and carcinogens (Gatrell & Elliot, 2009; Luginaah, 2009; McMichael, 2011; Gatrell & Elliott, 2014).

Interconnecting the theoretical viewpoints that examines health inequalities are approaches that emphasize the subjective experiences of disease and the personalized meanings that different people ascribe to the concept of illness and ill health. Yet the concept of health and illness cannot be dissociated from the notion of hunger and starvation. The subjective meaning of food security differs among various populations and is experienced differently among households (Maxwell & Smith, 1992). Situated within the philosophical tradition of humanism, the impulses that influence an individual's health or welfare related behaviours include both social (community) and physical resources such as access to nutritious food. The notion of food can be understood within the broader social determinants of health framework whereby both societal factors (gender, age, ethnicity and socio-economic status) and environmental factors (such as food availability, access and affordability) shape the health of populations in particular places (Kearns, 1993; Mayer, 2000; Gatrell & Elliott, 2014). A major premise underpinning this approach is that socio-economic and environmental conditions within which people live their everyday life can determine the patterns of their food security status, morbidity and mortality among populations. This perspective situates the understanding of health within the broader social, political, geographical, and environmental processes that govern everyday lives and wellbeing of populations (Dorn & Laws, 1994; Craddock, 2000; McLafferty, 2010).

The mental, psychological as well as the physical effects of inadequate food intakes or lack of dietary diversity in food and poor nutritional quality can have harmful effects on health, learning, development, immunity to infections, physical and psychological health, and family life (WHO, 2009; Bhattacharya, Currie & Haider, 2004; Bezner Kerr, Berti & Shumba, 2010). Food insecurity which is often characterized by chronic hunger, malnourishment and subsequent disease, may exhibit

increased susceptibility, incidence and prevalence of diseases throughout an individual life cycle (Saunders & Smith 2010). Chronic under nutrition that result from deficiencies in micronutrients may also result in impaired immunity, stunted growth, blindness, cognitive malfunctioning, and poor reproductive health outcomes (Black 2003; Viteri & Gonzalez 2002; Bhutta, Salam & Haider, 2013; Gibson, 2011). Such effects are pervasive in young children, increasing their vulnerabilities to chronic illnesses, inhabiting their cognitive abilities and may affect their economic and social productivity later in life. Additionally, under nutrition may have a multiplier effect on the quality of health and wellbeing of multiple generations, as undernourished adults are more likely to give birth to infants with low birth weight, a condition associated with higher risk of chronic disease conditions (Victora et al. 2008). Obesity, starvation and micronutrient deficiencies that greatly affect human health are experienced in both the developed and developing world (Blay-Palmer, Sonnino & Custot, 2015). According to Human Development Index, (2014), about 20% of Malawians are undernourished, about 48% of children stunted and 13% of children underweight. Food security is very closely linked to human survival, and people's physical and mental health.

1.5 Historical Conceptualization of food security

1.5.1 Introduction

This section begins with the historical conceptualisation of food security and how this influenced agriculture policy in Malawi, the country where the study was undertaken. It sketches the major agricultural policies and programs from the colonial times with specific reference to the smallholder farm sector and how these policies were influenced by the dominant food paradigm in the World at the time. These policies shaped the current economic and food security landscape in Malawi, and are outlined in order to provide a general context of the study. This overview includes the changing policy focus, and the evolution of key policy responses to the food security situation.

1.5.2 Historical Conceptualization of food security in the World

Historically, the conceptualisation of food security since the World food conference in 1974 has consisted of three significant and overlapping paradigms that interlink theory and policy progressively closer to 'real' food insecurity (Hewitt de Alcantara, 2013; Blay-Palmer et al., 2014; Sonnino, 2014A). These paradigm shifts are reflected in the definitions of food security that traverse from: a) the global, national to household and individual (food availability), b) food accessibility to a livelihood perspective, and recently c) from objective to subjective indicators such as the recent sustainable food security framework that conveys ideas about sustainable intensification and sustainable diets (Sonnino, 2014a). The World Food conference of 1974 emphasizes food availability in terms of World supplies of basic food-stuff that could sustain steady food consumption levels and also to balance fluctuations in production and prices (UN, 1975). This led to proposals for World food stocks and import stabilization schemes to be implemented. Food security was first conceptualized as a national self-sufficiency or self-reliance issue (Lang, Barling & Caraher, 2009; Harsch 1992). The proponents of this paradigm (F.A.O, IMF and World Bank) continue to advocate for efficiency in the production process and intensification, emphasizing the role of scientific and technological innovation in mitigating food scarcity (Sonnino, 2014A). Later on in the 1980s, emphasises began to shift policy focus from macro to the micro level. These debates incorporated wider access-based and livelihood approaches that stress concerns about food distribution (Sen, 1981; Sage, 2013) and also underscore the role of traditional knowledge and endogenous strategies in resolving food insecurity. A third emerging approach suggests the recognition of a wide range of interrelated topics including public health, political, socio-economic and ecological crises that threaten the food system, requiring public intervention (Sonino, 2014; Marsden & Morley, 2014). This concept referred to as the sustainable food security' is *"based on the fundamental assumption that the long-term capacity of the food system to provide an adequate amount of nutritious food will depend on its ability to respond to the environmental and socio-economic challenges that threaten its resilience and to minimize its impacts on human and environmental health"* (Sonino, 2014b, pg.

174). The paradigm employs two related concepts of sustainable intensification and sustainable diets (Marsden & Morley, 2014; Blay-Palmer et al., 2014) to advocate for a holistic approach to food security that recognizes the right to food, sovereignty of the food system, ecological considerations and also incorporates ideas of food availability, accessibility and other political-economy factors that shapes food policy.

1.5.3 Food policy development in Malawi

Due to the centrality of agriculture in Malawi's economy, development strategies and policy reforms have concentrated heavily on this sector (Harrigan, 2003; Chirwa, Kumwenda, Jumbe & Mind, 2008). Agriculture policy development and food security issues in Malawi have been closely mirrored by developments and shifts in the international food security paradigms. Following independence, from 1964 towards the end of the 1970s, Malawi pursued an outward orientated, agriculturally-based development strategy (Chirwa et al., 2008; Chirwa, 2011), avoiding the anti-agricultural bias seen in much of SubSaharan Africa at that time even though there were severe internal biases within the agricultural sector (Amoako & Guesten, 1982; Mkandawire, 1984; Chirwa et al., 2008). An annual average GDP growth rate of 5.5% was recorded during 1964–77 period mainly propelled by growth in the estate sector while smallholder agriculture was increasingly relegated, growing at less than 3% annually (Kydd & Christiansen, 1982; Harrigan, 2003). The estates sector was favoured through annexing of customary land for estate farms at the expense of smallholders, smallholders' were legally prohibited from growing cash crops reserved for estates and the smallholder farm sector was underfinanced and their meagre profits siphoned into estates by the Agriculture Development and Marketing Corporation (ADMARC) (Harrigan, 2003). These policy alternatives were mainly informed by the reigning paradigm that was concern with food availability advocating for international trade utilizing the principles of specialisation and comparative advantage. However, a disruption in external trade due to a 35% collapse in the terms of trade, 1979–80 drought and civil war in Mozambique (Mosley, Harrigan & Toye, 1995; Harrigan, 2003) exposed

severe fundamental weaknesses in the Malawian economy and revealed that the estate-led export strategy was no longer viable.

This forced the Malawian government to seek financial bailout from the IMF in the period 1981-1987 in the form of stabilisation and structural adjustment loans (SAL). Much of the SAL policy and loan conditionality was focused on the agricultural sector, emphasising reliance on markets characterized by what Lipton (1987) referred to as “pricism and state minimalism”. Major reforms focused on increasing smallholder productivity of exportable cash crops through producer prices increases offered by ADMARC whilst at the same time maize prices were controlled downwards and government spending on agriculture through a fertilizer subsidy programs were cut (Harrigan, 2003). These policies were aimed to liberalize cash crop production to include smallholder households with the aim of equipping them with capital (through cash crop production) to increase their purchasing power of food stuff from the market. The shift from the macro to micro level was reflected in policy initiatives adopted by the World Bank and FAO when the major food security paradigm was Sen’s (1981) livelihood strategy that placed food access and entitlements at the fore front of food security debates. These policies led to an increased production of exportable cash crops by displacing the main food crop- maize and worsened food insecurity situation due to removal of the fertilizer subsidies which made maize production unprofitable (Harrigan, 1994). This in part contributed to the food crisis of 1987, which was mainly due to a fall in maize production and the inability of the government to supplement local production through imports (Sahn et al., 1990; Harrigan 2003).

The food crisis of 1987 in conjunction with domestic pressures led to a reversal in government policy where the state played a more central role in maize pricing and addressing the structural deficiencies in the operations of ADMARC (Harrigan, 2003). This coincided with a period where scholarship work acknowledged the effects of structural constraints to moderate supply response to price incentives in the agricultural sectors of developing countries (Cleaver, 1985; Lele, 1989). This paradigm shift emphasizes the role of political economy; access based approaches and

shifted focus from the macro to the micro level (Sonnino, 2014A). The reversal in policy included a revised legislation to allow smallholders to grow cash crops, halting of the allocation of customary land to estates; increases in estate land rents, and continuation of the fertilizer subsidy program. Smallholder agriculture responded to these policies growing by about 15.8% due to a copious maize harvest and increased tobacco production (Harrigan, 1994; Harrigan, 2003). The gains were however, short lived due external shocks of reduced aid from the international community and an influx of refugees from Mozambique (Harrigan, 1994, Harrigan, 2003). After the election of a new government, the signing of the Mozambican peace treaty and liberalisation of the agricultural sector, small holder agriculture in 1995 and 1996 witnessed a 43.6% and 41.0% growth and the economy as a whole expanded by 14.3% and 10.9% respectively (Harrigan, 2003). In 2000, maize price bands were removed and agricultural inputs support programmes developed for smallholder farmers. These policies remained until 2006 when the government adopted the Malawi growth and development strategy (MGDS, I and II) meant to guide agricultural and food security policy till the year 2016. The MGDS I&II places emphasises on sustainable development combined with social support and disaster management, agro-processing and irrigation intensification to achieve food security (GAFSP, 2012). These major agricultural policies are depicted in Table 1.1.

Table 1.1: Major Agricultural Policies of Malawi under different policy regimes, 1964–2007.

Period	Time	Domestic policy action	Dominant food security paradigm
Pre-reform period	1964-1980	<ul style="list-style-type: none"> • Active government participation in economic activities • Provision of extension services and active research in agriculture • Macroeconomic stability • Preferential lending to the agricultural sector 	Insuring food availability
Reform period	1981-1986	<ul style="list-style-type: none"> • Periodic increases in interest rates and agricultural prices • Restructuring of state own enterprises • Liberalisation of industrial output prices 	Sen's livelihood strategy
	1987-1994	<ul style="list-style-type: none"> • Removal of preferential lending to agricultural sector in 1990 • Liberalisation of agricultural marketing services • Liberalisation of the prices of some agricultural produce in 1988 • Removal of fertilizer subsidy in 1991 • Privatization of state-owned enterprises 	
Post reform period	1995-2007	<ul style="list-style-type: none"> • Removal of restrictions that prevented smallholder from producing and marketing high value crops in 1995. • Reduction in surtax by 20% in 1996. • Liberalisation of prices for all crops except maize and introduction of a maize price band in 1996 • Privation of prices of state owned enterprises in 1996 • Elimination of maize price bands in 2000 • Agricultural input support programs for smallholders 	Sustainable development

Malawi growth and development strategy I and II	2006-2016	<ul style="list-style-type: none"> • Sustainable economic growth • Social support and disaster risk management • Increase agriculture productivity and diversification • Sustained availability and accessibility of food • Increase agro-processed products for domestic and export markets • Increase irrigation intensification 	
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1.6 Organisation of the thesis

This thesis is organised into five chapters including this introductory chapter. This chapter also describes the various policy developments in Malawi and how these policy instruments were directly informed by the prevailing food security paradigm in the World at the time. The geographies of food security are also discussed. The chapter also discusses the theoretical framework, as well as the larger picture of geographies of health and how the current study fit into that frame. Furthermore, the chapter scopes the food security and agriculture policy environment, taking into account other relevant social and economic features which are bound up with food security problem in Malawi. Chapter two provides a detailed description of the research methods, the study design, the theoretical as wells as the methodological underpinnings of the study are also discussed. The next two chapters consist of two manuscripts being prepared for publication in various peer review journals. Though each manuscript can be read as a distinct piece, collectively they provide an inclusive treatment of the study objectives and therefore serve to address the overall question that motivated this study: what are the impacts of agroecology use on food security and household asset levels? And are households with migrants better off in terms of food security and asset level?

The first manuscript (Chapter 3) focuses on the impact of agroecology adoption on household food security and asset levels. It examines how different households are in terms of their food

security status and asset levels depending on whether they adopt agroecological farming practices or not. Agroecology has been recognised as a viable agricultural strategy toward reducing food insecurity and poverty among family farmers (F.A.O, 2014). The second manuscript (Chapter 4), measures the effect of migration and remittance receipt on household food security status and asset poverty levels. Migration is a common practice among populations in this region and we sought to investigate how this practice might be affecting overall household welfare.

The main topic being investigated in this thesis - the vulnerability of family farmers in terms of food security and asset poverty in Northern and Central Malawi - is complex. It therefore engages with various issues and converges on a number of key themes. Hence, the final chapter (Chapter 5) follows through these issues and thoroughly trims them down into coherent arguments that leads to vital theoretical, methodological and policy contributions made by this study. The aim here is to discern the impacts of a set of programs and actions on the vulnerability of family farmers and thus demonstrate the theoretical and methodological contributions of this study to existing literature. The section also makes policy recommendations and suggestions for the attention of government and other food security stakeholders in Malawi and for future researchers.

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Chapter two

2.1 Methods

Even though there are many advantages to an integrated style of thesis, there are some limitations especially patterning to lack of details due to word count limits imposed by journals. A detailed description of data collection and methods employed in the analysis could not be provided in any of my papers due to limitations imposed by journals. Also, the study was conceived and conducted as a whole; therefore an isolated reading of each section will only give a poor understanding of the entirety of the thesis. This chapter is therefore used to elaborate on the means of data collection and the subsequent analysis of the data.

2.2 Study design

Due to the intricacies involved in evaluating the impact of a project such as the Malawi Farmer to Farmer Agro-ecological project and the impact of migration and remittance receipt with special focus on family farmers' asset levels and food security, a quantitative method was employed. A quasi-longitudinal data set that was carried out between 2012 and 2014 is used in my analysis (Figure 2.1) for the first paper whilst the 2014 data combined with propensity score matching was used for the second paper. I benefitted from an ongoing research project that had a baseline survey data. I conducted a follow-up survey in 2014 with participants from households that took part in the baseline study. The follow-up participants were identified using household identification number for tracking. Ethical approval for the study was obtained from the Non-medical Research Ethics Board of the University of Western Ontario (see Appendix 1).

A baseline survey was conducted in 2012 before the MAFFA intervention that assigned households either to the intervention group or counterfactual group which I was not part of. I arrived in Malawi in July 2014 to begin my field work-a follow up survey. Thanks to pre-established contacts in Malawi especially in the study area, there was relatively little lag time to the start of my study. Mrs. Esther Lupafya of MAFFA was my primary contact in both study areas and ensured the

success of my research. She was instrumental in recruiting my highly experienced six research assistants who proved very key to ensuring the success of the project. She further assisted in the training of the research assistants and she ensured that I had a pre-visit to the communities with an earlier student before embarking on my own study. This enabled me to develop a relationship with the community elders and some of the farmers. RAs were trained over a two-day period and given time to study the questionnaires and provide feedback, play-acted the survey process, learned to build relationships with participants, and became fluid in the flow of questionnaires. All the six research assistants were fluent in the Chewa and Tumbuka, the two widely spoken languages in Malawi. Play-acting also included acting out certain ethical scenarios and a discussion of how to suitably deal with these situations. Research assistants were made to sign confidentiality agreements to ensure that the RAs would adhere to the University of Western Ontario's research ethics guidelines and more importantly to understand that respondents have the right to refuse to participate or answer any question. Finally, the RAs and I travelled into the communities every morning ensuring we cover an entire village before moving to the next village.

Individual farmers were self-selected into the project: any farmer in the intervention villages could learn about different legume options and test them on their farms. The following criteria were used to select households into the SHFC and MAFFA programs; interest in agro-ecological farming approaches, and ability to farm. The baseline survey and a subsequent follow-up was conducted in June 2012 and September 2014 in both Dedza and Mzimba Districts using a 'stepped wedge' longitudinal panel design, in which the control households with similar characteristics to the intervention group were randomly selected from within villages. The baseline sample consisted of 1,203 households and the subsequent follow-up had a sample size of 1,000 households. Household heads or a knowledgeable adult within the household were interviewed using structured questionnaires specifically designed for this purpose. With the assistance of established data on respondents in the earlier survey, we were able to sample 1,000 households out of the initial 1,203 who participated in the baseline survey. Households were randomly sampled from an existing list from the

baseline study. The study was conducted during the harvesting season, so most household members were available and eager to tell us how they have benefitted from agroecology. Hence we had a response rate of 92%. All sample households are diversified smallholders, most of whom had farm sizes of less than 3 acres. The overall research project involves a prospective longitudinal design comparing intervention and control households. The present study reports the effects of a participatory agro-ecology intervention on food security status and household wealth in these communities and the impacts of migration and remittance receipt on household welfare. We collected data on household assets, demographic characteristics, agro ecological practices, gender relations as well as on and off-farm economic activities. The questionnaires also included a HFIAS module to explore household food insecurity, details of which are described further below. Data collected from the surveys were inputted into SPSS 12 and later converted into STATA13 for analysis. Due to my involvement in the data collection and favour done by one of the research assistant (Penjani) by translating the responses of the household heads to me, this enabled me to keep notes and gave me an understanding of the context and proved useful in writing my discussion. The majority of the work was done by the Author with my Supervisors providing an oversight role and ensuring consistency and clarity in my analysis.

Theories and Methodology

Due to the nature of the research questions and the objectives of this research, a quantitative methodology was employed. This is informed by philosophical views: the ontological (how we find information that can be known) –thus the means to acquiring knowledge through the use of face-to-face questionnaires and epistemology (what can be known of our world)-my assumption that the impact of the project can be quantified (Bryman, Becker & Sempik., 2008: Lincoln, Lynham & Guba, 2011: Bryman, 2014). We draw on Sayer's (1992) framing of the *extensive* versus *intensive* research design which incorporates the underlying assumptions, and aims of the research as a guiding principle as opposed to just the end product. While extensive research design seeks to find uniformities and similar patterns, peculiar features of a population, and report on how widely certain

phenomenon are distributed or represented, intensive research design on the other hand seeks to examine how processes work in a particular context, what results in changes, and why change is occurring? Sayer's extensive-intensive framing is not to be taken as a substitute for the quantitative-qualitative framing; however, the extensive-intensive lens must be understood as less of a question of method but more of a question of the type generalizability that can be achieved, often rooted in epistemological and ontological assumptions (Warshawsky, 2014). The research questions for my thesis as shown below were informed by these theoretical foundations. Even though there exists information about the role of agroecology, migration and remittance receipt in poverty and food insecurity reduction in SSA, very little was known about how these impacts in Malawi. My research therefore sought:

1. To examine the impact of agroecology adoption on household food security and asset levels of family farmers in Northern and Central Malawi,
2. To examine the factor associated with agroecology adoption in Northern and Central Malawi,
3. To examine the average treatment effect of migration on household food security and asset levels in Northern and Central Malawi, and
4. To examine the average treatment effect of remittance receipt on household food security and asset levels in Northern and Central Malawi

A look to this thesis' research questions reveals that they are informed by a positivist epistemology or according to Sayer, 1992, an extensive research. All questions seek patterned variance between certain groups, with the notions of generalizability of results. Since this work was unique in Malawi (a specific context) some 'generalizable' facts were practical, as well as theoretically appropriate in trying to appreciate the impact of agroecology use and remittance receipt on household welfare. Thus, a quantitative survey was the logical extension from my research questions.

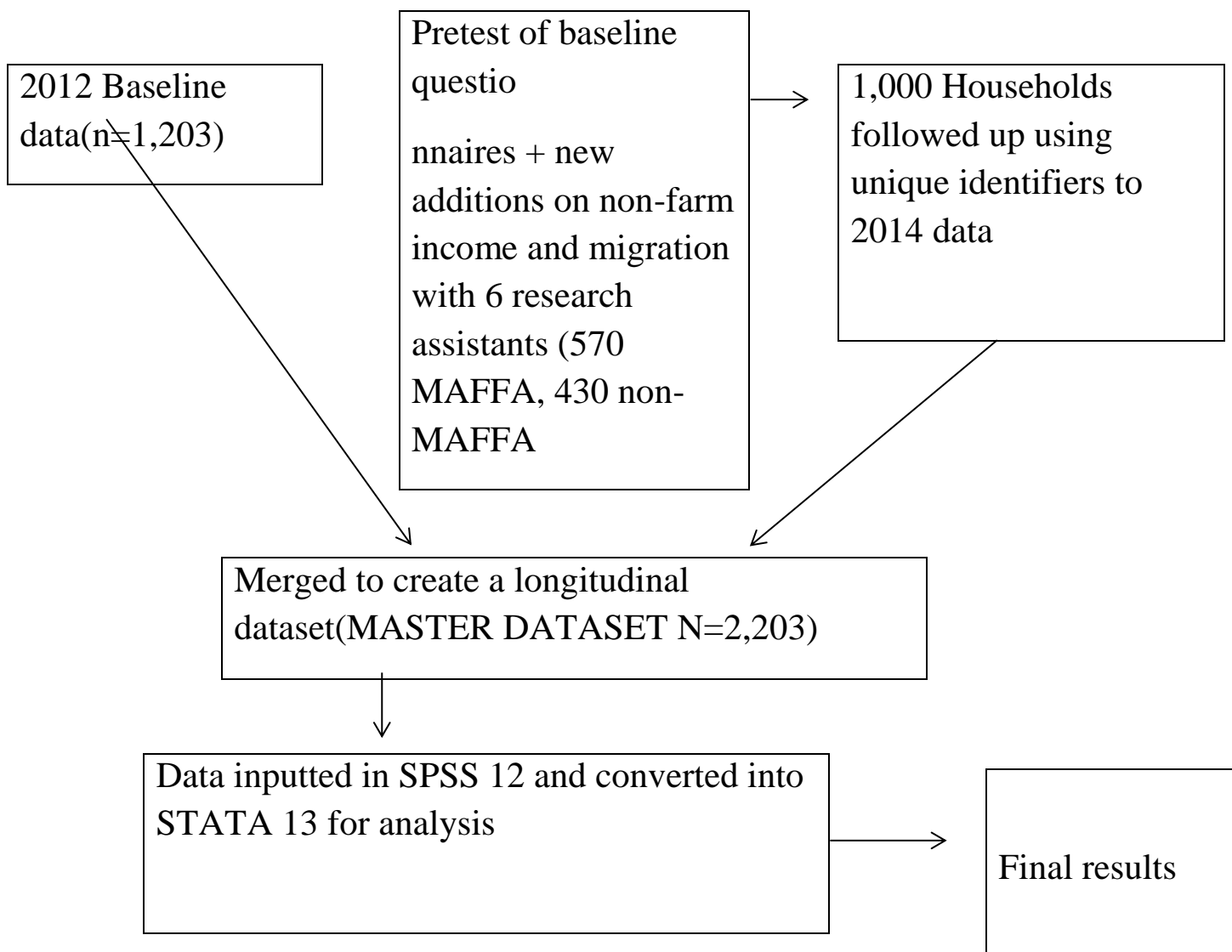
2.3 Robustness of results

To ensure the robustness of my results a number of different measures were undertaken. First, through the many drafts of the survey questionnaire, I sought to ensure we were asking questions that would be meaningful and accurate to the people of both Ekwendeni and Lobi, as well as tying into the theoretical constructs. Once in the field, the survey was pre-screened to ensure content validity and consistency. Second, through RA training, I minimized the variability between how different research assistants were asking questions as well as to ensure that questions were asked appropriately. Finally, through the use of a randomized sampling framework and an appropriate sample size (n=2,203), results are generalizable to these two districts in Malawi. Further robust analyses were conducted dependent on the method used in each of the manuscripts.

2.4 Conclusion

The aim of this chapter is to address the weaknesses of an integrated manuscript style of thesis by expanding on the methodology used in my research. I have described in detailed how and when the field work took place. This chapter also provides a brief philosophical underpinning of this research and how this philosophical underpinning led to the research questions which in turn informed the decisions on research methodology. The generalizability of the findings is also then explored.

Figure 2.1: Study Design



2.5 Reference

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Chapter 3

Impact of agroecological practices and farmer-led knowledge exchanges on household wealth and food security in Central and Northern Malawi

Abstract

Recent international assessments of agriculture have highlighted the urgent need for changes in farming practices in Sub-Saharan Africa, due to land degradation, high levels of food insecurity and anticipated climate change impacts. Agroecological approaches have shown great potential to address these multiple needs. While agroecological practices and skill enhancement of small holder farmers using these approaches can play vital roles in reducing food insecurity and poverty in Africa, rigorous assessment of welfare effects for small households that adopt these practices is limited. Using a longitudinal panel survey data and accounting for selection bias in agriculture innovation adoption, we analyze the impact of agroecology adoption and farmer-to-farmer learning on household income and food security in Northern Malawi (N=2,203). We used the Household Food Insecurity Access Scale (HFIAS) for our impact valuation. Estimates of average treatment-effects models show that agroecology adoption combined with improved crop management, and farmer to farmer exchanges have led to a significant increase in household wealth ($t=3.54$, $p=0.01$) and a large reduction in food insecurity ($t=-3.21$, $p=0.01$) compared to non-adopters, even after accounting for covariates and selection bias. These results indicate that agroecological innovations and farmer led exchanges can be welfare enhancing both in terms of food security and income for adopting small holder households. Adoption should be promoted through upscaling of farmer-to-farmer knowledge exchanges and community-led events that allows farmers to benefit from the experiences of other farmers and scientists.

Keyword: Agroecology adoption, Food insecurity, Household wealth, impact analysis, Northern Malawi

3.1 Introduction

The International Year of Family Farmers highlighted the crucial role that family farmers play in contributing to global food production (F.A.O, 2014; Lowder, Scoet & Singh, 2014). At the same time, family farmers often face high levels of poverty, food insecurity and challenges with agricultural production. There is widespread consensus that there is an urgent need for more investment in agriculture innovation and skill enhancement of smallholder farmers due to the vital roles they play in household food insecurity and poverty reduction (Foley et al. 2011; Loos et al. 2014). There is however, less consensus on the type of technologies and skills that may be appropriate for the family farm sector to enable sufficient food production, maintain ecosystem balance and achieve sustainable development in an era of climate change, globalisation of food systems and increasing environmental degradation (Koohafkan, 2012; Foley et al. 2011; Loos et al. 2014; Moseley, Schnurr & Bezner Kerr, 2015; Ponisio et al. 2015). This issue is particularly urgent in Sub-Saharan Africa (SSA), due to high levels of food insecurity, reliance on agriculture as a source of both food and income, and anticipated impacts from climate change (Gómez et al. 2013; Niang et al. 2014; Vanlauwe et al. 2014). There has been limited uptake of some agricultural technologies in SSA, due to a complex interplay between political, social and environmental factors (Smale & Tushemereirwe, 2007; Moseley et al. 2015). Impact analysis of agriculture innovation adoption is therefore required to gauge the type of technologies that are relevant and useful to family farmers and under what conditions. Relatively few empirical studies link agricultural technologies adoption to household food security and income levels, partly due to data unavailability and the complexities in data requirements. Prior research has analyzed productivity, income, and poverty effects of different agricultural technologies, with a focus on hybrid seeds, genetically-modified seeds and fertilizers (Bezu, Kassie, Shiferaw & Richer-Gilbert, 2014; Kathage & Qaim, 2012; Christiaensen, Demery & Kuhl, 2011; Cunguara & Darnhofer, 2011; Subramanian & Qaim, 2010), mostly focused on total crop yield. Only few studies have examined the impact of agroecological

approaches on household poverty or food security (Seufert & Ramankutty, 2011; Snapp et al. 2010; Ponisio et al. 2015).

Using two waves of data collected before and after an agroecological intervention, we compare the food security status and income levels of participating households before and after the intervention (Intervention group) to those households that did not participate (Control group). We used the Household Food Insecurity Access Scale (HFIAS), to measure household access to food (Coates, Frongillo, Rogers, Webb, Wilde & Houser, 2006). HFIAS has several advantages including the relative ease with which it can be used for data collection compared to other food security measurements such as dietary recalls or anthropometric indicators (Coates et al., 2006; Kabunga, Dubois & Qaim, 2014). Compared to other food security indicators, it captures a higher prevalence rate and correlates well overall with other indicators, and is considered a valid and reliable measure to assess chronic, persistent household food insecurity (Maxwell, Vaitla & Coates, 2014). This tool has been used previously for impact assessment by Kabunga et al., (2014) in examining the impact of banana tissue culture technology adoption on household income and food security in Kenya, whilst Qaim (2014) used the scale to assess the nutritional and health impact of agriculture innovations.

Agroecology integrates ecological, social and agronomic principles to the design and management of sustainable agro ecosystems (Gliessmann, 2007; Francis et al., 2011), and an alternative approach to agricultural development (Wezel & Soldat, 2009). Prior research has revealed that agroecological methods can increase productivity, yield stability and resilience of family farmers as well as reduce the costs of production and also contain many ecosystem service benefits (Koochafkan et al., 2012; Ponisio et al. 2015; Pretty et al. 2011; Snapp et al. 2010). In SSA, there is evidence that agroecological strategies such as incorporation of animal and plant residue into soils can help improve soil fertility and built resilience against climate variability and environmental degradation (Bezu et al. 2014; Koochafkan et al., 2012, Bezner Kerr et al., 2010, and Snapp et al., 2010). Agroecology as an alternative approach has gained momentum through some high-level

F.A.O meetings as well as reports highlighting its potential (Altieri, Funes-Monzote & Petersen, 2012; Wezel et al. 2009). A key principle of agroecology is enhancing biodiversity, which leads to a variety of environmental improvements beyond the production of food, including improved soil quality, nutrient recycling, pollination, regulation of local climate and hydrological processes, reduced use of undesirable organisms and harmful chemicals (Koohafkan et al., 2012; Kremen & Miles 2012). While some studies have documented the potential and actual effects of agroecology adoption (Bezner Kerr et al. 2010; Khan, Midega, Pittchar, Pickett & Bruce, 2011; Altieri et al., 2012; Altieri & Toledo, 2011; Snapp et al. 2010), there has been limited assessment of broader welfare impacts on poverty and food security, although studies to date have shown positive impacts (Scherr, McNeely & Shames 2008). This study contributes to the literature in this regard by examining the impact of the agroecology adoption on food security and household wealth. Methodologically, our analysis employ difference in difference (DID) approach to enable us compare the intervention group with the counterfactual (comparison group). DID model is a research design for estimating causal effects of a policy intervention and have been used extensively in impact analysis (Blundell & Costa Dias, 2000; Benin et al., 2011; Kabunga et al., 2014). The remainder of this article is organized as follows: in the next section, we present a brief background of agroecology adoption in Malawi, the theoretical framework and methods of the study. We then present the results of the study, followed by discussion of the implications and the findings for broader issues related to sustainable food production in SSA.

3.2 Background

Agricultural production and agroecology adoption

In Malawi, maize is the primary staple food. It is grown by family farmers for home consumption and income, and makes up over half of the total energy in diets (Ndekha et al., 2000, Arimond & Rue, 2004, and Bezner Kerr et al., 2010). Maize is high-yielding under optimal soil conditions but requires more nutrients for growth compared to other staple crops, and do not thrive

well in nutrient or water-deficient environments (Bezu et al., 2014). The Malawian government implemented several programs to increase maize production including price controls and what was known as a ‘starter pack’ program which provided free fertilizer and other inputs to poor farmers from 1998–2000; the Agricultural Productivity Improvement Programme -that provided inputs on franchising basis to poor farmers in 1998 and the Targeted Input Programme implemented in 2000 with the aim of providing cereal seeds, legume seeds and fertilizer to poor farmers (ReSAKSS, 2008). However, there have been some reported adverse impacts of such programs, including shortage of coupons and corruption in the distribution of coupons among poor farmers and several power dynamics that prevented the rural and poor farmers from enjoying these benefits (Chirwa & Dorwald, 2013). Poorer family farmers suffer most from these structural inefficiencies as they are unable to afford even the subsidized fertilizer and also face both a ‘hunger gap’ during the cropping period and credit constraints (Dorward & Chirwa, 2011). There is evidence however that legume diversification when combined with burying legume residue after harvest improves soil fertility and productivity as well as yield stability, reduced soil erosion and reduced input costs (Snapp et al., 2010). Previous researches by some of the authors indicate that legume diversification can also improve child nutrition, when combined with participatory nutrition education (Bezner Kerr et al., 2010). This study builds on these past researches by expanding the range of agroecological options to test, and investigate the food security and income dynamics from the use of agroecological farming practices.

Smallholder farmers in Mzimba and Dedza Districts of northern and southern Malawi experience high levels of food insecurity and poverty, coupled with endemic HIV/AIDS and malaria (NSO & MACRO, 2011). In 2012, a research project, the Malawi Farmer to Farmer Agroecology project (MAFFA), was initiated by the Soils, Food and Healthy Communities project of Ekwendeni Hospital, Malawian and Canadian scientists in the catchment areas of Ekwendeni and Lobi. The project uses farmer-to-farmer teaching about agroecology, nutrition, social equity and local food market development to improve food security, nutrition and household wellbeing. Farmers do their

own experimentation with agroecological methods, including the use of legume intercrops, crop diversification, compost manure, mulching and other soil and water conservation methods to improve soil fertility, productivity and knowledge exchanges. Legume intercrops were chosen based on earlier agricultural research carried out by the team (Bezner Kerr, Snapp, Shumba & Msachi, 2007; Snapp et al. 2010). The following legumes were grown by adopters: (i) peanut (*Arachis hypogaea*) and pigeon pea (*Cajanus cajan*); (ii) soyabean (*Glycine max*) and pigeon pea; (iii) pigeon pea intercropped with maize; (iv) velvetbean (*Mucuna spp.*) rotated with maize; and (v) *Tephrosia voglii* relay intercropped (i.e. alternating years) with maize. Common beans (*Phaseolus vulgaris*) and cowpea (*Vigna unguiculata*) were also grown. In addition to the legumes, some farmers chose to increase crop diversification with tubers such as sweet potatoes (*Ipomoea batatas*) cassava (*Manihot esculenta*), and alternative grains such as local open-pollinated varieties of yellow-orange maize, sorghum (*Sorghum bicolor*) and finger millet (*Eleusine coracana*). Many of these crops were previously grown in limited quantities (Bezner Kerr et al, 2007; Bezner Kerr, 2014). The effects of these agroecology innovations on food security and poverty may be both direct and indirect. The direct effects of agricultural innovation on poverty reduction include productivity enhancements enjoyed by the farmers who employ these methods, high nutritional levels and higher farm incomes and dietary diversity (Becerri & Abdulai, 2010; Jones et al. 2014). The indirect effects are efficiency- induced benefits and knowledge transfer to other farmers by the adopters of the innovation. This may lead to lower food prices and increase in consumption for all farmers within the community (de Janvry & Sadoulet, 2001). However, for these agricultural innovations to be sustainable and suited to particular conditions, MAFFA encouraged farmers to adopt several of the innovations such as applying compost manure, mixed and multiple cropping, and soil conservation rather than just a single innovation and to encourage farmer-led learning (Karanja, Renkow, & Crawford, 2003). In addition MAFFA goes beyond agroecological training to focus on knowledge sharing, leadership support and attention to social inequalities that may prevent impact, through an iterative process that integrates

reflection and action, including the development of different educational activities, campaigns and training.

Conceptualizing agroecology adoption, household income and wealth inter-linkages

Figure 3.1 provides a conceptual framework within which we analyze the impacts and linkages of agroecological innovation on household food security, wealth and general wellbeing. This framework focuses on smallholder farm households that adopt agroecology innovation with some modifications to (Qaim, 2014) framework. We focus primarily on the food consumption and income pathways. Agroecological innovation may affect household income and food security through multiple pathways, which can be both direct and indirect. For instance, farmers' collectively exchanging knowledge and experiences, preparing and applying compost manure, practicing legume intercropping and applying mulches may lead to soil quality enhancement which may subsequently result in higher productivity and greater diversity of food produced at the household level. These impacts have important linkages on household nutrition and health (Bezner Kerr et al. 2010; Jones et al. 2014). At the same time, these practices could increase women's labor at the expense of child feeding and care, thereby having unintended negative consequences on food security and nutrition. Furthermore gender dynamics at the household level which lead to crop sales without income being spent on family expenses or loss of land due to land seizure once the soil improved could also occur (Bezner Kerr, 2009). Thus adoption of the innovation may cause both intended and unintended nutrition and health effects, even if these were not the primary targets. Therefore, understanding both intended and unintended program effects is vital, especially when dealing with vulnerable populations.

Figure 3.1 shows additional potential impact pathways. Adoption of agroecology farming practices may affect the quantity and diversity of food produced at the household level. This could occur through increase in yield per field that helps to increase household calorie production (Shiferaw, Kassie, Jaleta & Yirga. 2014; Bezu et al. 2014) and also through changes in the quality of the food or meals produced. Cases in point are the introduction of legumes, horticultural and forestry

crops into cereal production systems (Kidoido & Korir, 2015; Keding, Msuya, Maass & Krawinkle, 2012; Bezner Kerr et al., 2010). In most households where most of the harvest is used for home consumption, these changes in food production, quantity, quality, and diversity can directly translate into changes in diets and food security at the household level (Jones et al., 2014).

However, family farm households also participate in market transactions where part of their produce is sold or they may even go into non-food cash crop farming, such as tobacco, coffee, or cotton, to diversify their income sources. Cash income from agriculture may be positively associated with food security and nutrition but the specific household context, political, economic and social dynamics including gender roles within and beyond households also play critical roles in determining the outcomes (Carletto, Kilic & Kirk, 2011; Girard, Self, McAuliffe & Olude, 2012; Leroy & Frongillo, 2007; Kidoido & Korir, 2015). Smallholder tobacco production in Malawi, for example, has high labor and input requirements and has been found to negatively impact nutrition and food security (Wood, Nelson, Kilic & Murray, 2013). Beyond the food consumption, nutrition and income pathways, agricultural innovations can also impact health directly, either positively or negatively. For instance, technologies that alter the use of chemical pesticides influences occupational health hazards for farmers and farm workers (Kouser & Qaim, 2011) whilst consumption of nutritious food may lead to better health of household members-which has feedback links with household labour supply.

Another potential impact from the agroecological innovation may be indirect, through increased farmer capacity, experimentation and leadership in the community, including women, youth and those with HIV. A study of a participatory agricultural project in Honduras found that farmer-led experimentation and the increased role of women led to positive impacts in terms of women's decision-making roles, leadership, employment and control of household resources (Classen, Van Gils, Bammens & Carree, 2012). These changes in turn could have positive impacts on income and food security (Smith & Haddad, 2015).

3.3 Methods

3.3.1 Data and sample

The overall research project involves a prospective longitudinal design comparing intervention and control households in Malawi. The present study reports the effects of a participatory agroecology intervention on food security status and household wealth in these communities. A total of 6000 households, 3000 per site (Mzimba & Dedza) are estimated to directly benefit from the program with 2000 households selected each year for participation in the intervention. The following criteria were used to select households into the program at the baseline level: interest in doing farm experiments, food insecurity, and ability to farm. A baseline survey (n=1,203 households) and a subsequent follow up (n=1,000 households) was conducted in June 2012 and September 2014 in both Dedza and Mzimba Districts using a ‘stepped wedge’ longitudinal panel design, in which the control households with similar characteristics to the intervention group were randomly selected from nearby villages-did not interview the fourth of every other household. Due to the existence of established contacts of farmers who agreed to be interviewed for the follow up survey and well coordinated and trust worthy networks in all communities, response rate was 95% and most households were willing to share their experiences. All sample households are family farmers, most of whom had farm sizes of less than 3 acres. Adult household members (both men and women) were interviewed using structured interviews specifically designed for this purpose. The interview was pretested prior to official data collection to ensure content validity and clarity. Interviews were conducted in the local dialect by a group of trained enumerators fluent in these languages, who were supervised by the researchers. We collected data on household assets, demographic characteristics, farming practices, knowledge of and use of agroecological approaches, gender relations as well as on and off-farm economic activities. The interviews also included a HFIAS module to explore household food insecurity, details of which are described further below.

3.3.2 Measures

Food security status, one of our two key dependent variables was constructed using the household food insecurity access scale (HFIAS) module which measures a household's own perception of their access to food (Coates et al., 2006; Swindale & Bilinsky, 2006 and Kabunga et al., 2014). The Food and Agriculture Organization's (F.A.O and USAID, 2007) HFIAS scale for measurement of food access indicator guide was used to categorize households into food secure, moderately food insecure and severely food insecure. Household wealth, a composite index based on the household's ownership of a number of consumer items, assets and agricultural goods was constructed using the DHS wealth creation guidelines. Principal component analysis (PCA), a technique for extracting from a set of variables an orthogonal linear combinations of the variables that capture the common information most successfully, was used to construct an overall index of household wealth (Filmer & Pritchett, 2001; Zeller, Sharma, Henry & Lapenu, 2006). Each asset was normalized by its mean and standard deviation. Adoption of agroecology was measured by asking farmers whether they adopted legume intercropping, crop diversification, use of compost manure, mulches and other soil and water conservation methods to improve soil fertility. Farmers that indicated adopting atleast three these practices were coded as adopting agroecology whilst those that didn't were coded as non-adopters. Wealth categories were then coded as Poor (poorer and poor=0), Middle (middle=1) and Rich (richer and richest=2) categories. Other variables used in the analysis include education of the husband and wife both coded (0=no education; 1=primary education and 3=secondary and higher), age of husband and wife (0= \leq 30 years; 1= between 30 and 45; 2=46-60 years; and 3=60 and over), household structure (0=monogamy, 1=polygamous, 2=female headed and 3=separated or divorce), farm size (0=less than 2.5acre,1=between 2-5 and 5 acres, and 3= \geq 5 acres), agricultural knowledge (0=low,1=average and 2=excellent), dry season farming (0=no, 1=yes) and household wellbeing (0=poor, 1=good and 2=excellent). Credit access, off and on farm income, self-reported improvement in wellbeing and market access were only included in wave 2 as these were not collected at the baseline survey.

3.3.3 Analysis

We used difference in difference (DID) estimation combined with kernel-based propensity score matching to evaluate the average impact of the project on food insecurity and household wealth. DID model is a research design for estimating causal effects of a policy intervention and has been used extensively in impact analysis (Kabunga et al., 2014). Our interest is in assessing the average treatment effects of MAFFA – the effect of treatment on the treated, which compares food security and household wealth in the intervention state (Y_1) with the outcomes in the control or the counterfactual (Y_0) conditional on receiving treatment. If we could observe (Y_0, Y_1) for everyone, the gain of being in the program is $\Delta = Y_1 - Y_0$.

The evaluation problem is that these outcomes cannot be observed for any household in both states, the treatment indicator can take either the value 0 or 1 but not both. Assessing the impact of any intervention requires making an inference about the outcomes that would have been observed for people affected by the intervention had it not been implemented. In absence of a controlled randomized assignment, no direct estimate of the counterfactual outcome is available (Blundell & Costa Dias, 2000; Benin et al., 2011). Instead, a comparison group not affected by the intervention is used as a proxy for the counterfactual (Leuven & Sieniasi, 2014). We use a non-experimental estimator; the difference-in-difference estimator, that matches the change in outcomes (food security and household wealth) in the intervention group before and after the intervention to the change in outcomes in the control group. The difference in difference estimates the average effect on the treated as a linear regression or a probit model:

$$Y_{ijt} = a_0 + X_{ijt}\beta_1 + X_{ijt}\beta_2 + T^{2012}\beta_3 + T^{2014}\beta_4 + P_j T^{2012}\beta_5 + P_j T^{2014} + \epsilon_{ijt} \quad (1)$$

where i is an index for household i th, participating in the survey j in year t . The dependent variable Y_{ijt} , reflect the food insecurity status and wealth level of the household and X_{ijt} is a vector of demographics variables. P_j is a dummy variable, which is 1 if the household j is a MAFFA household and 0 otherwise. T^{2012} and T^{2014} represent year dummies for the survey periods.

Due to differences in baseline characteristics between MAFFA and non-MAFFA households, we applied kernel-based propensity score matching to reduce the effects of confounding and account for any systematic differences in the baseline characteristics to enable us obtain unbiased estimates of the average treatment effects on the outcomes (Austin, 2011). With panel data, propensity score matching can be combined with DID estimation to improve the quality of non-experimental evaluation significantly (Blundell & Costa Dias, 2000; Benin et al., 2011; Kabunga et al., 2014) as time-invariant unobserved factors cancel out (Smith & Todd, 2005). In estimating the average treatment effects, we also used kernel-based propensity score matching difference-in-difference estimation which derives weight from the propensity score matching as explained further by (Heckman & Todd, 1998; Leuven & Sieniasi, 2014). In the kernel-based method, all treated subjects are matched with a weighted average of all controls, using weights that are inversely proportional. We conducted a balancing test for differences in terms of explanatory variables between agroecology adopters and non-adopters before and after matching (Dehejia & Wahba, 2002). We first present sample characteristics of some selected independent variables and our main dependent variables- household food insecurity and wealth as shown in Table 3.1. Table 3.2 and 3 presents our difference in difference estimates of the impact of the intervention on household food insecurity and income with and without covariates respectively.

3.4 Results

Table 3.1 shows the sample characteristic whilst 3.2 shows the differences in means between adopter and non-adopter. Agroecological practice users and non-users are similar with regard to the household structure, wife's age, husband age, educational level of both husband and wife, knowledge of agricultural practices, food security and farm size at the baseline level. Significant differences are however observed for other characteristics, such as wealth, household size, number of crops grown per field, dry season farming and general household wellbeing.

Table 3.1: Characteristics of the sample

Household characteristics	Pooled	Wave 1(2012)	Wave 2(2014)
<i>Family structure</i>	Frequency (%)	Frequency (%)	Frequency (%)
Monogamy	1,392(62.42)	775(63.01)	617(61.70)
polygamy	193(8.65)	99(8.05)	94(9.40)
Female headed	316(14.17)	127(10.38)	189(18.90)
Separated/Divorced	329(14.75)	229(18.62)	100(10.00)
<i>MAFFA member</i>			
No	837(38.03)	408(33.97)	429(42.90)
Yes	1,364(61.97)	793(66.03)	571(57.10)
<i>Wife age</i>			
Less than 30	741(33.23)	375(30.49)	366(36.60)
30-44	714(32.02)	374(30.41)	340(34.00)
45-60	428(19.19)	240(19.51)	188(18.80)
Greater than 60	347(15.56)	241(19.59)	106(10.60)
<i>Age of husband</i>			
Less than 30	665(28.82)	508(41.30)	157(15.70)
30-44	725(32.51)	346(28.13)	379(37.90)
45-60	417(18.70)	220(17.89)	197(19.70)
Greater than 60	423(18.97)	156(12.68)	267(26.70)
<i>Education level of husband</i>			
None	764(28.57)	439(35.69)	325(32.50)
Primary	1,122(50.31)	615(50.00)	507(50.70)
Secondary and higher	344(15.43)	176(14.31)	168(16.80)
<i>Education level of wife</i>			
None	637(28.57)	368(29.92)	269(26.90)
Primary	1,375(61.66)	776(63.09)	599(59.90)
Secondary and higher	218(9.78)	86(6.99)	132(13.20)
<i>Knowledge of agricultural practices</i>			
Poor	1,010(45.29)	814(66.18)	196(19.60)
Good	513(23.00)	268(21.79)	245(24.50)
Very good	707(31.70)	148(12.03)	559(55.90)
<i>Farm size</i>			
Less than 2.5 acres	760(34.08)	819(66.48)	226(22.60)
2.5-5 acres	1,003(44.98)	287(23.30)	226(22.60)
>5 acres	467(20.91)	126(10.23)	54(5.40)
<i>Household wellbeing</i>			
poor	618(27.73)	284(23.05)	334(33.43)
Good	890(39.33)	442(35.88)	448(44.84)
Very good	721(32.35)	506(41.07)	217(21.72)
<i>Wealth quintile</i>			
Poorer	459(20.58)	260(21.14)	199(19.90)
Poor	440(19.73)	240(19.51)	200(20.00)
Middle	445(19.96)	246(20.00)	199(19.90)
Richer	443(19.87)	243(19.76)	200(20.00)
Richest	443(19.87)	241(19.59)	202(20.20)
Sample size	2,201	1230	1000

Table 3.2-Differences in means by participation

Variable(s)	Mean Control	Mean Treated	Diff.	t
wealth	0.917	1.059	0.143	2.63***
Marital status	1.877	1.787	-0.091	1.23
Wife's age	1.255	1.233	-0.022	0.33
Husband's age	1.007	1.063	0.056	0.87
Husband's educational level	0.765	0.826	0.061	1.5
Wife's educational level	0.794	0.787	-0.007	0.21
Household size	1.172	1.043	-0.129	2.64***
Knowledge of best agric practices	0.495	0.456	-0.039	0.9
Farm size	0.363	0.42	0.057	1.48
Number of crop grown	0.434	0.578	0.144	3.07***
Dimba	0.431	0.487	0.055	1.82*
cashcrop	0.017	0.008	-0.01	1.52
foodsecurity	0.605	0.652	0.047	1.59
General household wellbeing	1.123	1.251	0.128	2.75***

*** p<0.01; ** p<0.05; * p<0.1

Bivariate analysis of the differences in mean values for the two outcome variables of interest, food security and wealth without covariates, are shown in Table 3.3 and Table 3.3a respectively. Both adopters and non-adopters were less likely to be food insecure with non-adopters slightly better off though not significantly different at the baseline. In 2014, however, adopters of agroecology were more likely to transition into higher levels of food security compared to non-adopters and the differences between adopters and non-adopters ($t=-3.57$, $p=0.01$) were statistically significant at the follow up period (see Table 3.3). The average treatment effect between the adopters and non-adopter of agroecology ($t=-3.65$, $p=0.01$) was also statistically significant. Wealth levels, expressed as a composite index of a household ownership of goods and assets, were also higher in 2014 than in 2012 for adopters, albeit the difference is statistically significant for only the difference between adopters and non-adopters at both periods; ($t=2.63$, $p=0.01$) at 2012, ($t=4.62$, $p=0.01$) at 2014 (see table 3.3A), the average treatment effect was however not statistically significant.

Table 3.3: Average impact of agroecology adoption on food security without covariates

Outcome variable	Baseline (2012)			Follow up(2014)			Diff-in-Diff
	Control	Treated	Diff(BL)	Control	Treated	Diff(FU)	
Food insecurity	0.873	0.966	0.093	1.068	0.841	-0.227	-0.320
Robust standard errors	0.049	0.036	0.061	0.048	0.041	0.064	0.088
T statistic	17.75	27.19	1.54	22.14	20.33	-3.57***	-3.65***

*** p<0.01; ** p<0.05; * p<0.1 Means and Standard Errors are estimated by linear regression

Table 3.4: Average impact of agroecology adoption on wealth without covariates

Outcome variable	Baseline (2012)			Follow up(2014)			Diff-in-Diff
	Control	Treated	Diff(BL)	Control	Treated	Diff(FU)	
Wealth	0.917	1.059	0.143	0.853	1.116	0.262	0.120
Robust standard errors	0.044	0.032	0.054	0.043	0.037	0.057	0.078
T statistic	20.84	33.58	2.63***	19.89	30.01	4.62***	1.53
R ²	0.007						

Table 3.4A: Average impact of agroecology adoption on wealth with covariates

Outcome variable	Baseline (2012)			Follow up(2014)			Diff-in-Diff
	Control	Treated	Diff(BL)	Control	Treated	Diff(FU)	
Wealth	0.922	1.059	0.137	0.624	1.116	0.491	0.354
Robust standard errors	0.046	0.032	0.056	0.074	0.037	0.083	0.100
T statistic	20.07	33.37	2.45**	8.38	30.12	5.91***	3.54***
R ²	0.2675						

*** p<0.01; ** p<0.05; * p<0.1 Means and robust standard Errors are estimated by linear regression

The positive relationship between agroecology adoption and our outcomes variables maybe due to a positive selection bias (see Kabunga et al. 2012), implying that farmers with influence at the village level, higher than average income may be more likely to adopt agroecology technology. In our next section, we derive the average treatment effects, controlling for other covariates and employ kernel-based propensity score matching to control for selection bias. Tables 3.4 and 3.4A shows the results of the probit models, which we estimated in order to derive the propensity scores. The results suggest that even after controlling for theoretical relevant covariates and propensity score, adoption of agroecology exerts a positive and significant impact on food security whereby adopters are more likely to transition into higher levels of food security compared to non-adopters ($t=-2.35, p=0.05$)(see Table 3.4). The average treatment effects of MAFFA on food security was positive and significant even after accounting for selection bias and other covariates ($t=-3.21, p=0.01$). Also, adoption exerts a positive and a significant impact on household wealth with adopters being more likely to be in higher levels of wealth compared to non-adopters with a positive average treatment effect ($t=3.54, p=0.01$)(see table 3.4A).

Table 3.4- Average effects of agroecology adoption on food security with covariates

Outcome variable	Baseline (2012)			Follow up(2014)			Diff-in-Diff
	Control	Treated	Diff(BL)	Control	Treated	Diff(FU)	
Food insecurity	1.136	1.255	0.119	1.359	1.173	-0.185	-0.304
Robust standard errors	0.044	0.029	0.053	0.071	0.033	0.079	0.095
T statistic	25.70	43.90	2.26**	19.05	35.09	-2.35**	-3.21***
R ²	0.1796						

*** p<0.01; ** p<0.05; * p<0.1 Means and robust standard Errors are estimated by linear regression

Table 3.4A: Average impact of agroecology adoption on wealth with covariates

Outcome variable	Baseline (2012)			Follow up(2014)			Diff-in-Diff
	Control	Treated	Diff(BL)	Control	Treated	Diff(FU)	
Wealth	0.922	1.059	0.137	0.624	1.116	0.491	0.354
Robust standard errors	0.046	0.032	0.056	0.074	0.037	0.083	0.100
T statistic	20.07	33.37	2.45**	8.38	30.12	5.91***	3.54***
R ²	0.2675						

*** p<0.01; ** p<0.05; * p<0.1 Means and robust standard Errors are estimated by linear regression

The results from our ordered logistic (Table 4.5) suggest that wife age, husband age, husband educational level, wife educational level, household size, knowledge of best agricultural practices, farm size, cash crop farming and general wellbeing are important determinants of agroecology adoption among small-holder farmers in Northern and Central Malawi. The probit model which accounts for selection bias, however, shows that, husband age, wife educational level, household size, knowledge of best agricultural practices, cash crop farming, household general wellbeing and wealth were associated with agroecology adoption among farmers in northern Malawi. Table 3.6 present results of the balancing test for the differences between adopters and non-adopter

Table 3.5: Ordered logistic regression and Probit Estimates of agroecology adoption

Variable(s)	Agro-ecology adoption	
	Ordered Logistics	probit
Marital status	0.01(0.017)	-0.02(0.048)
Wife's age	-0.01(0.021)	0.01(0.055)
Husband's age	0.02(0.019)	0.11(0.063)*
Husband's educational level	-0.07(0.031)**	0.05(0.075)
Wife's educational level	-0.10(0.034)***	-0.13(0.082)*
Household size	0.07(0.018)***	-0.09(0.038)**
Knowledge of best agricultural	-0.09(0.024)***	-0.21(0.081)***

practices		
Farm size	-0.09(0.028)***	0.09(0.064)
Number of crop grown	-0.02(0.023)	0.16(0.056)***
Dimba	-0.03(0.033)	0.06(0.086)
cashcrop	-0.15(0.060)***	-0.76(0.357)**
General household wellbeing	-0.04(0.022)**	0.14(0.051)***
wealth	-0.16(0.013)***	0.06(0.320)

*** p<0.01; ** p<0.05; * p<0.1 Means and robust standard Errors are estimated by linear regression and probit

Table 3.6: Balancing test for the difference between Adopters (treated) and non-adopters (control).

Variable	Before weighting			After weighting		
	Mean control	Mean Intervention	t-value	Mean control	Mean Intervention	t-stats
Marital status	1.877	1.787	1.23	1.811	1.787	0.34
Wife's age	1.255	1.233	0.33	1.237	1.233	0.06
Husband's age	1.007	1.063	0.87	1.046	1.063	0.28
Husband's educational level	0.765	0.826	1.5	0.803	0.826	0.59
Wife's educational level	0.794	0.787	0.21	0.781	0.787	0.17
Household size	1.169	1.064	1.69*	1.072	1.064	0.14
Knowledge of best agricultural practices	0.495	0.456	0.9	0.455	0.456	0.03
Farm size	0.363	0.42	1.48	0.393	0.42	0.73
Number of crop grown	0.434	0.578	3.07***	0.561	0.578	0.35
Dimba	0.431	0.487	1.82*	0.486	0.487	0.04
cash crop	0.017	0.008	1.52	0.01	0.008	0.43
food security	1.152	1.255	2.07**	1.277	1.255	0.47
General household wellbeing	1.123	1.251	2.75***	1.247	1.251	0.1

3.5 Discussion

We have analyzed the impact of agroecological farming on household wealth and food security. Distinct from previous impact studies, most of which rely on cross-sectional data, we used panel data covering two time periods. Similar to Kabunga et al (2014) this enabled us to combine propensity score matching with DID estimation to control for selection bias and temporal impact

variability. The estimation results show that agroecology farming methods positively influenced household food security and wealth in this context. The use of agroecological practices increased food security by 30%¹ and household wealth by about 42%² on average. Similar results have been observed for other natural resource management technologies such as sustainable rice intensification that build on agroecological principles (Noltze, Schwarze & Qaim, 2013). Thus, agroecological farming practices combined with farmer-to-farmer exchanges can improve food security and livelihoods significantly among rural farmers in Northern and Central Malawi. The estimated effects of agroecological practices that include: intercropping, improved farm and soil management practices, on food security and wealth are substantial taking into consideration that the impact assessment was carried out only two years after the program implementation. The findings here support other studies that report that the direct effects of agricultural innovation on poverty reduction may include productivity enhancements enjoyed by farmers who actually adopt the technology, higher consumption, diversification into off farm activities and cash crop farming, and also manifest in the form of higher farm incomes (Becerri & Abdulai, 2010). Specific to agroecological approaches, there are also direct impacts on food security, which when combined with community-led participatory education, can translate into positive nutritional outcomes (Bezner Kerr et al. 2010). The indirect effects include capacity-building and knowledge exchange within the community which may further lead to lower food prices and increases in consumption, and an improvement in the overall living standard of the community (de Janvry & Sadoulet, 2001). However, for these benefits to be sustained, smallholder farmers need to be encouraged to practice improved soil management practices, continued application of compost manure, mixed and intercropping rather than just adopting a single component on one time basis (Karanja, Renkow, & Crawford, 2003).

1 -0.35 exponentiated value of the effect of agroecology adoption on food security

2 0.35 exponentiated value of the effect of agroecology adoption on household wealth.

In the case analyzed here, switching to agroecology and encouraging social learning between farmers produces positive synergistic effects. Our results suggest that smallholder farmers will benefit greatly from scaling up of the agroecology program. Since agroecology is a knowledge intensive innovation, its successful uptake requires proper training and ongoing support of farmers. Consequently, the program should not be extended to other communities without first training farmers on best agricultural practices and soil management skills, as adoption without these skills may lead to a frustrating experience. Rather than emphasis on one or two innovation, teaching farmers basic principles of agroecology combined with a supporting them to test a range of options on their own farm should be encouraged.

Furthermore, the factors influencing the adoption of agro-ecological adoption vary significantly between households. This finding draws attention to the need to incorporate household inequalities in terms access to land, farm size, household size, educational level of husband and wife, cash crop farming and health of the household head into interventions that seek to increase the adoption and use of agroecology farming models. This finding is consistent with those reported by Bezu et al. (2014) who examined the determinants of improved maize varieties adoption in Malawi and the subsequent effects on household welfare. The results are also consistent with determinants of adoption of other agricultural innovations such as tissue culture bananas and other technologies in the small farm sector (Doss, 2006; Kabunga, Dubois & Qaim, 2012; Kabunga et al., 2014). For instance, among the poorly-endowed households, inadequate land and social networks may in themselves acts as a disincentive to adopt innovative technology that may hold promise to move family farmers out of chronic poverty (Langyintuo & Mungoma, 2008). Investment in community agricultural durbars and programs that encourages farmer-to-farmer knowledge exchanges, allows farmers to benefit from extension officers, from the experiences of other farmers and soil scientists, may increase the probability of agroecology adoption and improved crops and soil management practices. Additionally, field demonstrations within the project catchment areas that show the superiority of

agro-ecology over other local farming practices may serve as additional educational tools to increase the adoption rates.

This study has some potential weaknesses that should be pointed out. A predisposition to provide socially acceptable responses may have introduced some bias in the data as we could not physically validate responses. Nonetheless the findings provide valued insights into the impact of agroecology adoption on household wealth and food security within a rural setting that relies on agriculture as their main livelihood, with the benefit of a longitudinal dataset that enabled us to control for any possible bias between adopter and non-adopters.

3.6 References

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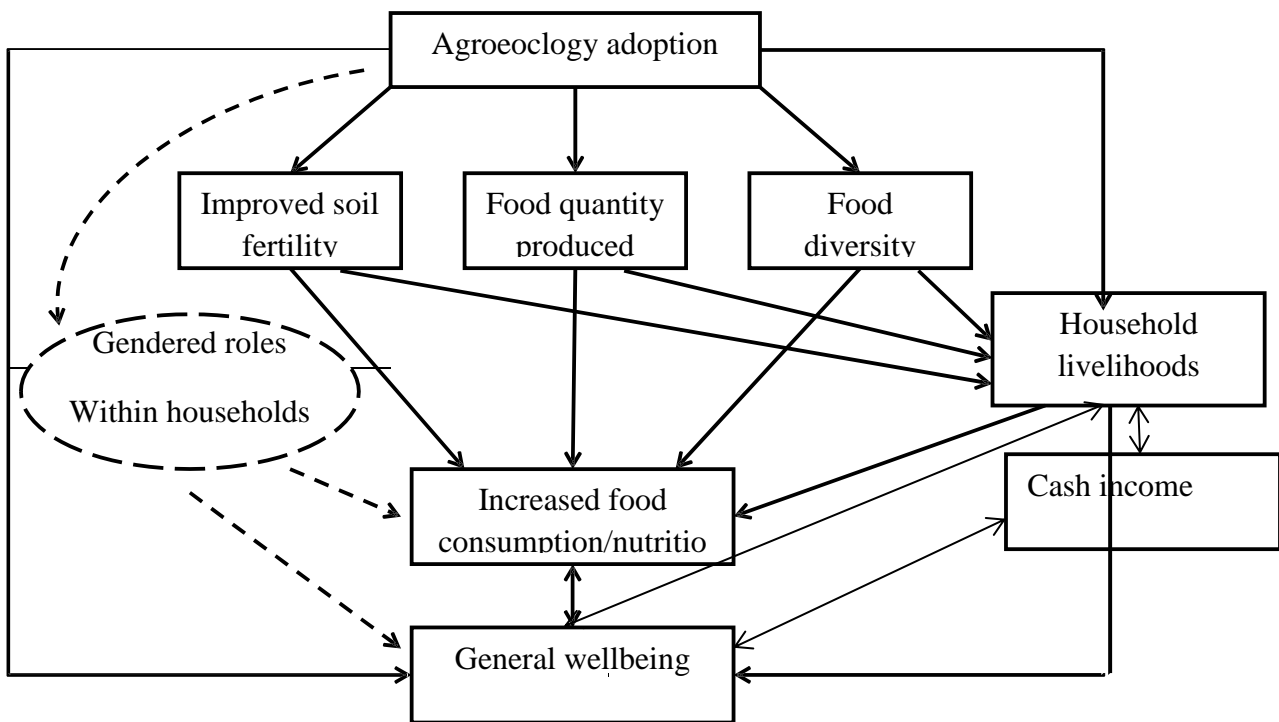


Figure 3.1: Impacts of agricultural innovation on food security and household wealth

Adapted from Qaim, 2014.

Chapter 4

Impact of Migration, and remittance receipt on household food security and asset levels in Northern and Central Malawi

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Abstract

Family farmers in most developing countries employ diverse strategies including migration as a major investment and livelihood strategy to mitigate the effects of adverse economic conditions, climate variability and food insecurity. These rural households are often interconnected with their urban members through remittance flows and knowledge transfer. While this is the case in most developing countries, there has been little research that investigates the linkages between migration, migrant remittances, and the food security status and asset levels of the originating rural households. In response this paper aims to examine the impact of migration and remittances on the food insecurity and wealth levels. Data was collected from a sample of 1,000 family farmers aged between 18 and 65 using self-administered survey questionnaires. The Household Food Insecurity Access Scale (HFISA) was used to evaluate the food security status of households. Results from our treatment effects models indicate that migration and remittance receipt has significant impacts on household food insecurity and assets levels. For instance households with migrant members are ($\beta=-0.157$, $p=0.01$) less likely to be food insecure and has an average treatment effect of ($\beta=0.151$, $p=0.01$) on household asset levels, indicating a positive impact on household asset levels. The findings suggest that smallholder farmers in Northern and Central Malawi may be employing migration and remittance receipt as a livelihood and investment strategy in context of unfavourable economic conditions, environmental degradation and resultant food insecurity. The study concludes by making relevant policy recommendations.

Keywords: Migration, Remittance, Food security, Agro-ecological, ordered logistic regression, Northern and Central Malawi,

4.1 Introduction

Family farmers in SubSaharan Africa (SSA) employ migration and other mitigation strategies in the face of major threats to their livelihoods. These threats may include unfavourable economic conditions such as unemployment and high cost of living, wars, famines or the adverse effects of environmental degradation and climate variability on their productive capacity. The capacity or ability of households to adapt sufficiently to either maintain, or improve their food security status in the face of these challenges will influence their decisions to choose migration as an adaptive or mitigation strategy (Zezza, Carletto, Davis & Winters, 2011; Karamba, 2011; Crush, 2013). Against this background, migration and remittances have become a vital component in the livelihood and development strategies employed by several households in the developing world, where an enormous number of people are seeking better opportunities in developed countries, in major cities or better agricultural land within their country of residence (Kalipeni, 1996; Zezza et al., 2011; Kuuire, Mkandawire, Arku & Luginaah, 2013; Crush, 2013). Remittances refer to financial flows or receipts into households that do not require a *quid pro quo*³ in economic value (Quartey, 2006; Wagh & Pattillo, 2007; Muchiri, 2014). Global remittances have expanded dramatically in the last decade, driven by an upsurge in migration, financial intermediation and are increasingly regarded as vital resources to promote economic growth and poverty reduction in the developing world (Karamba, 2011; Crush, 2013). Remittance flows to SSA has been estimated at \$31 billion in 2012 (World Bank, 2012; Aga & Martinez, 2014) and are projected to increase in subsequent years. Despite the increasing importance of remittance flows, and the fact that most remittances receipts are spent on household food consumptions (Adams & Cuecuecha, 2010; Zezza et al., 2011), the relationship between remittance receipt and food security have not been adequately investigated. This paper seeks to contribute to the existing literature on the developmental effects of remittance by examining the impact of migration and remittances receipt on the food security status and asset levels of receiving

³ Returned Favour

households. This is in a context where a substantial number of countries in SSA are unlikely to meet the millennium development goal of reducing by half: the prevalence of child underweight, the percentage of populations under the minimal dietary energy consumption and the proportion of populations under poverty (Fosu, 2015; F.A.O, 2014; Zezza et al., 2011). Current estimates obtained from Food and Agriculture Organisation (F.A.O) indicates that the rate of reduction of food insecurity in SSA is lower compared with other parts of the world (F.A.O, 2014).

There is an extant, albeit scant literature that investigates the linkages and determinants of migration and remittances receipt, even though these issues play vital roles in the development process of most developing nations. Initially, researchers in this field were mainly interested in the impacts of remittances on economic growth, investment and poverty reduction (Pant, 2008; Giuliano & Ruiz-Arranz 2009; Petreski & Jovanovic, 2013), however the non-pecuniary impacts of remittances such as impacts on health, education and social structures have received some considerably attention recently (Petreski & Jovanovic, 2013). Welfare effects of remittance have been viewed as a double edged –either a mechanism for economic growth or as an ailment that weakens an economy (Abdih et al., 2012; Petreski & Jovanovic, 2013). However, studies examining the linkages between remittance receipt and other welfare effects in Sri Lanka, Guatemala and Ghana reveal that remittances act as an insurance flow for some households and help raises the asset and resilience levels of poor people (Deshingkar, 2006, Adams, 2004, 2006; De & Ratha, 2012). For instance, (Adams, 2004, 2006) found that remittance receipt has the greatest impact on reducing the severity of poverty among poor people in Guatemala and Ghana whereas Adams & Cuecuecha, (2010 and 2011) report of the developmental impacts of remittance in Indonesia and Guatemala. Gyimah-Brempong & Asiedu (2011) also found that remittances receipt is positively associated with the number of children attending school at the household level, suggesting an increase in human capital formation that may lead to a decrease in poverty reduction in the long run.

4.1.1 Migration in Malawi

Migration in Malawi is motivated mainly by two factors: to earn money with which to supplement subsistence agriculture, and also at the beginning or end of marriages (Anglewicz, 2012). Other studies have also documented the influence of colonialism and historical processes that have shaped migration in Malawi (Kerr, 2005; Mkandawire, Luginaah & Baxter, 2011; Beegle & Poulin 2013). Male labor migration has been an important source of income in Malawi with migration been predominantly international, with a recent trend in rural-urban migration occurring in the later part of the 1990's (Anglewicz, 2012; Beegle & Poulin, 2013). The history of urban growth in Malawi is an inconsistent unlike most sub-Saharan African countries (Preston, 1979). This is as a result of the restriction of rural-urban migration by President Banda during his long rule from 1963-1994 (Anglewicz, 2012). However, rural-urban migration increased swiftly after a new government was elected in 1994 (Englund, 2004) even though international migration remains the most prevalent (Anglewicz, 2012). International migration, nevertheless, has been a life-cycle event for most young Malawian men during the colonial period and continues today as men continue to seek better opportunities in mines or agricultural estates in South Africa, Zambia, and Zimbabwe (Kalipeni 1992; Kydd & Christiansen 1982).

International migration in Malawi is enhanced by strategic location within Southern Africa, and the favourable political and economic climate provided by the Southern Africa Development Community (SADC) and Southern African Migration Systems (SAMS) (Thomas & Nkpen, 2013). Malawi and 14 other countries form the Southern African Development Community (Zuberi & Sibanda, 2004; Thomas & nkpen, 2013) with the South African economy providing the dynamism that supports such international migrations. Due to its comparatively low level of development and the equivalent attraction of its nationals to income earning opportunities within the region, Malawi serves as a major source of migrant labor within the SAMS (Kalipeni, 1992; Bryceson, 2006; Beegle & Poulin, 2013; Thomas & nkpen, 2013) with South Africa and Botswana being the major destinations (Van, 2002; Oucho, 2007). There are also instances of rural-urban, urban-rural and rural-

rural migration occurring in Malawi mostly in search of better opportunities and favourable agricultural land (Beegle & Poulin, 2013). Most of these migrants however maintain ties with their originating households through remittance flows and our study did not distinguish between these groups of migrants.

4.1.2 Linkages between migration and food security

For most migrant households- both remittance receiving and non-receiving, the changes that occur as a result of a household member migrating include: the potential to receive remittances from the migrant member which may affect household consumption directly and indirectly, information transfer on best agricultural and nutritional practices from the migrant, and a reduction in household size that may not only lead to lower consumption requirements, but also less family labor or a disruption in household gendered roles (Zezza et al., 2011; Crush, 2013), and intra-household resource allocation and the feminization of agriculture (Radel, Schmook, Mcevoy, Mendez & Petrzalka 2012). Male out-migration leaves women as heads of households and managers of farm fields with the responsibilities of maintaining subsistence agriculture as well as ensuring the nutritional levels of children (Radel et al., 2012) .The overall influence of these changes on the food consumption and household nutrition can either be positive or negative (Karamba, 2011; Crush, 2013).

Despite these linkages between migration and their subsequent effects on household productivity, food insecurity and asset levels, only few studies have empirically examined these linkages in SubSaharan Africa (Glewwe 1991; Quartey, 2006; Adam, 2004; Adam, 2006; Gyimah-Brempong & Asiedu, 2011). Migration - both international and domestic - can influence household nutrition and food insecurity through several connexions. Remittances from migrants may affect household food consumption and nutrition directly through increase in household purchasing power through income effects that alter their budget constraints and enable them to consume more (Crush, 2013, Zezza et al., 2011). Migration may indirectly impact household food insecurity through

providing liquidity and credit needed for purchasing agricultural inputs and diversifying into non-agricultural ventures that may subsequently affect household production and investment decisions (Quartey, 2006). However, migration could also impact negatively on household productivity through the loss of labor of the migrant household member, especially when the migrant member is an abled member of the household. Despite the importance of migration and remittance receipt and their likely impact on household food insecurity and asset levels, there have been limited studies examining this relationship in Malawi. The purpose of this paper is to examine the effect of migration and remittance receipt on household food insecurity and asset levels. More specifically, we ask the question: 1) what is the average impact of migration on household food insecurity? 2) Are households that received remittances different in terms of food insecurity from households that do not receive remittances? We seek to examine to what magnitude remittance flow is ‘developmental’ in nature – does it ameliorate household poverty and contribute to household food security?

4.1.3 Economic theory

In this section, we outline the econometric theory relied upon to examine the impact of migration and remittance receipt on household food security and asset levels and draws extensively on the work of Glewwe (1991) and Quartey (2006). According to economic theory of utility maximization, the main objective of every household is to maximize utility subject to a given budget constraint (Stark, 1991; Docquier, Rapoport & Salomone, 2012). Migration may alter the household budget constraint through remittance receipt (income effects) or limit the household productive capacity through loss of the household member to migration that could result in less productivity and consumption (Glewwe, 1991; Quartey, 2006; Docquier, Rapoport & Salomone, 2012). The first scenario may relax the budget constraint that will enable households to increase consumption whilst the later stretches the household budget constraints that limit household consumption levels, *ceteris paribus*⁴. The present study adopted household food insecurity index which is created using HFIAS

4 All things being equal

as an indicator of household welfare. We employed duality theory to express household decisions in terms of expenditure and cost functions to enable us specify the resources required by a utility-maximizing household to attain a given level of satisfaction (Quartey, 2006). The amount of expenditure required (denoted by X) to achieve a given level of satisfaction depends on the prices of goods and services (p_1, \dots, p_n), household characteristics such as age, sex, household size, education agricultural productivity variables, house wealth and credit and market access, and the utility level (U) that the household wants to obtain. This can be expressed as

$$X^h = E(U; p_1, \dots, p_n; a^h \dots a_m^h)$$

Where, h superscript denotes a particular household, p is the prices of goods and services, a is household characteristics. The model can be extended to compare food insecurity and asset levels of households living under different pricing structures as shown by both Glewwe (1991) and Quartey (2006). We investigate the average effects of migration and remittance receipt on household welfare by regressing X^h on various independent variables that are exogenous.

4.2 Methods

4.2.1 Data and sample

A survey of 1,000 households was conducted from July-September 2014 in North and Central Malawi within villages in Mzimba and Dedza districts. Households were diversified family farmers with average farm sizes less than 3 acres. The current study reports the average effects of migration and remittance receipt on household food security and asset levels. Household heads or a well-informed adult within the household were interviewed using structured questionnaires specifically designed for this purpose. The questionnaires were tested before official data collection to ensure content validity and precision. Surveys were conducted in the local dialect by a group of trained enumerators fluent in these languages (Timbucka, and Chichewa) and were supervised by the researchers. The survey collected data on household migration patterns, household assets, and

demographic characteristics as well as on and off-farm economic activities and was entered into SPSS version 11.0 and later converted to STATA 13 for analysis. The questionnaires included a HFIAS module to explore household food insecurity, details of which are described further below. Ethics for this research was obtained from Non-Medical Research Ethnic Board at Western University (number 105142). In addition, informed consents were obtained prior to each survey.

4.2.2 Measures

Food insecurity status, one of our dependent variable was constructed using the Household Food Insecurity Access Scale (HFIAS) module which measures a household's own perception of their access to food (Coates, 2006; Swindale & Bilinsky, 2006). HFIAS indicator guide was used to categorize households into food secure, moderately food insecure (moderate and mildly food insecure) and severely food insecure (Coates, 2006). The main independent variables, migration and remittance receipt, were constructed from the questions, 'Has any of your family members migrated to another village, town or country'? In response household heads indicated if any member had migrated or not, coded (0=no; 1=yes). The second independent variable was elicited from the question, 'Do you receive any remittances from the migrated member?' to which households provided their responses, coded (0= do not receive remittance; 1=do receive remittance). Agricultural variables controlled for in the analysis are: farm size (0= less than 2.5acre,1= between 2-5 and 5 acres, and 3= >5 acres); agricultural knowledge (0=low ,1=average; 2=excellent); intercropping (0= mono-cropping, 1=2 crops, 2=more than 3 crops); and dry season farming (0=no, 1=yes). Biosocial variables such as age of husband and wife (0=<= 30 years; 1= between 30 and 45; 2=46-60 years; and 3=60 and over); and family structure (0=monogamy, 1=polygamous, 2=female headed and 3=separated or divorce) were also controlled for in our analysis. Socioeconomic status variables such as educational level of the husband and wife both coded (0=no education; 1=primary education and 3=secondary and higher), household wellbeing (0=poor, 1=good and 2=excellent) and household wealth also were also controlled for. Household wealth which is a composite index of a household's

ownership of a number of consumer items, assets and agricultural goods was constructed using the DHS wealth creation guidelines (DHS, 2014). Principal component analysis (PCA), a technique for extracting from a set of factors, the focal factors that capture the common information most successfully, was used to construct an overall index of household wealth (Filmer & Pritchett, 2001; Zeller, Sharma, Henry & Lapenu, 2006). Each asset was normalized by its mean and standard deviation and later aggregated to create asset level of the households. Asset ownership was later dummied into quintiles and coded (Poorest =0; poorer=1; middle=2; richer=3; and richest=4). Other variables controlled for our analysis include; credit access (no=0; yes=1), off farm income (no=0; yes=1), on-farm income (no=0; yes=1), and market access (no=0; yes=1) which are factors that prior studies have indicated as important factors that affect food insecurity, farm productivity and income diversification (Owusu et al., 2011; Ahmed 2012; Olale and Henson, 2013).

4.2.3 Analysis

The impact of migration and remittance receipt on household food insecurity and asset levels are estimated through average treatment effects (ATE) using propensity score matching- a non-parametric treatment-outcome procedure (Rosenbaum & Rubin 1983, 1985) to correct for selection and missing data biases. Propensity score matching, unlike Ordinary Least Squares (OLS), Instrumental Variables (IV) and Heckman methods, does not assume linearity of the outcome equation and has the same advantage of tackling endogeneity of the treatment variable (in our case migration and remittance receipt)(Olale & Henson, 2013). PSM constructs a statistical comparison group by matching every individual observation of households with migrant members with an observation with similar characteristics from the group of households without migrant member. A similar procedure is undertaken for remittance receipt as well. This creates an experimental data in which households with migrant members and non-migrant households, or remittance receiving and non-receiving households are randomly assigned (Dehejia & Wahba, 2002; Olale & Henson, 2013), allowing for the identification of a causal link between migration, remittance receipt and our outcome

variables. This is relevant for policy analysis as it enables us to know what would happen to if households did not have migrant members or did not receive any remittances.

Our analyses further employ augmented inverse probability weighting (AIPW) as a matching tool (Cassel, Sarndal & Wretman, 1983; Rosenbaum, 1987; Hirano & Imbens, 2001; Drukker, 2014). The AIPW estimators compute averages of the augmented inverse-probability-weighted outcomes for each treatment level and contrast these averages to obtain the treatment effects (Drukker, 2014; Zhang, Tsiatis, Laber & Davidian, 2014; Curtis, Hammill, Eisentein, Kramer & Anstrom, 2007). Thus, it uses one model to predict treatment status, and use another model to predict the outcomes. The AIPW procedure involves three stages. First, it estimates the parameters of the treatment model and uses them to calculate the inverse-probability weights. Then, it estimates separate regression models of the outcome for each treatment level and obtain the treatment-specific predicted outcomes for each household. The final procedure involves computing the weighted means of the treatment-specific predicted outcomes, where the weights are the inverse-probability weights estimated in step 1. The differences of these weighted averages then provide the estimates of the average treatment effects (ATEs).

In our study, the treated (intervention) group are households that contain a migrant member or households that receive remittances whilst the counterfactual group are non-migrant and non-remittance receiving households. Under ideal conditions, the effective strategy is to obtain the average effect of migration and remittance receipt on food insecurity and household wealth, also known as the average treatment effect (ATE). ATE can be expressed as:

$$ATE = E(NY_i) = E(Y_{i1} - Y_{i,0}) \dots \dots \text{equationn 1}$$

Where IN_i refer to either migration or remittance receipt. At least one of the outcomes is observed whilst the other is not observed for each individual, thus a household either contain migrate member or not or receive remittance or not. We also adopted augmented inverse probability weighting to create the unobserved component (Seaman & White, 2013). The assumptions that underlie a valid

matching include the Conditional Independence Assumption (CIA), overlap, and independent observations.

The CIA is represented by:

$$(Y_{i,1}, Y_{i,0}) \perp\!\!\!\perp I_i \mid X \dots \text{equation 2}$$

Where X is a vector of covariates not affected by either migration or remittance receipt and $\perp\!\!\!\perp$ is the symbol for independence. This assumption implies that, given X , we can use the non-treated units as the comparison group. Hence matching consists of linking each treated unit to a set of non-treated units with similar features. The propensity scores are estimated using logit regressions to obtain the probability of migration and remittance receipt. Augmented inverse probability weighting (AIPW) was used to obtain potential outcome means (POMs) and the differences in the POMs were used to estimate the average treatment effects (Cattaneo, 2010, Cattaneo et al. 2013). AIPW estimators are shown to be more efficient than other weighting estimators (Robins & Rotnitzky 1992, Robins et al., 1994, Lunceford & Davidian 2004, Cattaneo 2010, Cattaneo, Drukker & Holland, 2013). As a sensitivity analysis, we compared our results to other matching techniques such as ‘nearest neighbor’ matching and propensity score matching. A detailed description of these matching methods is done by Becker & Ichino (2002). The *teffects* command available in STATA13 was used to build all models.

4.3 Results

4.3.1 Descriptive result

Table 4.1 provides descriptive statistics of the variables used in our study. Notably, about 47% households were severely food insecure compared to 30% who were moderately food insecure and 23% reported being food secure. Majority of households cultivated farm sizes not greater than 2.5 acres, intercrop at least three crops, had no migrated household member, and reported very good

knowledge of best agricultural practices. Out of 31% of households with migrated members, about 20% of household heads reported receiving remittances. It is evident that quite substantial percentage of wives and husbands had primary education, aged between 30-45 years and had a nuclear family structure. The distributions of household heads in the sample were evenly spread across the various wealth quintiles, with majority engaging in non-farming activities, has access to markets but less access to credit.

Table 4.1: Descriptive statistics

Food insecurity	Frequency (%)
Food secure	231(23.10)
Moderately food insecure	300(30.00)
Severely food insecure	469(46.90)
Household member migrated	
no	687(68.70)
yes	313(31.30)
Received remittances	
no migrated member	687(68.70)
Migrated but no remittance	116(11.60)
Migrated and remits	197(19.70)
Farm size	
2.5 acres	720(72.00)
2.6-5 acres	226(22.60)
> 5 acres	54(5.4)
Number of crop	
only one	228(22.80)
two	269(26.90)
At least three	503(50.30)
Knowledge on agriculture	
poor	196(19.60)
Good	245(24.50)
Very good	559(55.90)
Dry season farming	
no	513(51.30)
yes	487(48.70)
Ganyu	
No	525(52.50)
Yes	475(47.50)
Household size	
1-3	290(29.00)
4-5	326(32.60)
>6	384(38.40)
Age of husband	
less than 30	157(15.70)

	30-45	379(37.90)
	46-60	197(19.70)
	>60	267(26.70)
Age of wife		
	less than 30	366(36.60)
	30-45	340(34.00)
	46-60	188(18.80)
	>60	106(10.60)
Wife education		
	no education	269(26.90)
	primary	599(59.90)
	Secondary and higher	132(13.20)
Husband education		
	no education	325(32.50)
	primary	507(50.70)
	Secondary and higher	168(16.80)
Family structure		
	nuclear	617(61.70)
	Female headed	94(9.40)
	Male centered	189(18.90)
	others	100(10.00)
Household health		
	poor	334(33.43)
	Good	448(44.84)
	Very good	217(21.72)
Non-farm activities		
	no	234(23.40)
	Yes	766(76.60)
Access to credit		
	no	730(73.07)
	yes	269(26.93)
Access to market		
	no	363(36.30)
	yes	637(63.70)
Wealth		
	poorest	199(19.90)
	Poorer	200(20.00)
	Middle	199(19.90)
	Richer	200(20.00)
	Richest	202(20.20)
Observations	1,000	

Table 4.2 presents logit regression results for the probability of household member migrating under the parameter estimates for treatment. The results show that, education of household head, age of household head, and wealth has significant and positive associations with the probability of migration. However, size of the household, ethnicity and market access has significant negative association with the probability of migrating.

Similarly, as shown in table 4.3, education and age of household head, and wealth were positively associated with the probability of a household receiving remittance whereas size of the household, ethnicity and market access were negatively related with remittance receipt.

4.3.2 Impact of migration

5.1.2.1 Food insecurity

As showed in tables 2, migration has a positive and significant impact on household food insecurity. The potential outcome means (POMs) show that households with migrant members had on average 1.21 ($\beta=1.21$, $p=0.01$) points on food insecurity whilst the potential outcome mean for households without migrant members is ($\beta=1.28$, $p=0.01$). The difference of these two points (1.21-1.28) gives an average treatment effect (ATE) of ($\beta =-0.08$, $p=0.01$) points for households with migrant members. Thus, households with migrant members are on average 0.08 points less likely to be food insecure.

5.1.2.2 Assets ownership levels

Similarly, under column 3 of tables 2, migration also has a significant positive effect on household asset levels. The potential outcome means (POMs) for households with migrant member is ($\beta=2.24$, $p=0.01$), whilst the potential outcome mean for households without migrant members is ($\beta=1.89$, $p=0.01$). The average treatment effect of migration on households asset levels is therefore (β

5 Estimated coefficients

=0.350, $p=0.01$) - implying that households with migrant members are 0.35 points more likely to be in higher level of wealth (assets).

Table 4.2: Average effects of migration on household food insecurity and wealth levels using nearest neighbor- matching under augmented inverse probability weighting.

	Food insecurity	Wealth levels
Potential outcome means	Coefficients(SE)	Coefficients(SE)
<i>Migration</i>		
No migrant member	1.28(.031)***	1.89(.051)***
Has migrant members	1.21(.049)***	2.24(.088)***
Average treatment effects	0.157(.019)***	0.151(.019)***
Outcome model parameter estimates(households without migrated members)		
Farm size	-0.315(.054)***	0.81(.091)***
Household size	0.039(.035)	0.209(.055)***
Family structure	0.072(.031)**	0.093(.048)**
Number of crops grown	-0.106(.036)***	0.307(.063)***
Knowledge of best agricultural practices	-0.202(.034)***	0.263(.058)***
Ethnicity	0.040(0.023)*	-0.136(.034)***
_cons	1.68(.086)***	0.748(.139)***
Outcome model parameter estimates(households with migrated members)		
Farm size	-0.244(.068)***	0.571(.109)***
Household size	0.072(.054)	0.149(.087)*
Family structure	0.045(.042)	0.284(.061)***
Number of crops grown	-0.072(.061)	0.055(.095)
Knowledge of best agricultural practices	-0.184(.59)***	0.358(.099)***
Ethnicity	0.075(.031)**	-0.117(0.050)**
_cons	1.31(.126)***	1.36(.194)***
Parameter estimates for treatment model		
Farm size	0.116(.135)	0.294(.130)**
Household size	-0.209(.093)**	-0.144(.091)
Family structure	0.125(.104)	0.181(.102)*
Number of crops grown	0.115(.106)	0.157(.105)
Knowledge of best agricultural practices	0.024(.112)	0.089(.109)
Marital status	-0.110(.099)	-0.118(.098)
Religion	0.158(.266)	0.082(.261)
Wife education	0.102(.149)	0.153(.148)
Educational level of husband	0.602(.149)***	0.719(.145)***
Age of husband	0.505(.085)***	0.498(.084)***
Ethnicity	-0.227(.074)***	-0.250(.074)***
Credit access	-0.017(.172)	0.065(.173)
Market access	-0.718(.165)***	-0.534(.155)***
Wealth quintile	0.315(.070)***	

4.3.3 Impact of remittance receipt

4.3.3.1 Food security

The effect of remittance receipt on household food insecurity and wealth are depicted in Table 4.3. As showed in the first column, remittance receipt has a positive and significant impact on household food insecurity status. The potential outcome means (POMs) on food insecurity for remittance receiving households were ($\beta=1.17$, $p=0.01$) points whilst the potential outcome mean for households that do not receive remittance was ($\beta=1.29$, $p=0.01$). This results in an average treatment effect (ATE) of ($\beta =-0.12$, $p=0.01$) points for households that remittance receiving. Thus households that receive remittances are on average 0.12 points less likely to food insecure.

4.3.3.2 Assets ownership levels

Similarly, under column 3 of tables 3, remittance receipt exerts a positive and significant impact on household wealth or assets levels. The potential outcome means (POMs) show that the average effect of non-remittance receipt on household wealth were ($\beta=1.92$, $p=0.01$) points whilst the potential outcome mean for households that receive remittance was ($\beta=2.35$, $p=0.01$). This results in an average treatment effect (ATE) of ($\beta =0.43$, $p=0.01$) points for remittance receiving households. Thus households that receive remittances are on average 0.43 points more likely to be wealthy.

Table 4.3: Average effects of remittance receipt on household food insecurity and wealth levels using nearest neighbor- matching under augmented inverse probability weighting.

	Food insecurity	Wealth levels
Potential outcome means		
<i>Remittance receipt</i>	Coefficients(SE)	Coefficients(SE)
Do not receive remittance	1.29(.028)***	1.92(.047)***
Receive remittances	1.17(.083)***	2.35(.137)***
Average treatment effects	-0.157(.019)***	0.151(.019)***
Outcome model parameter estimates(households without migrated members)		
Farm size	-0.288(.047)***	0.768(.082)***
Household size	0.056(.032)*	0.179(.051)***
Family structure	0.071(.028)***	0.100(.045)**
Number of crops grown	-0.106(.033)***	0.270(.059)***
Knowledge of best agricultural practices	-0.192(.032)***	0.268(.055)***
Ethnicity	0.038(0.019)**	-0.152(.032)***
_cons	1.641(.078)***	0.882(.129)***
Outcome model parameter estimates(households with migrated members)		
Farm size	-0.269(.084)***	.491(.137)***
Household size	-0.029(.069)	0.248(.111)**
Family structure	0.053(.054)	0.348(.072)***
Number of crops grown	-0.034(.075)	0.050(.119)
Knowledge of best agricultural practices	0.189(.078)**	0.314(.133)**
Ethnicity	0.105(.041)***	-0.018(0.068)
_cons	1.237(.165)***	1.36(.261)***
Parameter estimates for treatment model		
Farm size	0.081(.157)	0.286(.149)***
Household size	-0.390(.111)***	-0.303(.107)***
Family structure	0.005(.123)	0.075(.123)
Number of crops grown	0.132(.132)	0.172(.130)
Knowledge of best agricultural practices	0.201(.137)	0.275(.133)**
Marital status	0.146(.114)	0.127(.114)
Religion	0.052(.372)	-0.041(.362)
Wife education	0.255(.176)	0.303(.178)*
Educational level of husband	0.856(.172)***	0.967(.169)***
Age of husband	0.538(.098)***	0.528(.096)***
Ethnicity	-0.262(.084)***	-0.290(.085)***
Credit access	0.055(.191)	0.127(0.192)
Market access	-0.906(.191)***	-0.689(.178)***
Wealth quintile	0.365(.083)***	none

4.3.4 Robustness check

To ensure robustness of our results, we conducted an average treatment effect (ATE) analysis of the impact of migration and remittance receipt on household wealth using kernel based propensity score matching and the nearest neighbor propensity matching. The results posit a positive impact of migration and remittance receipt on household wealth and household food insecurity (see Tables 4.4, 4.4A, 4.5, and 4.5A). These results support those we reported using the AIPW procedure.

Table 4.4: Average effects of migration on household food insecurity and assets levels using nearest neighbor propensity score matching

Food insecurity	Coefficient	Standard errors	Confidence Interval
migration			
(migrated vs not migrated)	-0.152***	0.058	(-0.2677284 -0.0364885)

Assets levels	Coefficient	Standard errors	Confidence Interval
migration			
(migrated vs not migrated)	0.226***	0.071	(0.0874354-0.3643718)

Table 4.4A: Average effects of remittance receipt on household food insecurity and assets levels using nearest neighbor propensity score matching

Food insecurity	Coefficient	Standard errors	Confidence Interval
Remittance receipt			
(receive remittance vs do not receive remittances)	-0.306***	0.082	(-0.4661637 -0.1456167)

Assets levels	Coefficient	Standard errors	Confidence Interval
Remittance receipt			
(receive remittance vs do not receive remittances)	0.529***	0.146	(0.2417095-0.8161888)

Table 4.5: Average effects of migration on food insecurity and asset levels using kernel based propensity score matching

Food insecurity	Coefficient	Standard errors	Confidence Interval
migration			
(migrated vs not migrated)	-0.131**	0.065	(-0.2589397 -0.0031085)

Assets levels	Coefficients	Standard errors	Confidence Interval
migration			
(migrated vs not migrated)	0.417***	0.101	(0.2203971 0.6149442)

Table 4.5A: Average effects of remittance receipt food insecurity and asset levels using kernel based propensity score matching

Food insecurity	Coefficient	Standard errors	Confidence Interval
Remittance receipt			
(receive remittance vs do not receive remittances)	-0.204***	0.058	(-0.3185379 -0.089762)

Assets levels	Coefficients	Standard errors	Confidence Interval
Remittance receipt			
(receive remittance vs do not receive remittances)	0.345***	0.138	(0.0735616 0.6172015)

4.4 Discussion and conclusion

Malawi has witnessed widespread migration of able youth mostly from its rural areas to urban centers as well as international labour out-migration to South Africa, Botswana, Zambia and elsewhere (Anglewicz, 2012) as well as internal migration in search of better opportunities (Beegle & Poulin, 2013). It is also a country where food insecurity and malnutrition are prevalent with only limited improvements in recent decades (Stewart & Bell, 2015; Conrad, 2015). The recent global surge in remittance flows to the developing countries such as Malawi that has put substantial amounts of resources into the hands of households raises hopes that such flows may improve food consumption and enhance household food security and nutrition (Karamba, Quiñones & Winters, 2011) and also propel households out of assets poverty (Petreski & Jovanovic, 2013; De & Ratha, 2012; Gyimah-Brempong & Asiedu 2011; Adams, 2004, 2006, Glewwe, 1991). Our study examined the average treatment effects of migration, and remittances receipts on household food insecurity and asset ownership of smallholder farmers in Northern and Central Malawi. It is hoped that our results will contribute to the scant literature on the linkages and impacts of migration and remittance receipt on food insecurity and wealth, and also assist the Malawi government to design and implement policies that reduce the cost of migration and maximizes the potential benefits of remittances.

In order to separately estimate the impact of migration and remittance receipt on household food insecurity and household wealth, we estimated two separate models. Our Results posit a positive influence of migration on household food security. There are several pathways through which migration could possibly affect household food security, either through reduction in the number of mouths to feed at the household level, or through other positive feedbacks from migrants such as remittance as well as information and knowledge transfers. In order to estimate the separate effects of remittances receipt, we distinguished between remittance receiving and non-receiving households.

Our findings, overall, point to a positive influence of both migration and remittance receipt on households' food security and wealth levels. These results are consistent with those of other authors

who argue that migration is increasingly used by households as a strategy to reduce risks, improve livelihoods, and gain access to resources, and may also be used to increase productivity at the household level (Quartey, 2006; Gyimah-Brempong & Asiedu, 2011; Dinkelman & Mariotti, 2014). Migration should therefore be perceived as an opportunity rather than a threat to development, and policies and programs should be directed at aiding remittance flows through financial intermediation, reducing the cost of migration and remittance receipt in order to maximize the positive impacts of remittance flows. We support the view that rural growth linkages which emphasize the role of agriculture as the major strategy towards enhancement of rural livelihoods may benefit from an understanding of how in the face of environmental and social stressors, family farmers' may rely on social networks to secure a better livelihood (Kalipeni, 1996; Van, 2011; Black, Adger, Arnell, Dercon, Geddes & Thomas, 2011). However, our results show that remittance receipt had a greater impact on household asset levels rather than on food security implying that households spend their remittance receipt on acquiring assets rather than on food consumption. In long run, interventions aimed at ensuring food security should place emphasis on other agricultural interventions such as agroecology adoption and other improved farming methods.

Furthermore, while migration is not a substitute for effective agricultural and food security policies, remittance flows can however create synergies between agriculture investment, assets accumulation and knowledge transfer needed by smallholder farmers to maximize productivity (Ruel, Garret & Haddad, 2008; Gray, 2009). Migration may be an opportunity for rural family farmers to overcome employment constraints of the agricultural seasons, allowing them to take up paid work in cities and other neighbouring countries to enable them earn more regular work and income while also allowing scope for the creative mixture of farming and non-farm activities (Gray, 2009; Rigg, 2006). Therefore government agencies and development practitioners have to recognize this progressively disembedding of rural livelihoods from rural spaces and embrace social remittances as a way of transforming production and consumption practices in rural areas (Goldring, 2004). The maize centric or farm-centric model of development among rural farmers is fast losing its grip as farmers

diversify into several livelihoods (Sen, 2003) to overcome stressors and shocks. There is therefore the need to re-focus development efforts on the question on rural spaces, rather than on rural populations (Deshingkar, 2005; Rigg, 2006) and support farmer with evidenced-based means of supporting a productive and sustainable rural spaces and rural economies. This requires governments to think of farmers as agrarian entrepreneurs (Goldring, 2004; Rigg, 2006) who can take advantage of opportunities and improve their welfare. Thus removing structural constraints, expansion of opportunities for farmers to diversify may endow households with more capabilities to improve their livelihood security.

The study has some potential limitations. For instance, the self-reported nature of our outcome and other variables could bias our results as the research team could not physically validate remittance receipts. Also, as with all cross sectional datasets, we were unable to make causal linkages between our explanatory variables and food security. Despite these challenges, the findings contribute significantly to understanding the linkages between migration and remittance receipts in a context where historical and induced climate variability have made migration a mitigation and a development strategy.

Our study is one of the few studies that examined the impact of migration and remittance receipt in the context of a SubSaharan African country especially within the COMESA region where mass migration have been witnessed from poor countries to relatively better countries. Since countries within this region are similar in many regards, our results maybe externally valid. Our results posit to an overall positive effect of migration and remittance receipt on household food security and asset building , implying the need for policies to ensure ease in remittance flows through financial intermediation, reduction in fees and taxes. Competition among remittance receiving outlets should be promoted as a means to reduce transaction costs and stimulate remittances through formal channels. Remittances flows in Malawi holds promise to help in household consumption smoothing, provide some form of social insurance to poorer households, and also contribute to reducing income inequality that may diminish households' economic vulnerability and boost their

capacity for future investments. However, the structural inefficiencies such as lack of jobs, poor infrastructure, and inadequate policy attention to environmental changes and its effects on smallholder agriculture that fuels such migrations should be of concern to policy makers. Also, one cannot lose sight of the major structural barriers and inequalities migrants often face in their destination points. Unskilled migrants are especially vulnerable as they are exposed to demeaning working conditions and may also face harassment and maltreatment from citizens of their destination countries. There is therefore the need for greater government commitment to improve the conditions of work as well as create work opportunities for the youth of Malawi and also collaborate with other government within the COMESA regions to ensure the safety of Malawi migrants.

4.5 References

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CHAPTER 5

SUMMARY AND CONCLUSIONS

This chapter summarizes the main findings of this dissertation, its theoretical and methodological contributions with regards to impact of agroecology adoption and other livelihood strategies on the welfare of family farmers in Malawi. It also provides a discussion of the policy implications of the study and finally concludes by emphasising relevant issues for further research.

5.1 Introduction

This study aimed to examine the impact of various livelihood strategies employed by family farmers to improve their food security and asset poverty levels in Malawi. Specifically, the study aims to investigate the impact of agroecology adoption, migration and remittance receipt on the food security and asset levels of households. Both remittance receipt and sustainable farming practices have been hailed as viable means to improve household standard of living and fasten developing countries pace towards achieving the Millennium Development Goals of reducing hunger by half and propelling households out of poverty (Marsden & Morley, 2014; Blay-Palmer, Knezevic & Spring, 2014, Altieri, Funes-Monzote & Petersen, 2012; Zezza, Carletto, Davis & Winter, 2011; Crush, 2013). The International Year of Family Farmers also emphasized the crucial role that family farmers play in contributing to global food production (F.A.O, 2014; Lowder, Skoet & Singh, 2014) and noting at the same time that family farmers often face high levels of poverty, food insecurity and challenges with agricultural production. Prior research has revealed that agroecological methods can increase productivity, yield stability and resilience of family farmers as well as reduce the costs of production and also impact positively on the ecosystem (Koohafkan, Altieri & Gimenez, 2012; Ponisio, M'Gonigle, Mace, Palomino, Valpine & Kremen, 2015; Pretty, Toulmin & Williams, 2011; Snapp, Blackie, Gilbert, Bezner Kerr & Kanyama-Phiri, 2010). In SSA, there is evidence that agroecological strategies such as incorporation of animal and plant residue into soils can help improve soil fertility and built resilience against climate variability and environmental degradation

(Bezu, Kassie, Shiferaw & Ricker-Gilbert, 2014; Koohafkan et al., 2012, Bezner Kerr, Berti & Shumba, 2010, Kiers et al., 2008 and Snapp, Blackie, Gilbert, Bezner Kerr & Kanyama-Phiri, 2010). Agroecology as an alternative agricultural approach has gained momentum through some high-level FAO meetings as well as reports highlighting its potential (Altieri et al., 2012; De Schutter, 2012; Wezel, Casagrande, Celette, Vian, Ferrer & Peigné, 2009). The adoption of agroecology is particularly urgent in Sub-Saharan Africa (SSA) due to high levels of food insecurity, reliance on agriculture as both a source of food and income, and the anticipated impacts from climate change (Gómez et al., 2013; Niang et al., 2014; Vanlauwe et al. 2014).

Migration and remittances have become vital components in the livelihood and development strategies of several households in the developing world, where a lot of people are seeking better prospects in developed countries, in major cities or better agricultural land within their countries' of residence (Kalipeni 1996; Zezza et al., 2011; Kuuire et al., 2013; Crush, 2013). Remittances refer to financial flows or receipts into households that do not require a *quid pro quo* in economic value (Addison, 2005; Wagh & Pattillo, 2007). Global remittances have expanded dramatically in the last decade, driven by an upsurge in migration, financial intermediation and are increasingly regarded as vital resources to promote economic growth and poverty reduction in the developing world (Karamba, 2011; Crush, 2013).

In view of the on-going debates, this research adopted quantitative research methodologies in order to examine the impact of these livelihood strategies on food security and asset levels in the particular context of Malawi, a country that remains in the rank of countries that need improvement in their food security score (GFS1, 2014) and ranks 174 out 187 countries in their human development index. On over-all food security, Malawi ranks 94 out 109 countries, ranking 95th, 96th and 90th in terms of affordability, availability and quality and safety of food respectively. The primary objectives of the research were as follows:

6 Returned Favour

1. To examine the impact of agroecology adoption on household food security and asset levels of family farmers in Northern and Central Malawi,
2. To examine the factor associated with agroecology adoption in Northern and Central Malawi,
3. To examine the average treatment effect of migration on household food security and asset levels in Northern and Central Malawi, and
4. To examine the average treatment effect of remittance receipt on household food security and asset levels in Northern and Central Malawi

5.2 Summary of findings

5.2.1 Objectives one, and two: impact of agroecology adoption or use on household food security and asset wealth

Quantitative approaches were used to determine the impact of agroecology adoption on food security and asset levels, and the factors that predict household's adoption of agroecology (see chapter 3).

Using difference in difference (DID) estimation, combined with kernel-based propensity score matching to control for selection bias and temporal impact variability, the findings of this study reveal that agroecology adoption greatly enhanced the food security status and asset levels of participating households. Thus, agroecological farming practices combined with farmer-to-farmer knowledge exchanges can improve food security and reduce poverty significantly among rural farmers in Northern and Central Malawi. The estimated effects of agroecological practices that include: intercropping, improved farm and soil management practices on food security and wealth are substantial taking into consideration that the impact assessment was carried out only two years after the program implementation. The findings here support other studies that report that the direct effects of agricultural innovation on poverty reduction may include productivity enhancements enjoyed by farmers who actually adopt the innovation, higher consumption and nutrition levels, and also manifest in the form of higher farm incomes (Becerri & Abdulai, 2010; Bezner Kerr et al. 2010).

Specific to agroecological approaches, there are also direct impacts on food security, which when combined with community-led participatory education, can translate into positive nutritional outcomes (Bezner Kerr et al. 2010). The indirect effects include capacity-building and knowledge exchange within the community which may further lead to lower food prices and increases in consumption, and an improvement in the overall living standard of the community (de Janvry & Sadoulet, 2001).

Results from the logistic and probit regressions suggest that ages of both husband and wife, educational level of husband and wife, household size, knowledge of best agricultural practices, farm size, cash crop farming and general wellbeing are important determinants of agroecology adoption among small holder farmers in Northern and Central Malawi.

5.2.2 Objectives three and four: impact of migration and remittance receipt on household food security and asset wealth

The focus here was to examine the average treatment effect or impact of migration and remittance receipt on household welfare-food security and asset poverty. Using average treatment effects (ATE) and propensity score matching- a non-parametric treatment-outcome procedure (Rosenbaum and Rubin 1983, 1985) to correct for selection and missing data biases, we distinguished between households with migrant member and those without, and also households that receive remittances from non-remittance receiving households. The analyses further employ augmented inverse probability weighting (AIPW) as a matching tool (Cassel et al, 1983; Rosenbaum, 1987; Hirano & Imbens, 2001; Drukker, 2014), that creates an pseudo experimental data to enable an identification of causal links between migration, remittance receipt and our outcome variables. This is relevant for policy analysis as it enables us to know what would happen to households if they did not have migrant members or did not receive any remittances and vice versa. The findings over all reveal positive impacts of both migration and remittance receipt on household food security status and asset wealth levels. Households with migrant members are more likely to be both food secure and be in higher levels of asset wealth. This implies that migration is improving household welfare either

through knowledge transfer, reduction in the number of mouths to feed at the household level or is impacting household welfare via income effects as a result of remittance receipt.

With regards to the effect of remittance receipt on household welfare, the results show that remittance-receiving households were more likely to be food secure and also more likely to report high asset levels. Remittances flows to households in Malawi hold promise to significantly help households smoothen consumption, provide some form of social insurance to poorer households in terms of adversity, and also contribute to reducing income inequality that may diminish households' economic vulnerability and boost their capacity and resilience for future investments and shocks. Competition among remittance receiving outlets should be promoted as a means to reduce transaction costs and stimulate remittances flows through formal channels.

This thesis revealed the potential of agroecological farming practices and farmer-to-farmer led knowledge exchanges to improving the food security and asset levels of vulnerable populations. Chapter Three of the thesis demonstrates that adopters of agroecology which includes intercropping, improved farm and soil management practices combined with knowledge exchanges leads to great improvements in welfare at the household level. Efforts to replicate agroecology interventions in other communities may benefit from encouraging community ownership of such projects and the use of indigenous farming practices and encourage knowledge diffusion among farmers. Chapter four also underscores the potential of remittance to help smoothen income and consumption and also build asset levels at the household thereby increasing the resilience levels of households to withstand adversity and unfavourable agricultural season.

5.3 How the findings of manuscripts are integrated

Overall, the two manuscripts interrogated two different livelihood strategies adopted by family farmers or small-holder farmers to secure their livelihoods in the midst of stressors and shocks. The two manuscripts independently reveal that these strategies are impacting positively on their lives in terms of food security and asset poverty levels. The impetus of these arguments is that family farmers

have the agency to propel their own development process but may need government and development partners to reduce the structural barriers and initial inequalities that inhabit the use of their agency. I therefore advocate for an integrated approach that respects the agency of family farmers and help them realise their goals without necessarily dictating to them top-down approaches as to what is the best solution to their problems.

5.4 Theoretical contributions of the study

This study contributes to the literature on sustainable livelihood diversification of rural populations and offers an understanding of how vulnerable people make use of their localised spaces to edge out a living in the midst of structural and environmental challenges. Although, the sustainable livelihood approach has been widely used to study rural populations, this study is among the few studies in the current study context to examine how rural populations combine different portfolios of assets to enhance their economic and social status, and improve food security. Importantly, this study also demonstrates that households that adopt sustainable agricultural practices through agroecology (natural capital), relaying their knowledge bases (human capital) from participatory training on best agricultural practices such as soil and crop management, experiences better welfare outcomes when compared to households that did not adopt these practices. This study adopted a vigorous econometric analysis that shows that agroecology adoption indeed enhances household welfare.

Consistent with other studies, I found that migration and remittance receipt enhances household welfare (Ruel et al., 2008; Gray, 2009). Through social capital in the form of remittance receipt and knowledge transfer, split households are able to diversify their resources to overcome problems of seasonal income that is often prevalent in most rural communities where farming is the major livelihood (Ellis & Biggs, 2001; Rigg, 2006; Morse & McNamara, 2013). This supports the view that rural growth linkages which emphasize the role of agriculture as the major strategy towards enhancement of rural livelihoods may benefit from an understanding of how in the face of

environmental and social stressors, family farmers' may rely on social networks to secure a better livelihood.

Also, as outlined in the first chapter of the thesis, family farmers or small holder farmers have been neglected in terms of macroeconomic policies in Malawi. Indeed, it is the combined effects of Centuries of discrimination and unequal policy focus that have continued to impact negatively on small-holder farmers' productivity making them net buyers of food (Dorward & Chirwa, 2011). As shown in the findings of the study, this has continued to impact small-holder agriculture due to their limited access to land and the promotion of cash crop farming (tobacco, cotton and tea) for export to the neglect of staples which are mainly grown by family farmers.

5.5 Methodological contributions

There are also methodological contributions that emanate from this dissertation demonstrating the strength of using longitudinal data analysis techniques such as: difference-in-difference estimation (DID) and treatment effects (*teffects*), and also demonstrate the power of propensity score matching methods to correct or minimize selection and omitted variable biases and to ensure households with similar characteristics are compared. These models enabled us to estimate the causal effects of a policy or an intervention and also compare the food security and asset levels in households that adopt agroecology, contains migrant members or receive remittances with the outcomes in the control or the counterfactual group that did not receive any of these. This thesis thus demonstrates the appropriateness of using longitudinal data analysis techniques such as difference-in-difference and propensity score matching for impact analysis and to establish causality.

Furthermore, in a context where subsistence farming is the main economic activity for majority of the population in Malawi, self-reported income will be a bias estimator of wealth as most farmers will likely not remember their sources of income or even the annual amount. We therefore relied on household ownership of asset to determine their wealth level. Principal component analysis (PCA), was used to construct an overall index of household asset levels (Filmer and Pritchett, 2001;

Zeller et al., 2006). Similarly, due to several challenges including recall bias associated with using measures such as dietary recalls or anthropometric indicators to measure household food security (Coates, Frongillo, Rogers, Webb, Wilde & Houser, 2006; Kabunga et al., 2014), we employed the HFIAS to measure food security at the household level. Compared to other food security indicators, HFIAS captures a higher prevalence rate and correlates well overall with other indicators, and is considered a valid and reliable measure to assess chronic, persistent household food insecurity (Maxwell et al., 2014). Though neither of these methodologies is new, they have been widely used, it is worthwhile to stress and emphasize their superiority to encourage future researchers to use these methods.

5.6 Policy Implications

There are a number of policy recommendations that have emerged from the findings of this research. The study confirms the long held view that agroecological farming practices that encourages community ownership and the adoption of indigenous farming knowledge can greatly improve the welfare of households (Altieri et al., 2012; Altieri & Toledo, 2011). The results suggest that smallholder farmers will benefit immensely from scaling up of the agroecology program to other communities within the catchment area. Agroecology requires intensive training and previous indigeneous knowledge about its practicability; hence its successful uptake requires proper training and contineous support for farmers that adopt it. Consequently, the program should not be blindly extended to other communities without first training farmers on best agricultural practices and soil management skills, as adoption without these skills may lead to a frustrating experience. Farmers should be encouraged to adopt these innovations as a whole package without selectivity. Continuing support to farmers on the basic principles of agroecology and continuous support in the form of assisting farmers to test a range of agroecological options on their own farms and a first-hand experience of how other farmers are benefitting should be encouraged. As this study reveals, factors influencing agro-ecological adoption vary significantly among households. Agroecology

interventions needs to incorporate household inequalities in terms of households' access to land, farm size, and household size, education as well as the health of the household head into interventions that seek to increase the adoption and use of agroecology farming models.

Secondly, the analysis of the impact of migration and remittance receipts points to positive influences of these strategies in improving food security and reducing poverty at the household level. Migration and remittance receipt maybe used by households as a strategy to reduce risks, increase resilience, improve livelihoods, gain access to resources, and may also be used to increase farm productivity. The Malawi government should ensure ease in remittance flows through financial intermediation, and reduction in fees and taxes that often accompany remittance receipt and also liase with other government to ensure the safety of Malawi migrants such as those in South Africa who have affected by xenophobia. Competition among remittance receiving outlets should be promoted as a means to reduce transaction costs and stimulate remittances through formal channels. While migration is not a substitute for effective agriculture and food security policies, remittance flows from migrants can however create synergies between agriculture investment, assets accumulation and knowledge transfer needed by family farmers to maximize productivity (Ruel, Garrett & Haddad, 2008; Gray, 2009; Crush, 2013). Migration should therefore be perceived as an opportunity rather than a threat, and policies should be directed.

5.7 Limitations of the study

Even though this study made theoretical, methodological contribution as well as contribute to the debates on the impact of agroecology and remittance receipt on household welfare, there are some limitations that should be acknowledged. Firstly, the asset index constructed from household ownership of a bundle of assets, while an important contribution also has its drawbacks. Due to the self-reported nature of the list of assets, its reliability is a suspect. An ideal situation would have been to physically document these assets but we were unable to do this. Another weakness of the asset index is that it is context-specific to rural areas that depend on agricultural for their livelihood—thus

another context may present a different criteria in their analysis making comparisons difficult. Secondly, despite the advantages of Household Food Insecurity Accessibility Scale (HFIAS), in capturing higher prevalence of food insecurity and correlates well overall with other indicators, and is considered a valid and reliable measure to assess chronic, persistent household food insecurity especially in a context where most food is home grown (Coates et al., 2006; Webb et al., 2006), its' self-reported nature may have introduced some biases in our data as we could not physically validate the responses of the farmers. There have also been concerns about the need to increase the number of indicators to include food sufficiency; nutrient adequacy; cultural acceptability; safety; and certainty and stability in food security measurement (Coates, 2013) and future research will benefit greatly from the addition of such indicators.

Thirdly, there is a gap in my thesis between the focused quantitative analysis of the impact of agroecology adoption, migration and remittance receipt on food security and asset poverty and the need for qualitative or ethnographic analysis of how these livelihood strategies may affect household welfare. The use of qualitative data would have enabled us to show how people talked about food insecurity or the subjective meaning they attached to food and what it means to be food secured. It would have been ideal to also use qualitative study to bridge this gap and provide some additional explanation and understanding as to the rationale for these impacts.

Finally, a limitation of this study is that it has focused squarely on the impact of the various livelihood strategies without being able to show how other factors affect household welfare. Even though these factors are controlled for in the analysis, their independent effects could not be outlined. While the impacts of these livelihood strategies are definitely important especially in developing country context, it is but one piece in a larger approach that must deal with other fundamental determinants of household welfare. Foremost among these are things such as access to clean water and health care, women's empowerment, economic justice and other social determinants of health. Enhancing food security and reducing poverty are only some few steps in the right direction.

5.8 Directions for future researchers

Agroecological approaches to ensuring household food security and reducing poverty even though not new phenomenon in SSA, have not been adequately studied. While this dissertation has contributed to literature around this body of knowledge, it has also opened up some directions for future researchers in this field, which this section will explore. Firstly, one of the strengths of this study was the use of longitudinal data and other matching techniques to enable us to create an experimental data. The use of these longitudinal techniques was helpful in establishing causal connections between variables. Future research may benefit by adopting some of these techniques in impact analysis of policy or intervention.

Secondly, a qualitative or ethnography study of how these livelihood strategies may affect household welfare will be a useful addition to this body of literature. The use of a qualitative method will enable us to know the subjective experiences of farmers with regards to agroecology and also know the reason behind their adoption or non-adoption. Similarly, such methodologies will also enable to know that processes and considerations that inform households to adopt migration as a potential livelihood strategy. The proposed future research will contribute immensely to design and implementation of agricultural intervention in Malawi and also guide to educate farmers on how to maximize returns on remittances.

Finally, while this study reveals the positive impacts of agroecology adoption, migration and remittance receipt on household welfare in the context of Malawi, a comparative study within SSA or even among other agricultural approaches will be useful to understand how these results compare. For instance, it is not clear whether an agroecological intervention may impact more on household welfare than chemical farming or intensification agriculture. While this study cannot generalize, it presents potentials. Are resource-poor household more receptive of agroecological methods? How does these results compare with households that adopt other agricultural practices? It will also be useful to know what areas households are investing their remittance receipts into-is it spend on

consumption or towards food production? There remains lots of work to be done to understand the dynamics of livelihood strategies and the impact of interventions in developing countries' contexts.

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6.0 List of appendix

6.1 Thesis approval

re-issued



Research Ethics

Western University Health Science Research Ethics Board NMREB Amendment Approval Notice

Principal Investigator: Dr. Isaac Luginaah

Department & Institution: Social Science\Geography,Western University

NMREB File Number: 105142

Study Title: Impact of the Soils, Food and Healthy Communities (SFHC)/Malawi Farmer to Farmer Agroecological (MAFFA) Projects on Household Assets and Income in Malawi

Sponsor:

NMREB Revision Approval Date: June 30, 2014

NMREB Expiry Date: December 31, 2015

Documents Approved and/or Received for Information:

Document Name	Comments	Version Date
Revised Western University Protocol	Clean	
Other	RA Confidentiality Agreement - Clean	
Revised Letter of Information & Consent	Clean	
Instruments	Clean	
Approval Notice		2014/06/27

The Western University Non-Medical Science Research Ethics Board (NMREB) has reviewed and approved the amendment to the above named study, as of the NMREB Amendment Approval Date noted above.

NMREB approval for this study remains valid until the NMREB Expiry Date noted above, conditional to timely submission and acceptance of HSREB Continuing Ethics Review.

The Western University NMREB operates in compliance with the Tri-Council Policy Statement Ethical Conduct for Research Involving Humans (TCPS2), the Ontario Personal Health Information Protection Act (PHIPA, 2004), and the applicable laws and regulations of Ontario.

Members of the NMREB who are named as Investigators in research studies do not participate in discussions related to, nor vote on such studies when they are presented to the REB.

The NMREB is registered with the U.S. Department of Health & Human Services under the IRB registration number IRB 00000941.

6.2 Questionnaires

Baseline survey
The Malawi Farmer-to-Farmer Agroecology Baseline Survey Protocol
November 2012

Participant Selection

Awareness meetings will be held in the selected villages to introduce the project, and at least 5 villagers from each village will be invited to attend, with at least half of them women. Project staff will facilitate a discussion about food security with the community representatives, and generate a list of indicators of different levels of food security. A list of all households in the participating villages will be generated during those meetings, and the village groups will be asked to rank all members of their village using a food secure ranking system (similar to wealth ranking) into 3-4 categories (e.g. highly food secure, food secure, food insecure, highly food insecure) based on agreed upon local indicators. The village representatives will then be asked to return to their communities and present the project, and invite those households who are ranked as food secure to participate if they are interested.

Survey Questions and Order

A version of HFIAS, the Household Dietary Diversity Score and an Individual Dietary Diversity Score which was tested in Malawi (Mtimuni and Geresomo 2006) will be used in the survey to measure food security status at the household level, and both household and individual dietary diversity. The order, based on the reported experience in this same study, as well as our own experience, that moving from general to specific is a logical flow, will be as follows:

Malawi Farmer-to-Farmer Agroecology Baseline Survey Chichewa Version

November - December 2012

Informed Consent. ENUMERATOR, PLEASE READ THE FOLLOWING TO THE RESPONDENT

Dzina langa ndi _____. Ndimagwila ntchito lidzi ndi Ekwendeni Mission Hospital mu project ya Nthaka, Chakudya ndi Nthanzi mudzi, Sukulu yakachenjeda ya Chancellor ku Zomba, Nthambi ya Geography ku sukulu yakachenjeda ya Manitoba mdziko la Canada. tikupanga kafukufuku kuti timvetsetse zambiri za banja lanu komanso mmene kumachitila ulimi. Ndimamafune ndidziwe ngati mungakhale omasuka kutenga nawo mbali mukafukufuku ameneyi. Ngati kungakhale omasuka ndikufotokozelani zammene kafukufuku ameneyi ayendele. Chonde khalani omasuka kundifunsa pamene sumunamvetse. Zotsatila za kafukufuku ameneyi zidzagwilitsidwa ntchito kupititsa patsogolo ntchito yowona kuti chakudya mudziko muno chilimo chokwanila. Zotsatila zakafukufuku ameneyi zilembedwa ndikukasungidwa ku Project ya Nthaka, Chakudya ndi Nthanzi M'mudzi ku Ekwendeni Mission Hospital.

Ngati mulole kutenga mbali mukafukufuka ameneyi, tifuna tiphunzileko za zomwe inu mumadziwa komanso mumachita pa ntchito yanu ya ulimi. Ndicheza nanu pamphindi 30, ndipo munthawi imeneyi ndikufuna nditadziwa za upangili wa ulimi, kadyedwe kapanyumba panu pano komanso za zina ndi zina zomwe zimangathandizile kukhala ndi chakudya chokwanila panyumba. Osadandaula kuti o pamwina mukuyankha mulakwika, fundo zones mungandiwuze pano zikhala zothandiza kafukufuku ameneyi. Ngati panthawi ina iliyonse mungawone kuti simuli omasuka kuyankha mutha kukana kuyankha kapena mwina sumukufuna kuti zina zomwe zikuchitika pakhomu panu pano ndisawone mutha kundiwuza kuti tikaakhale pamalo pena kapena kuti ndilekele

pompo.

Nditsindike kuti potenga nawo mbali pakafukufuku ameneyi sumulandila kena kalikonse koma mukhala ndi mwayi odziwa zambiri za kafukufuku ameneyi komanso mpata okamba zakukhosi pazomwe zimakudetsani nkhawa inu ngati mlimi. Fundo zomwe mutigayile pakafukufuku ameneyi zikhoza kuthandizila mmudzi muno. Mfundo zomwe kutingayile pano tikagawana ndi mabungwe amdziko muno, kunja kwa dziko lino ndipo zikathandizila ntchito zowona kuti lu chakudya chokwanila mdziko muno komanso kuti nthakaikusamalidwa. Simulipila china chilichonse potenga mbali mukafukufuku ameneyi kupatula nthawi imeneyi mutakhale mukuyankha mafunso. Simulipilidwa kanthu kalikonse panthawi yomwe mutenge mbali mukafukufuku ameneyi.

Dziwani kuti mukuyenela kutenga mbali mukafukufuku ameneyi musakamizidwa ndipo mutha kunena kuti ndisiye kufunsa mafunsowa nthawi ina iliyonse. Mukasankha kuti tilekeze panjira kapena kuti simukufuna kutenga nawo mbali pakafukufukuyu sumudzalipila chindapusa chili chonse. Ngakhale dzina lanu ndililembe pa pepalapa silidzatuluka pena pali ponse paxotsatila za kafukufuku ameneyi komsnso mafunso okhawa amene mwayankha ndi amene nditawalembe papepalapa. Tikamaliza kafukufuku ameneyi mapepala onse omwe ndalembo mayankho anu akasungidwa mosamalika ndipo palibe amene akawagwilitile ntchito kapena kuwona zomwe zalembedwa kupatula anthu amene akalembe za zotsatila za kafukufuku ameneyi.

Kumbukilani kuti mutha kundifunsa mafunso nthawi ina iliyonse pazomwe simukumvetsa. Mutha kutipeza ife a Nthaka, Chakudya ndi Nthanzi Mmudzi ku chipatala cha Ekwendeni Mission ku Ekwendeni, kapena poyimba foni pa 0888 517 768. Zikomo kwambiri.

Kodi mukulolela kupitilira kuti muyankhe mafunso amukafukufuku ameneyi?

(English translation of informed consent: My name is _____. I am working in collaboration with Ekwendeni Hospital, the Soils, Food and Healthy Communities project, Chancellor College, the Department of Geography at the Western University and University of Manitoba in Canada. We would like to understand more about your family and farming practices. I would like to ask you if I might interview you, and I'd like to explain more about what will be involved. Please feel free to ask any questions at any time. The results from this study will be used to inform future initiatives aimed at improving farmers' food security. We will write up the results of the study and will make the results available at the Soils Food and Healthy Communities Project at the Ekwendeni Hospital.

If you agree to participate in this part of this study, we want to learn from your knowledge and how you are farming. We will be spending about an hour asking you questions about your cropping practices, your diet and other information that affects your family's food security. There is no right or wrong answer to our questions. If you feel uncomfortable at any moment, or would prefer that I not participate/observe certain activities, you can refuse my presence at any time.

There is no direct benefit to you for participating in this part of research; however, it will help you to get to know us and become familiar with our study and provide an opportunity for you to express any concerns that you have regarding your life as a farmer. Additionally, the information gained in this study will benefit your community indirectly. We will share what we learn from your farming practices with local, national and international institutions such that it can be used to inform initiatives for improving food security and soils for smallholder farmers. You will not incur any costs by participating in part of the study other than about an hour spent discussing things with us. You will not receive any payment for this time.

Your participation in this study is completely voluntary and you may refuse to participate or leave the study at any time. If you decide to not participate in the study it will not result in any penalty or loss of benefits to which you are otherwise entitled. Your name will only be recorded to document that you have agreed to participate in this research. It will not be put in any of the project documents to be prepared from this research. Only the research team will have access to the data provided and records will be kept safely in a locked cabinet to which only the research team will have a key, to ensure no one apart from the study investigators can have access to them.

Do you agree to continue with the survey? YES NO

You are encouraged to ask me questions at any time during or after this study. To get in touch with us you can contact the Soils Food and Healthy Communities Project located in the Ekwendeni Hospital in Ekwendeni, Malawi. They will be able to put you in contact directly with

me. The telephone number for Soils Food and Healthy Communities . Thank you for all your help and cooperation with this study.

Malawi Farmer-to-Farmer Agroecology Baseline Survey Chichewa Version

November - December 2012

NOTE TO ENUMERATORS: DO NOT CONTINUE IF THE RESPONDENT HAS NOT SAID 'YES' TO ABOVE.

Informed consent obtained (Please circle)

YES

NO

	DATE ACCOMPLISHED	BY WHOM?	
	Day/Month/Year	Name	Signature
Interview			
Data Check			
Data Entry			

PART A: HOUSEHOLD INFORMATION

Instructions: For the questions in Part A, if it is a monogamous household, interview the husband and wife together, if it is a polygamous household, flip a coin to decide which wife should be interviewed. Make it a priority to involve the wife in the discussion. You should conduct the interview at or near the household's main dwelling unit.

TA/Village Area: Dera _____ Mudzi/Village: _____ HHOLD # _____

QUESTION	NAME	GENDER and WIFE # (if polygamous)
A1 Dzina lanu ndani? What is your name? (if the wife/husband together, ask both of their names and indicate gender).	1. 2.	1. 2. Wife # _____

No.	Question (<i>Instructions</i>)	Possible Responses	Code	
			Husband	Wife
A2.	<i>Munabadwa liti?</i> What year were you born? (<i>If don't know, probe using main events e.g. Banda came 1959</i>)			
A3.	<i>Kodi muli pa banja?</i> What is your marital status? (<i>Circle the code that corresponds to the response given</i>)	Monogamous married and living with spouse	1	1
		Polygamous married and living with spouse	2	2
		Married and wife heading household; spouse works or lives elsewhere	3	3
		Separated/divorced/widowed and living without spouse	4	4
		Never married	5	5
		Other (specify)	97	97

A4.	<i>Kodi munalekela pati sukulu?</i> What is your level of education?	No schooling	1	1
		Some primary school	2	2
		Completed primary school	3	3
		Some secondary school	4	4
		Completed secondary school	5	5
		Post-secondary	6	6
		Other (specify)	97	97
		Don't know	98	98
		Refused	99	99
A5.	<i>Kodi munabadwila mudzi muno?</i> Were you born in this village?	Yes (<i>Skip to A7</i>)	1	1
		No (<i>Go to A6</i>)	2	2
A6.	<i>Ngati musali mbadwa yamudzi muno, munabwera liti?</i> If you were	Less than 5 years	1	1
		Between 5 and 10 years	2	2

	not born in this village, for how many years have you lived here?	More than 10 years	3	3
		Don't know	98	98
		Refused	99	99
A7.	Kodi inu mwakhala mukulima kwa zaka zingati panokha? How many years have you been farming independently (separate from your parents)?			

A8 Transition (Please read): Tsopano ndikufunsani mafunso okhudzana ndi anthu onse amene mumakhala nawo pakhomo pano makamaka amene mumadyera limodzi/amene inu mumawasamala kapena kudiyera kuchokela m'poto mmodzi. Ndikufunanso ndidziwe ngakhale za omwe sakhala pakhomo pano nthawi zonse chifukwa akugwilila ntchito olo bizinesi kutali koma amabwela nthawi ndi nthawi komanso amathandiza kugula ndi kapezedwe ka zakudya pakhomopa. (We now will ask a number of questions about your household as a whole. When we say household we mean "one or more people related or unrelated, who live together and make common provision for food. They regularly take all their food from the same pot, and/or share the same grain store or incomes for the purposes of purchasing food" (NSO 1998:120).") [For Enumerator:] *Include everyone who eats and sleeps here; also include 'part time' residents ie family members who work away for part of the year but contribute to household income. Record each person's relationship to household head. Ask current school grade (children); grade on leaving school or never attended school. Ask if any of the adults in the household are not able to work. Ask why? (eg too old, blind, chronically sick etc)* [from Zomba survey, Kambewa). **Kodi Pakhomo pano, mumakhala anthu angati amene mumadyera Mnkali imodzi? - _____**

Name	Sex	Age	Relationship to household head	Full time or p/time resident	If part time, approx how many weeks present/ yr?	Children: Current School grade	Adults/youth: If unable to work, why? (e.g. too old, often sick, etc) [put NA if able to work]

Name	Sex	Age	Relationship to household head	Full time or p/time resident	If part time, approx how many weeks present/ yr?	Children: Current School grade	Adults/youth: If unable to work, why? (e.g. too old, often sick,etc) [put NA if able to work]

No.	Question (<i>Instructions</i>)	Possible Responses	Code / Response
A9	<i>Kodi chaka chatha munalandira makuponi angati a feteleza?</i> Last year, in 2011, how many <u>fertilizer</u> vouchers did your household receive?		
A10	<i>Kodi munalandilako feteleza wina kuposela wamakuponi? Ngati munalandilako anali wambili bwaji _____?</i> Did you receive any fertilizer from other sources? A10b If yes, specify source & amount: _____	Yes	1
		No	2

A11	ASSETS Does anyone in your household have the following? <i>Kodi pakomo pano pali amene ali ndizinthu izi?</i>	Yes	No	#	Don't Know	refused
	Hoe/ Khasu	1	2		98	99
	Radio /wailesi	1	2		98	99
	Iron sheets for the roof/malata	1	2		98	99
	Cellular phone/foni	1	2		98	99
	Sofa set/mpando wa sofa	1	2		98	99

	Refrigerator/fuligi	1	2		98	99
	Plough/plawo	1	2		98	99
	Bicycle/njinga	1	2		98	99
	Tobacco press/	1	2		98	99
	Ox-cart /ngolo	1	2		98	99
	Motorcycle or car/mnthuthuthu, galimoto	1	2		98	99
	Wheel barrow/wilibala	1	2		98	99
	Solar electricity/magetsi a sola	1	2		98	99
	ESCOM electricity/magetsi	1	2		98	99
	Sewing machine/mashini yosokela Malaya	1	2		98	99
	Other asset (ask and observe) specifyZina: _____	1	2		98	99
	Cattle/Ng'ombe [enter #]	1	2		98	99
	Pigs/Nkhumba [enter #]	1	2		98	99
	Poultry (chicken, doves and/or guinea fowl)/ Nkhuku, nkhanganga, nkhunda, abakha[enter #]	1	2		98	99
	Sheep/Nkhosa [enter #]	1	2		98	99
	Rabbits/Kalulu,Mbira [enter #]	1	2		98	99
	Goats /Mbuzi[enter#]	1	2		98	99
	Other livestock /Zina zomwe sindinadzitchule: _____	1	2		98	99

A12	Mui ndi malo aakulu bwanji olima? [probe for all land, not just cultivated land] How much land does your household own? (acres)					
A13	Munalima malo aakulu bwanji chaka chatha 2011-2012? How much upland land did your household farm this past year, last rainy season 2011-2012? (acres)					
A14a	Munabwelekako/kuchita lendi malo olima chaka chatha? Did you rent any land <i>from</i> anybody last year?	<table border="1"> <tr> <td>Yes</td> <td>1</td> </tr> <tr> <td>No</td> <td>2</td> </tr> </table>	Yes	1	No	2
Yes	1					
No	2					
A14b	Ngati eya, anali aakulu bwanji? If yes, how many acres?	# acres: _____				

A15a	Kodi munachititsako lendi/kubwereketsako munda uliwonse chaka chatha 2011? Did you rent any land to others last year?	Yes	1
		No	2
A15b	Ngati eya, wawukulu bwanji? If yes, how many acres?	# acres: _____	
A16a	Munalimako mbewu zam'dimba chaka chatha? Did you grow crops in a dimba this past dry season? ... [If no, skip to A18] [If yes], A16b. Kodi linali lalikulu bwanji? What was the size of the dimba? A16c. What crops did you grow? Munalima mbeu zanzi? Enumerator: Probe for all possible crops...) Masamba, tomatoes, anyezi, batatesi, karoti, nkhwani, nyemba, chimanga, nsawawa/kabaifa, mbatata ya kholowa, coco, nzimbe, chigwada/ Green leafy vegs, tomatoes, onions, potatoes, carrots, pumpkins, beans, maize, sweet peas, sweet potatoes, yams, sugar cane, cassava...	Yes	1
		No	2
A16b		A16b. Area cultivated:	
A16c.		A16c. Crops:	
A17	What methods do you use to water the dimba crops? Kodi mumagwiritsa ntchito njira zanzi pothirira mbewu zakudimba?	Diesel pump	1
		Treadle pump	2
		Hand watering	3
		Gravity canals	4
		Deep planting/ residual moisture	5
		Other _____	97
A18	Have you ever heard of local yellow maize? [if no, skip to A32] Kodi munamvapo za chimanga chamakolo cha chikasu/chayelo?	Yes	No
A19	Munachionako chimanga cha chikasu (chayelo)? Have you ever seen local yellow maize?	Yes	No
A20	Munadyakochakudya chopangidwa kuchokera ku chimanga cha cha chikasu (chayelo)? Tiuzeni kuti ndi zakudya zanzi. Have you ever eaten foods made with local yellow maize? If so, what were they? [list in local language]	Yes [if no, skip to A22]	No
A20b	How would you describe these local yellow maize foods? (e.g.taste, smell, write exact words in local language) Kodi munganeko zotani kufotokozero za zakudya zimenezi kumbali ya kakomedwe, kafungo kake ndi zina zotero.		
A21	Kodi ndiliti limene munadya komaliza zakudyazi? How long ago was the last time you ate local yellow maize?	[name year]	
A22	Kodi kuno chimanga chamakolo cha chikasu/chayelo chimadziwika		

	ndi dzina lanji? What is the local name for local yellow maize?		
A23	Pali munthu amene analimako chimanga chimanga chamakolo cha chikasu/chayelo pakomo pano? Have you or anyone in your household ever grown yellow maize?	Yes No <i>[if no, skip to A31]</i>	
A23a	[If yes] Kodi munadzala liti komaliza chimanga chimenechi? When was the last time you planted local yellow maize?	[name year] [if last year, skip A24]	
A24	[If not last year] Munasiyiranji kudzala chimanga chimenechi? Why did you stop growing local yellow maize?		
A25	Chimanga chimemechi munachidzala malo okwanira maekala angati? How many acres did you plant? Kodi?	# acres	
A26	Kodi ndi chifukwa chiayani mumalima chimanga chimenechi?chifukwa chani? Why do you grow yellow maize? (write answers below, find out if they like to eat it)		
A27	Kodi mumakumana ndi mavuto pa ulimi wa chimanga chimenechi? Have you experienced any problems growing local yellow maize? <i>Skip to A29 if No</i>	Yes	No
A28	[If yes] Ndimavuto anji? what kinds of problems have you experienced? (describe below)		
A29	Kodi munayamba mwagawanako nzeru ndiwina aliyense pa zakalimidwe ka chimanga chimenechi? Did you share ideas about growing local yellow maize with anyone? <i>[If no, skip to A31]</i>	Yes	No
A30	[If yes] who did you share with? Ndi ndani?? [category of person]		
A31	Ngati simunalimeko chinangachi, simunalimeko chifukwa chani? If you have never planted local yellow maize, why not?		
A32	Mchaka chapitachi, kodi inu kapena wina aliyense pakomo pano mwamene amalima nawo, anadwalako kwasabata imodzi kapena kupitiliro apo kotero kuti zinasokoneza kagwilidwe kantchito zakumunda? In the last year, were you or someone in your household sick for 1 week or more such that it affected your farming activities? <i>[If no, Skip to A34]</i>	Yes	No
A33	[If yes] Sick Person 1 a. Sanakwanitse kulima kwa nthawi yayitali bwanji? How long was the sick household member not farming? b. Kodi anthuena apabanja pano anaasiya kulima kuti azisamalira matendawo? Were any other household members taken away from farming because of the illness (e.g. to care for the person)? If yes, for		

	<p>how long? _____</p> <p>c. Anadwala chani?Can you tell me about the illness?</p>
	<p>Sick Person 2</p> <p>a. Sanakwanitse kulima kwa nthawi yayitali bwanji? How long was the sick household member not farming?</p> <p>b. Kodi anthuena apabanja pano anaasiya kulima kuti azisamalira matendawo? Were any other household members taken away from farming because of the illness (e.g. to care for the person)? If yes, for how long? _____</p> <p>c. Anadwala chani?Can you tell me about the illness?</p>
	<p>Sick Person 3</p> <p>a. Sanakwanitse kulima kwa nthawi yayitali bwanji? How long was the sick household member not farming?</p> <p>b. Kodi anthuena apabanja pano anaasiya kulima kuti azisamalira matendawo? Were any other household members taken away from farming because of the illness (e.g. to care for the person)? If yes, for how long? _____</p> <p>c. Anadwala chani?Can you tell me about the illness?</p> <p>a. Sanakwanitse kulima ka nthawi yayitali bwanji? How long was the sick household member not farming?</p> <p>b. Kodi anthuena apabanja pano anaasiya kulima kuti azisamalira matendawo? Were any other household members taken away from farming because of the illness (e.g. to care for the person)? If yes, for how long? _____</p> <p>c. Anadwala chani?Can you tell me about the illness?</p>

A34: AGRICULTURAL QUESTIONS [questions adapted from Crop Diversity survey 2010) A34 Tell me what you planted last rainy season (2011-2012)?

#	A34a Munalima mbeu zanzi muminda imeneyi? What crops did you plant in each field last year? Possible crops: Maize/Ngoma Tobacco/Hona Cotton/Thonje Pigeonpea/Nyamodolo Groundnut/skaba Soya Bean/Nchunga Velvet bean/Karongonda Cassava/Vikhawu Bambaranut/Zgama Sorghum/Vidomba Sweetpotato/Mbwete/Mboholi Irish potato/Katufeni Cowpea/Nkhunde Pearl Millet/Nyauti Finger Millet/Ripoko Tomato/Mapuno pumpkin/Majungo Paprika Rice/Mpunga Mphangwe/Green leafy vegs Other (specify)	A34b Kodi pa mbeu ili yonse munalim ayo munalim a malo a akulu bwanji? What was the area planted for each field? (acres or specify unit)	A34c Munakolola zambiri bwanji What is the estimated yield of each crop from that field? (specify units)	A34d Munad ya zambiri Bwanji? Did you eat any of the crop (s)?	A34e Panaopa, mwatsala nazo zambiri bwanji? Ngati mulibe zinatha liti? How much do you have left of the crop? If none, what month did you use up the crop(s)?	A34f pa mbeu zomwe munakololazo, munagulitsa po zambiri bwanji? Did you or anyone in your household sell any of the crops? If yes, how much did you sell? (kg or specify amount) (list all crops that they sold).	A34g Kodi munagwo iitsa ntchito feteleza wanji ndipo wochulu ka bwanji? (if applied fertilizer) what type did you apply and how much?	A34h Kodi munkateteza bwanji mbewu zanu ku matenda ndi zilombo zoononga? How did you deal with pests and plant diseases? Had no problems = 0 Did nothing with problem=1 If did something, methods used: Pesticide = 2 Hand picking=3 Ash=4 Tephrosia or other plant leaves crushed and liquid applied = 5 Other (specify)=6	A34i Nanga mphesi ndi zotsalira zina mukakolola munachita nazo chiyani? What did you do with the crop residues? Nothing = 0 Remove to thresh=1 Remove for livestock=2 Leave & incorporate early =3 Leave & incorporate late =4 Burn for cooking=5 Burn for land clearing or mice hunting=6 Burn for nutrients=7 Herbicide=8(type) Other (describe)=77	A34j Kodi munasunga bwanji zokolola zanu kuti zisawonongeke ndi anankafumbwe ndi chiswe? What did you do to prevent the harvest from insects e.g. weevils or termites? Nothing = 1 Pesticide = 2 Hand sorting=3 Ash=4 Other (specify)=5
1										

#	A34a Munalima mbeu zanzi muminda imeneyi? What crops did you plant in each field last year? Possible crops: Maize/Ngoma Tobacco/Hona Cotton/Thonje Pigeonpea/Nyamodolo Groundnut/skaba Soya Bean/Nchunga Velvet bean/Karongonda Cassava/Vikhawu Bambaranut/Zgama Sorghum/Vidomba Sweetpotato/Mbwete/Mboholi Irish potato/Katufeni Cowpea/Nkhunde Pearl Millet/Nyauti Finger Millet/Ripoko Tomato/Mapuno pumpkin/Majungo Paprika Rice/Mpunga Mphangwe/Green leafy vegs Other (specify)	A34b Kodi pa mbeu ili yonse munalim ayo munalim a malo a akulu bwanji? What was the area planted for each field? (acres or specify unit)	A34c Munakolola zambiri bwanji What is the estimated yield of each crop from that field? (specify units)	A34d Munadya zambiri Bwanji? Did you eat any of the crop (s)?	A34e Panaopa, mwatsalana zambiri bwanji? Ngati mulibe zinatha liti? How much do you have left of the crop? If none, what month did you use up the crop(s)?	A34f pa mbeu zomwe munakololazo, munagulitsa po zambiri bwanji? Did you or anyone in your household sell any of the crops? If yes, how much did you sell? (kg or specify amount) (list all crops that they sold).	A34g Kodi munagwi iitsa ntchito feteleza wanji ndipo wochulu ka bwanji? (if applied fertilizer) what type did you apply and how much?	A34h Kodi munkateteza bwanji mbewu zanu ku matenda ndi zilombo zoononga? How did you deal with pests and plant diseases? Had no problems = 0 Did nothing with problem=1 If did something, methods used: Pesticide = 2 Hand picking=3 Ash=4 Tephrosia or other plant leaves crushed and liquid applied = 5 Other (specify)=6	A34i Nanga mphesi ndi zotsalira zina mukakolola munachita nazo chiyani? What did you do with the crop residues? Nothing = 0 Remove to thresh=1 Remove for livestock=2 Leave & incorporate early =3 Leave & incorporate late =4 Burn for cooking=5 Burn for land clearing or mice hunting=6 Burn for nutrients=7 Herbicide=8(type) Other (describe)=77	A34j Kodi munasungabwanji zokololozanu kuti zisawonongeke ndi anankafumbwe ndi chiswe? What did you do to prevent the harvest from insects e.g. weevils or termites? Nothing = 1 Pesticide = 2 Hand sorting=3 Ash=4 Other (specify)=5

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Mbeu/ Crop Type	A35 Chaka Chathachi, Kodi munalima mbeu zanzi?? [crop type]? In 2011/12 growing season, what type of [add crop type] did your household grow? <i>(Fill in all variety names using exact words in local language)</i>	A36 Mungatigawireko, pang'ono mbeu zimene munaakolozo? Tikufuna kukafufuza zamichele imene zilinazo? Can we have a small sample of your crop? We want to learn about the nutrient value of the food eaten in this area. [Check <input type="checkbox"/> if they give a sample. Make sure sample is labeled with crop type, Variety # and Hhold #. Put in separate bag & seal, make sure it doesn't get wet]
Maize/ chimanga	Variety 1: _____ <input type="checkbox"/> Variety 3: _____ <input type="checkbox"/> Variety 2: _____ <input type="checkbox"/> Variety 4: _____ <input type="checkbox"/>	
Sorghum/ mapira	Variety 1: _____ <input type="checkbox"/> Variety 3: _____ <input type="checkbox"/> Variety 2: _____ <input type="checkbox"/> Variety 4: _____ <input type="checkbox"/>	
Finger Millet/ mawere	Variety 1: _____ <input type="checkbox"/> Variety 3: _____ <input type="checkbox"/> Variety 2: _____ <input type="checkbox"/> Variety 4: _____ <input type="checkbox"/>	
Groundnut/ mtedza	Variety 1: _____ <input type="checkbox"/> Variety 3: _____ <input type="checkbox"/> Variety 2: _____ <input type="checkbox"/> Variety 4: _____ <input type="checkbox"/>	
Soya	Variety 1: _____ <input type="checkbox"/> Variety 3: _____ <input type="checkbox"/> Variety 2: _____ <input type="checkbox"/> Variety 4: _____ <input type="checkbox"/>	
Pigeonpea / Nandolo	Variety 1: _____ <input type="checkbox"/> Variety 3: _____ <input type="checkbox"/> Variety 2: _____ <input type="checkbox"/> Variety 4: _____ <input type="checkbox"/>	
Cowpea	Variety 1: _____ <input type="checkbox"/> Variety 3: _____ <input type="checkbox"/> Variety 2: _____ <input type="checkbox"/> Variety 4: _____ <input type="checkbox"/>	
Beans/	Variety 1: _____ <input type="checkbox"/> Variety 3: _____ <input type="checkbox"/>	

nyemba	Variety 2: _____ <input type="checkbox"/> Variety 4: _____ <input type="checkbox"/>
Bambara Groundnut/	Variety 1: _____ <input type="checkbox"/> Variety 3: _____ <input type="checkbox"/>
	Variety 2: _____ <input type="checkbox"/> Variety 4: _____ <input type="checkbox"/>

A37	<i>Mungandiwuzeko zamitundu ya mitengo yomwe ili pakhomo pano? Kodi mumayigwilitsa ntchito motani?</i> Can you tell me what trees you have on your homestead and their use? (<i>List all named and uses</i>) [probe for trees used for firewood, to improve soils etc]	Trees:	Uses:
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A38 Kodi mumadziwa njira ina iliyonse yamakolo kapena yamakono yotetezera kapena kuwonjezela chonde mnthaka ndi kusunga chinyontho osathira fertiliser? Do you know of any ways (including traditional) to improve the quality/health of the soil and water, without applying fertilizer?		Yes	1
		No	2
A38a. Methods Tchulani njira	A38b Where did you learn about these methods? Munaphunzira kuti?	A38c Do you currently use any of these methods? If not, why? Kodi mumagwilitsabe ntchito njirazi/upangiliwu?Ngati ayi, chifukwa?	
1	1	1	
2	2	2	
3	3	3	
4	4	4	
A39 Kodi ndi njira zANJI zomwe mukuzidziwa zomwe zingathandize kuti banja likhale ndi chakudya chokwanila? Do you know of any ways to improve household food security?		Yes	1
		No	2
A39a. Methods Tchulani njira	A39b Where did you learn about these methods? Munaphunzira kuti?	A39c Do you currently use any of these methods? If not, why? Kodi mumagwilitsabe ntchito njirazi/upangiliwu?Ngati ayi, chifukwa?	
1	1	1	
2	2	2	

3	3	3
4	4	4
A40. Kodi mumadziwa zomwe inu ndi banja lanu mungachite pothandizila kuti ana azidya chakudya chabwino, chokwanira kuti asanyentchere? Do you know of any ways that you and your family can improve young children's nutrition?		Yes 1
		No 2
A40a. Methods Tchulani njira	A40b Where did you learn about these methods? Munaphunzira kuti?	A40c Do you currently use any of these methods? If not, why? Kodi mumagwilitsabe ntchito njirazi/upangiliwu? Ngati ayi, chifukwa?
1	1	1
2	2	2
3	3	3
4	4	4
A41. Munamvapo za Vitamin A? Have you heard of Vitamin A?		Yes No
A42. [if yes] Mukudziwa mmene mungachulukitsire vitamin A mu zakudya zimene mumadya? Do you know of any ways that you and your family can increase Vitamin A in your food? [If no, skip to A43]		Yes 1
		No 2
A42a. Methods Tchulani njira	A23b Where did you learn about these methods? Munaphunzira kuti?	A42c Do you currently use any of these methods? If not, why? Kodi mumagwilitsabe ntchito njirazi/upangiliwu? Ngati ayi, chifukwa?
1	1	1
2	2	2
3	3	3
4	4	4

HOUSEHOLD FOOD SECURITY 7 Instructions to the Enumerators: For each of the following questions, make sure that you refer to the past four weeks. If the answer is 'yes', explain whether: sometimes (once or twice), often (3-10 times), frequently (more than 10 times). **Pafunso**

7 The English and Chichewa versions of the Household Food Insecurity Access Scale come from a published, pre-tested and back-translated version done in Malawi (Mtimuni and Geresomo 2006, see <http://www.foodsec.org/web/publications/pubshome/fsi4dm-pubsarchive/en/>). The Tumbuka version comes from previous HFIAS surveys conducted by the SFHC team.

linalilonse mwa mafunso otsatilawa, fotokozani mmene zinaliri pa masabata anayi apitawa. Ngati yankho liri 'ee', fotokozani ngati ndi Mwa apo ndi apo (kamodzi kapena kawiri), nthawi zina (katatu kufikira khumi), kawirikawiri (kupitilira khumi) masabata anayi apitawa.

#	Question (Check only one response). Each of the following questions applies to past 4 weeks.	Never	Rarely (1-2 times)	Sometimes (3-10 Times)	Often (More than 10 times)
A43	<i>Kodi pa masabata anayi apitawa, munakhalapo ndi nkhawa kuti mukhala ndi chakudya chosakwanira pakhomo panu?</i> In the past 4 weeks, were you ever worried that you may not have enough food in your household?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
A44	<i>Kodi pa masabata anayi apitawa, pali wina aliyense pakhomo pano analephera kudya zakudya zimene amafuna kudya chifukwa cha kuchepekedwa?</i> [in the past 4 weeks] was there anyone in this household unable to eat the kinds of foods you preferred because of a lack of resources?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
A45	<i>Kodi pa masabata anayi apitawa, pali wina aliyense pakhomo pano analephera kudya zakudya zosiyanasiyana chifukwa cha kuchepekedwa?</i> In the past four weeks did you or any household member have to eat a limited variety of foods due to a lack of resources?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
A46	<i>Kodi pa masabata anayi apitawa, pali wina aliyense wa pakhomo pano anadyapo zakudya zoti sazikonda chifukwa chochepekedwa?</i> In the past four weeks was there any household member who had to eat some foods that you really did not want to eat because of a lack of resources to obtain other types of food?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
A47	<i>Kodi pa masabata anayi apitawa, pali wina aliyense wa pakhomo pano anadya chakudya chochepa chifukwa kunalibe chakudya chokwanira?</i> In the past four weeks was there anyone in this house hold who ate less amount of food [or a smaller meal than you felt you needed] because there wasn't enough food?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
A48	<i>Kodi pa masabata anayi apitawa, pali wina aliyense wa pakhomo pano anadya mopereweza pa tsiku (kangati) chifukwa kunalibe chakudya chokwanira masabata anayi</i>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

#	Question (Check only one response). Each of the following questions applies to past 4 weeks.	Never	Rarely (1-2 times)	Sometimes (3-10 Times)	Often (More than 10 times)
	<i>apitawa?</i> In the past four weeks was there any household member who ate fewer times per day because there wasn't enough food?				
A49	<i>Kodi pa masabata anayi apitawa, pali tsiku lina lirilonse lomwe munakhalapo opanda chakudya chirichonse chifukwa chochepekedwa?</i> In the past four weeks was there ever no food to eat of any kind in your household because of lack of resources? [<u>make sure all types of food</u>]	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
A50	<i>Kodi pa masabata anayi apitawa, pali wina aliyense wa pakhomu pano anagonapo ndi njala chifukwa chakudya chinali chosakwanira?</i> [<u>make sure all types of food</u>]. In the past four weeks, did you or any household member go to sleep at night hungry because there wasn't enough food?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
A51	<i>Kodi pa masabata anayi apitawa, pali wina aliyense wa pakhomu pano amene anakhala tsiku lonse kapena kugona ndi njala chifukwa chakudya chinali chosakwanira?</i> <u>Probe more to make sure they are not including any food such as cassava, green maize.</u> In the past four weeks was there any household member who had spent a whole day and night without eating because there wasn't enough food?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
A52	<i>Kodi alipo wina aliyense pakhomu pano anakagwilapo ganyu chifukwa panyumba pano palibe chakudya?</i> Have you or any household member had to do ganyu for food in the past 4 weeks because you have run out of your own food sources?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

A53 Kodi mukungamza kuti chimanga chimene munakolola chaka chatha chidzatha liti? How long do you expect last year's maize harvest to last? (month) **Month ended or expected to finish:**

HOUSEHOLD DIETARY DIVERSITY: Mafunso Akudya zakudya za magulu osiyansiyana pakhomu

Read to participant: *Tsopano ndikufunsani za zakudya ndi zakumwa zimene wina aliyense wa pakhomu pano anadya kapena kumwa dzulo kuyambira pamene munadzuka kufikira nthawi yogona (kupati zakudya kapena zakumwa zimene munakadya kwina).* Now I will ask you questions about food stuffs and drinks that any household member ate or drank yesterday from the time he/she woke up

until he/she went to bed (Do not include food or drink taken elsewhere)

A54 Kodi dzulo panali wina aliyense wa pakhomo pano anadya kapena kumwa izi? (Did any household member eat or drink any of the following yesterday?)

#	Gulu la chakudya	Zitsanzo/ Examples	Yes	No
1	Zakudya za mgulu la chimanga (Cereals)	Chakudya china chilichonse monga : nsima, phala, buledi, supageti, sikono, mtakula, mabisiketi, thobwa, mpunga, mitama, chigumu, chimtuwitsa, mandasi, zitumbuwa, kapena zakudya zinazilizonse zochokera ku mawere, mapira, chimanga, Mpunga, mchewere, tiligu? Any food such as Nsima, porridge, bread, spaghetti, scones, biscuits, rice, boiled whole maize grain, sweetbeer, boiled samp, milk scone, doughnuts, maize- banana pan cake, or any food made from finger millet, sorghum, bullrush millet, maize and wheat?	Yes	No
2	Zakudya za masamba ndi mizu yokhala ndi vitamini A (Vitamin A rich tubers & vegetables)	Chakudya chinachilichonse mwa izi: maungu, karoti, kapena mbatata za kholowa za chikasu,? Any food such as: pumpkins, carrots or sweet potatoes having yellow pigment, including local yellow maize? [please check here if they indicate that they ate local yellow maize] <input type="checkbox"/>	Yes	No
3	Mbatata ndi zakudya za mizu zoyera (White tubers and roots)	Chinachilichonse mwa izi: mbatata zoyera, chilazi, chinangwa, mbatatesi, koko, kapena zakudya zina zilizonse zochokera ku mizu? Any food in the group of: white sweet potatoes, coco yams, cassava, irish potatoes, yams or any white roots and tubers?	Yes	No
4	Ndiwo za masamba zobiliwira (Dark greenleafy vegetables)	Ndiwo za masamba zobiliwira kuphatikizapo za ku tchire monga izi: chisoso, luni, bonongwe, chigwada, mtoliro, mpiru (lobo), kamganje, lepu, mnkhwani, chitambe, khwanya, denje? Relish of dark green leafy vegetables as well as the indgenous vegetables including, Cat's whiskers leaves, Amaranthus, cassava leaves, sweet potato leaves, mastard, rape, local rape, pumpkin leaves, cow peas leaves, bean leaves, denje, black jack leaves	Yes	No
5	Ndiwo zina zirizonse za masamba (any other vegetables)	Kapena ndiwo zina ziri zonse za masamba monga izi: Chinese, thelele lobala, kabichi, mabiringanya, matimati, . Any kind of relish from leafy vegetables e.g Chinese cabbage, okra, cabbage, egg plants ,tomatoes, onions, green pepper and green beans?	Yes	No
6	Zipatso zokhala ndi Vitamini A (Vitamin A	Zipatso zilizonse monga izi: Papaya, mango? Any fruits like papaya (pawpaw)?	Yes	No

	rich fruits)			
7	Zipatso zina zirizonse (Other fruits)	Zipatso zina zirizonse kuphatikizapo zakutchire monga izi: malalanje, manachesi, mandimu, bwemba, nthema, masawo, mapeyala, nthochi, malambe?? Any other fruits including the indigenous wild fruits e.g oranges, tangerines, lemons, tamarind, elephant fruits, <i>masawo</i> , avocado pears, bananas and baobab fruits?	Yes	No
8	Nyama (Meats)	Nyama ina iriyonse monga izi: Nyama ya ng'ombe, ya nkhusa, ya nkhumba, ya mbuzi, ya kalulu, mbewa, ya m'tchire, ya nkhu, bakha, toulukauluka monga nkhanguni, nkhangwa, kapena mbalame zina, chiwindi, impso, mtima, kapena nyama yina ya zamkati, kapena chakudya chilichonse cha nyama. Any meat e.g beef, lamb, pork, goat meat, rabbit meat, mice, wild game, poultry duck, flying insects e.g nkhanguni, guinea fowl or any other bird, liver, kidney, heart, offals or any other meat.	Yes	No
9	Mazira (Eggs)	Mazira a mtundu wina uliwonse? Eggs of any kind?	Yes	No
10	Nsomba Fish)	Nsomba zaziwisi kapena zowuma? Fresh or dried fish?	Yes	No
11	Nyemba, mtedza ndi nthanga (Legumes, nuts & seeds)	Mtundu wina uliwonse wa nyemba monga izi: Nyemba, khobwe, nandolo, nkhangudzu, nsawawa, nzama, soya, mtedza, mphodza, nseula, tchana? Any type of beans and peas e.g beans, cow peas, pigeon peas, nkhangudzu, peas, ground beans, soya beans, ground nuts, green gram, custard apple, Nseula, chick peas?	Yes	No
12	Mkaka ndi zopangidwa kuchoka ku mkaka (Milk and milk products)	Zakudya zochokera ku mkaka monga: mkaka, yogati, chambiko? Milk and Food made from milk e.g yoghurt, sour milk?	Yes	No
13	Mafuta ophikira ndi a nyama (Oils and Fats)	Mafuta ena alionse monga: mafuta ophikira, mafuta ochokera ku nyama, majalini? Any type of fats or oils e.g. cooking oil, animal fats and margarine used for cooking or added to food?	Yes	No
14	Zakudya zotsekemera (Sweets)	Chakudya china chilichonse chotsekemera monga izi: shuga, uchi, zakumwa zosaledzeretsa monga fanta, fizesi, kokakola, sprite, cocopina, zakumwa zothirako shuga, kapena zakudya za sugar monga chokoleti, masiwiti?? Any sweet, sugar, honey, soft drinks such as fanta, fizzes, cocacola, sprite cocopina, drinks to which sugar was added or sugary foods e.g chocolate, sweets?	Yes	No
15	Khofi/tiyi (coffee/tea)	Tiya wina aliyense, kapena khofi? Any tea or coffee?	Yes	No

A55. *Mungandiwuzeko za momwe mumaphikila/kaphikidwe ka zakudya zomwe nditatchulezi?*

Can you tell me about any recipes that you use at home for the following crops?

Legume	Recipes Used <i>Mmene mumaphikira</i>	How often in last month? <i>Kagati mwezi wathawu?</i>
Soybeans/ <i>soya</i>	1. 3. 2. 4.	1. 3. 2. 4.
Pigeonpea/ <i>nandolo</i>	1. 3. 2. 4.	1. 3. 2. 4.
Cowpea/ <i>khobwe</i>	1. 3. 2. 4.	1. 3. 2. 4.
Beans/ <i>nyemba</i>	1. 3. 2. 4.	1. 3. 2. 4.
Local yellow maize Chimanga chamakolo cha Chikasu chayelo	1. 3. 2. 4.	1. 3. 2. 4.
Sweet potatoes/ <i>mbatata</i>	1. 3. 2. 4.	1. 3. 2. 4.
Cassava/ <i>chinangwa</i>	1. 3. 2. 4.	1. 3. 2. 4.

PART B: FARMING INFORMATION & INDIVIDUAL DIETARY DIVERSITY

Instructions for Enumerator: For the questions in Part B, please interview either the husband or the wife separately, in the case of spousal-couple households. Please flip a coin to decide which adult to interview. (If there is more than one wife, you will have to do multiple flips, once for husband vs wife, and then for each wife e.g. Wife 1 vs Wife 2...) You should conduct these interviews alone with the respondent, with enough distance to ensure they do not hear each other.

Part B questions apply to: (circle one): **Man** **Woman ____ (specify if**
wife)
more than one

(Please read): Ndikufunsani mafunso okhudzani ndi zomwe mumadziwa pa nkhani ya ulimi komanso njira zomwe mumapezera upangili wa zaulimi? I would like to ask you a few questions that concern where you get your farming information, what kind of social groups you are in, and other topics. I will start with some questions about farming knowledge and where you get your farming information.

B1	<p><i>Kodi ndi chani chomwe mumakhala mukuchiganizila kapena chimakudetsani nkhawa pa moyo wanu?</i></p> <p>(What are your most important concerns when it comes to your life?)</p>		
B2	<p><i>Nanga pa nkhani ya ulimi ndichani chomwe chimakudetsani nkhawa kapena mumachiganizila kwambiri?</i> What are your most pressing agricultural concerns?</p>		
B3.	<p>What are the main ways that you learn new information or solve a problem in your farming? 8</p> <p><i>B1a. Kodi upangili wa zaulimi ndi malimidwe mumawupeza kuti?</i></p> <p><i>(Circle all that apply, don't read out loud just select based on what they say.)</i></p> <p>Rank the top <u>two</u> sources in order of importance for information that you have used in your own farm.</p>	Code	Rank
	Self- experience / observation	1	
	Ask relatives/friends	2	
	Ask other farmers (not relatives or friends)	3	
	Ask a farmers group – list	4	

	Radio	5	
	Television	6	

8 Question adapted from Humphries et al 2012 and SFHC Crop Diversity survey 2010.

	B1b. Pa nthowa izo mwazunura muniphalirepo nthowa zikulu ziwiri izo mukugwiriska nthito pa munda winu? (Put rank to the right of the two top-ranked sources)	Extension agents (agricultural field assistants)	7	
		Special activities – list (e.g. field day) _____	8	
		Demonstration trials	9	
		Newspaper	10	
		Shopkeeper	11	
		Other (specify)	12	
B4.	Can you describe 2 types of useful information that you learned from these sources, which you are still using? Mungandiwuzeko ndondomeko zaupangili wa za ulimi zomwe munaphunzira kuchokera ku njira zomwe mwatchulazi?	(Describe the type of information named) 1. 2.		

B5	Kulingana ndi anthu ena asinkhu wanu mmudzi muno inu mumawona kuti umoyo/nthanzi lanu lili bwanji? In general, compared to other people your age, would you say your health is: Excellent, Very Good, Good, Fair or Poor?	Excellent ndine wa thanzi kwabasi	
		Very Good ndine wa thanzi ndithu	
		Good ndine wa thanzi	
		Fair choncho	
		Poor sindilibwino kweni kweni	
		Not Sure Sindingadziwe bwino bwino	
		Refused	
B6	Kodi inu mumakhutula mutani ndi thanzi la thupi lanu? How satisfied are you with your health? Would you say you are Very Satisfied, Somewhat Satisfied, Not Too Satisfied, or Not At All Satisfied?	Very Satisfied kwambiri	
		Somewhat Satisfied ndine okhutilabe choncho	
		Not Too Satisfied osati kweni kweni	
		Not At All Satisfied sindine okhutila	
		Not Sure Sindikudziwa	
		Refused	

B7	Nu mumawona kuti mumakwanitsa kugwila ntchito zapakhomo pano ndi mphamvu? How would you rate your ability to handle the day-to-day demands in your life, for example, work, family and farming responsibilities?	Excellent opanda vuto lililonse	
		Very Good Kwabasi	
		Good Ndimakwanitsa	
		Fair Choncho	
		Poor Sindimakwanitsa	
		Not Sure Sindingadziwe	
		Refused	
B8	Inu mumawona kuti mumakwanitsa bwanji kuthana ndi mavuto ogwa mwazizizi/osawayembekezela? When you have a family or personal crisis, how would you rate your ability to handle the crisis: excellent, very good, good, fair, poor or not sure?	Excellent ndimakwanitsa popanda vuto	
		Very Good ndikwanitsa	
		Good ndimakwanitsabe	
		Fair Choncho	
		Poor zimavuta	
		Not Sure sindikudziwa	
		Refused Wakana	

INVOLVEMENT IN LOCAL ORGANIZATIONS

B9.	Alipo pakhomo pano amene ali mu kalabu/bungwe la alimi, kopaletivi kapena bungwe lililonse lomwe limathandiza ndi upangili wa ulimi, kuti pabanja pakhale chakudya chokwanira kapena kuti mupeze ndalama, kapena kuti anthu pabanjapo azidya zakudya za magulu? Do you or any members of your household participate in any community group that helps with agriculture, food security, health/nutrition or income or other group?	Yes	1
		No (Skip to C1)	2
		Don't Know (Skip to C1)	98
		Refused (Skip to C1)	99
B10.	[IF YES], Ngati alipo, ndi ndani, ndipo amakumana kangati? What group, and please indicate year joined, position and why participate.		

Organization Name	Year joined	Position with organization	Why do you participate?

SECTION C: SOCIAL SUPPORT and GENDER RELATIONS

Note to enumerator: the following questions are quite sensitive. Please assure the respondent that all identities are kept confidential and will not be shared with anyone. Please say to respondent: Tsopano ndikufunsani mafunso okhudzani ndi mmene mumakhala pakhomo pano (kapena pabanja lanu). Ndikutsimikizileni kuti zomwe titakambilane pano ndizachinsinsi ndipo palibe amene atadziwe za zomwe takambilana pano. [I am now going to ask you about household issues. Please remember that all questions are confidential and will not be shared with anyone beyond the research team.]⁹

C1. (Read the following to the respondent): Pali nthawi zina zomwe munthu umafuna munthu wina kuti akuthandizeko nzeru, maganizo kapena kumudandaulira kumene. Mungandiwuzeni kuti ndikangati kamene munapezako chithandizo chotere? People sometimes look to others for companionship, guidance, assistance, or other types of support. Could you tell me how often each of the following kinds of support is available to you when you need it?					
C1a. Kodi ndi kangati kamene mumapeza munthu amene mumakhala ndi nthawi yocheza kapena kupanga zinthu zomwe inu mumakonda limodzi? How often do you have someone to have a good time or do something enjoyable with?	Nthawi zones Always <input type="checkbox"/>	Nthawi zambiri Most of the time <input type="checkbox"/>	Nthawi zina Sometimes <input type="checkbox"/>	Mwa apo ndi apo / Rarely <input type="checkbox"/>	Never <input type="checkbox"/>
C1b. Kodi ndi nthawi zochuluka bwanji zomwe mumapeza munthu okhuthululirana naye zakukhosi? How often do you have someone to confide in, talk with about yourself or your problems, and get advice?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Never <input type="checkbox"/>
C1c. Kodi ndi nthawi zochuluka bwanji zomwe mumapeza munthu okutengelani kuchipatala mukadwala, kukupatsani ndalama kapena chakudya	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Never

⁹ Adapted from Humphries et al. 2012, Pandey et al. 2012 and Story and Burgard 2012.

mukachepekedwa?? How often do you have someone to take you to the hospital or give you money or food if you need?					<input type="checkbox"/>
C1d. Kodi ndi nthawi zochuluka bwanji zimene mumakhalandi munthu okuwonetsani chikondi? How often are you in the company of someone who shows you love and affection?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Never <input type="checkbox"/>

C. Tsopano ndikufunsani za mmene mumagwirizanirana kapena kumanga mfundo zosiyana siyana zokhudzana ndi kakhaliidwe, umoyo ndi zina pa banja lanu. Now I'd like to ask you about decision-making in your household.	1= self 2 = spouse 3= Both 4= Sons 5=Daughters 6= Other family members 7= Other (specify)
C2 Kodi amane amapanga ganizo kapena kukhala ndi ulamuliro pa za mbewu zimene zoti zilimidwe ndi komwe zidzalidwe pabanja pano ndani? Who usually decides what and where to plant?	
C2 Kodi amene ali ndi ulamuliro pazokolola zomwe mungagulitse ndi kagulitsidwe kake ndani?? Who usually decides what farm products to sell?	
C3 Kodi amene ali ndi ulamuliro pa nkhani yogula zinthu zikuluzikulu (monga njinga, wailesi, cell phone, feteleza, malata) pakhomo pano ndani? Who usually makes decisions about major household purchases (e.g. fertilizer)?	
C4 Kodi amene ali ndi ulamuliro pa nkhani yogula zinthu zomwe mumagwiritsa ntchito tsikunditsiku pakhomo pano (monga sopo) ndani? Who usually makes decisions about purchases for daily household needs (e.g. soap)?	
C5 Kodi amene ali ndi ulamuliro pa nkhani yoti mukachezere achibale ndi anansi ndani?? Who usually decides about visits to your family or relatives?	
C6 Kodi amene ali ndi ulamuliro pa nkhani yoti muzitengapo mbali ndi kulowa m'magulu osiyana siyana kaya a zaulimi, azosunga ndalama, zachitukuko, zaumoyo, ndani? Who usually decides whether you can participate with different local organizations?	

C7 Kodi amene ali ndi ulamuliro pa nkhani nkhani ya maphunziro a ana anu? Who usually decides about your children's education?										
C8 Kodi akazi anu angaganize mwaokha za mbewu zome zidzalidwe ku munda? Can your wife (or you if it is woman) ever decide to plant crops on own?					Yes		No			
C9 Kodi akazi anu angaganize mwaokha zogulitsa zokolola? Can your wife (or you if it is the woman) ever decide to sell crops on her own?					Yes		No			
C10 Kodi akazi anu angaganize mwaokha zolowa nawo mu gulu losunga ndalama. Can your wife (or you if it is the woman) ever decide on her own to join an organization such as a village bank?					Yes		No			
C11 Kodi akazi anu angaganize mwaokha kukayendera achibale omwe sakhala mmudzi mwanu numo osakuuzani? Can your wife (or you, if it is the woman) ever decide to visit family or friends outside the village on her own?					Yes		No			
C12 Kodi abambo amathandiza kusamalira ana pakhomo pano? Do you (or your husband) ever help with child care?					Yes		No			
C12b [If yes], Pa nyengo zilinga pa mwezi? how often per month?			Daily	Frequently	Sometimes		Rarely			
C13 Kodi abambo, mungakhale opanda vuto lirironse akazi anu atakhala pa udindo mu bungwe lomwe ali membala? Would you (or your husband) be comfortable with your wife being in a leadership position in an organization, that led her to travel away from home?					Yes		No			
C14 Kodi inu kapena amuna anu amathandiza kuphika zakudya zapakhomopano? Do you (or your husband) ever help with food preparation?							Yes		No	
C14b [If yes], Ngati ndi choncho, ndikangati? how often per month?				Daily	Frequently		Rarely	Never		
C15 Kodi amuna anu amachapa zovala? Do you (or your husband) ever do the laundry?					Yes		No			
C15b [If yes], Ngati ndi choncho, ndikangati? how often? (write any details provided):				Daily	Frequently (3-5 times)	Rare Occasions	Never			

C16 : **Nthawi zina mwamuna amakwiya kapena kunyansidwa chifukwa cha zomwe mkazi wake wachita. Mukuganiza kuti ndi kololedwa kuti mwamuna amenye mkazi wake wake zinthu ngati izi zikachitika?** Sometimes a husband can get irritated or annoyed by things that his wife does. Do you think a husband is justified in

hitting or beating his wife in the following situations: (adapted from Pandey et al. 2012)			
C16a <i>Akagulitsa zokolola mwayekha osawawuza mwamuna wake?</i> She sells something (like crops) without telling him?	Yes	No	
C16b <i>Akapseleletsa ndiwo?</i> She burns the food?	Yes	No	
C16c <i>Akakana kugonana ndi mwamuna wake?</i> She refuses to have sex with him?	Yes	No	
C17 <i>Kuti bambo akunyumba akumenyanipo pamasabata anayi apitawa??</i> Did you (or your husband) beat your wife in the last four weeks? C17b <i>Ngati ndi choncho, chinachitika ndi chani kuti akumenyeni/muwamenye?</i> If yes, can you tell me more about the situation?	Yes	No	
C18 <i>Kodi pali amene amamwa mowa pakhomo pano?</i> Does anyone in the household drink alcohol? If so, who? <i>Kodi pali amene amamwa moyo nyumba mwanu? _____?</i>	Yes	No <i>[if no, go to end of survey]</i>	
C19. <i>Kodi amuna anu amamwa mowa Ngati eya, kangati??</i> [If someone drinks] Can you estimate how often per week this person usually drinks?	Daily	Frequently (3-5 times)	Sometimes (1-2 times) Never
C20. <i>Kodi pali kusintha kuli konse pakamwende pa zaka zitatu zadutsazi</i> Has the consumption of this person changed in the past 3 years?	Yes	No	
C21 <i>Ngati pali kusintha mukuwona ngati ndi chifukwa chani?</i> If so, why do you suppose it has changed?			

Now I have finished my questions. Thank you very much for your patience and information.

District # _____ Respondent HHID _____ Interview Date: ____/____/ 2014

Interviewer # _____ Respondent's Gender: Male _____ Female _____

#	QUESTION (and Enumerator Instructions)	Possible Responses	Code
SECTION A: COMMUNITY			
1	Have you lived in this area for the last five years	No	0
		Yes	1
		Don't know	8
		Refused	9
2	How long have you lived in this area?	0-5 years	0
		6-10 years	1
		11-15 years	2
		20 or more years	3
		Was born here	4
		Don't remember	8
		Refused	9
3	How many years have you lived in this house? RECORD ONLY ONE RESPONSE ONLY	0-5 years	0
		6-10 years	1
		11-15 years	2
		20 or more years	3
		Don't remember	8
		Refused	9
4	What do you like most about this area?	Nothing	0
		Business/livelihood opportunity	1
		Affordable housing	2
		Clean Environment	3
		Safe Neighborhood	4
		Seafront/ocean	5
		Enough land for farming	6
		Others	7
		Don't know	8
		Refused	9
5	What do you don't like most about this area?	Nothing	0
		Natural Disaster	1
		Poor Environmental Condition	2
		Bad Infrastructure (road, drains...)	3
		Lack of Social Services	4
		Unsafe Neighbourhood	5
		Others	7
		Don't Know	8
		Refused	9
		6	Which one of the following housing type best describes the type of dwelling this household occupies?
House	0		
Self-contained	1		
Flat	2		
Traditional dwelling/ homestead	3		
Room in backyard	4		
Live on the street	5		
Squatter hut/ shack	6		
Others (Specify):	97		
Refused	99		

7	Does you have electricity? Solar,ESCOM	No	0
		Yes	1
		Don` t know	8
		Refused	9
8	What is/are the source(s) of drinking water in dry season? (More than one answer)	Public tap water	0
		Open well	1
		Pumped well	2
		Lake or River	3
		Restored rain water	4
		Water from tanker truck, vendor	5
		Others	6
		Refused	9
9	What is/are the source(s) of drinking water in rainy season? (More than one answer)	Public tap water	0
		Open well	1
		Pumped well	2
		Lake or River	3
		Restored rain water	4
		Water from tanker truck, vendor	5
		Others	6
		Refused	9
10	Which of the following best describes the household structure? (Read the answers to them) People living in this house	Female Centered (No husband/ male partner in household, may include relatives, children, friends)	0
		Male Centered (No wife/ female partner in household, may include relatives, children, friends)	1
		Nuclear (Husband/ male partner and wife/ female partner with or without children)	2
		Extended (Husband/ male partner and wife/ female partner and children and relatives)	3
		Child centered (Child-headed)	4
		Polygamous (husband with more than one wife)	5
		Other (specify):	6
Refused	9		
11	Prior to this place, where did you live?	Other farming community	0
		Other coastal community	1
		In the city	2
		Refused	9
12	What was the main reason why you migrated here?	Fishing	0
		Trading	1
		Farming	2
		Employment	3
		Education	4
		Other	5
		Refused	9
13	Has any of your family members migrated to another village or country?	No	0
		Yes	1
		Refused	9
14	IF YES , what was the reason?	Fishing	0

		Trading	1
		Farming	2
		Employment	3
		Education	4
		Other	5
		Refused	9
15	(ONLY for those who answered YES in Q. 13.) How does the migration of family member affect your household economic status?	Nothing changed	0
		Only a little better	1
		Much better	2
		Don't know	8
		Refused	9
15 B	Do you receive any remittances from the migrated member?	No	0
		Yes	1
		Don't know	8
		Refused	9
15 C	If YES to 15B , how much annually?	Enter amount	
		Don't know	999998
		Refused	999999
16	How do you rate your household's quality of life relative to others in the community?	The worst	0
		Among the worst	1
		About the same	2
		Better	3
		The best in the community	4
		Don't know	8
		Refused	9
17	What would hinder you and your family to achieve your desired future in this community?	Nothing	0
		Lack of resources	1
		Lack of good education	2
		Lack of local jobs	3
		Lack of access to market	4
		Pollution	5
		Loss of tradition	6
		Restrictive conservation units	7
		Poverty	8
		Competition with large vessels	9
		Loss of land	10
		Natural disaster	11
		Others (Specify)...	97
		Don't know	98
	Refused	99	

SECTION B: GENDER AND LIVELIHOOD

18	In your household who contributes most of the income?	Children	0
		Male Head/Father	1
		Female Head/Mother	2
		Male relative	3
		Female relative	4

		Other (Specify)	7
		Don't Know	8
		Refused	9
19	In your household who contributes THE SECOND MOST of the income?	Children	0
		Male Head/Father	1
		Female Head/Mother	2
		Male relative	3
		Female relative	4
		Other (Specify)	7
		Don't Know	8
		Refused	9
20	In your household who is considered to be in charge of decision making?	Everyone contributes equally	0
		Male Head/Father	1
		Female Head/Mother	2
		Male relative	3
		Female relative	4
		Both female and male	5
		Other (Specify)	7
		Don't Know	8
		Refused	9
21	In your household who makes decisions about making large household purchases? (Example: Vehicle, furniture etc.)	Everyone contributes equally	0
		Male and Female Heads decide together	1
		Mostly the Males	2
		Mostly the Females	3
		Other (Specify)	7
		Don't Know	8
		Refused	9
22	In your household who makes decisions about making household purchases for daily needs?	Everyone contributes equally	0
		Male and Female Heads decide together	1
		Mostly the Males	2
		Mostly the Females	3
		Other (Specify)	7
		Don't Know	8
		Refused	9
23	In your household who makes decisions about visits to distant families and relatives?	Everyone contributes equally	0
		Male and Female Heads decide together	1
		Mostly the Males	2
		Mostly the Females	3
		Other (Specify)	7
		Don't Know	8
		Refused	9
24	In your household who makes decisions about what food to eat each day?	Everyone contributes equally	0
		Male and Female Heads decide together	1
		Mostly the Males	2
		Mostly the Females	3

		Other (Specify)	7
		Don't Know	8
		Refused	9
25	In your household who usually makes decisions on paying for any health related expenses?	Everyone contributes equally	0
		Male and Female Heads decide together	1
		Mostly the Males	2
		Mostly the Females	3
		Other (Specify)	7
		Don't Know	8
		Refused	9

SECTION C:HOUSEHOLD FOOD SECURITY

26	Over the years, how often (If ever) have you or your family member gone WITHOUT:							
	Conditions (Code)	Never (0)	Just once or twice (1)	Several times (2)	Many times (3)	Always (4)	Don't know (8)	Refused (9)
	Enough food to eat?							
	Enough clean water for home use?							
	Enough fuel to cook your food?							
	A cash income?							

27. These next questions are about food eaten in your household in the last 12 months and whether you were able to afford the food you need.

READ THE LIST AND CIRCLE ONLY ONE ANSWER FOR EACH QUESTION

6-Item 12-Month Food Security Scale - Questionnaire

27a.	The first question is: “The food that (I/we)harvested/bought just didn’t last, and (I/we) didn’t have money to get more.” Was that often, sometimes, or never TRUE for (you/your household) in the past 12 months?	(1) Often Affirmative	(2) Sometimes Affirmative	(0) Never True Negative	(8) Don't Know (9) Refused
	“(I/we) couldn’t afford to eat balance meal.” Was that often, sometimes, or never true for (you/your household) in the past 12 months?	(1) Often Affirmative	(2) Sometimes Affirmative	(0) Never True Negative	(8) Don't Know (9) Refused
27c.	In the past 12 months, did (you/or other adults in your household) ever reduce the size of the meals or skip meals because there wasn’t enough money for food?	(1) Yes	(0) No		(8) Don't Know

			[SKIP TO 29e]		[SKIP TO 29e]
		Affirmative	Negative		(9) Refused
27d.	[ASK OF ONLY IF 27C= YES] How often did this happen?	(1) Almost every month	(2) Some months but not every month	(3) Only 1 or 2 months	(8) Don't Know (9) Refused
		Affirmative	Affirmative	Negative	
27e.	In the past 12 months, did you ever eat less than you felt you should because there wasn't enough money to buy food?	(1) Yes	(0) No		(8) Don't Know (9) Refused
		Affirmative	Negative		
27f.	In the past 12 months, were you ever hungry but didn't eat because you couldn't afford enough food?	(1) Yes	(0) No		(8) Don't Know (9) Refused
		Affirmative	Negative		

SECTION D: HEALTH STATUS AND ACCESS TO HEALTH CARE SERVICES

28	In general, compared to other people your age, how do you describe your health at the moment?	Poor	0
		Fair	1
		Good	2
		Very good	3
		Excellent	4
		Don't Know	8
		Refused	9
29	Would you say your health have improved, stayed the same or worse in the last ten years	Improved	0
		Stayed the same	1
		Worsened	2
		Don't know	98
		Refused	99
30	How would you rate your ability to handle the day-to-day demands in your life, for example, work, family and volunteer responsibilities?	Poor	0
		Fair	1
		Good	2
		Very good	3
		Excellent	4
		Don't Know	8
		Refused	9
31	How would you rate your ability to handle unexpected and difficult problems, for example, family or personal crisis?	Poor	0
		Fair	1
		Good	2
		Very good	3
		Excellent	4

		Don't Know	8
		Refused	9
NOW I WOULD LIKE TO ASK YOU INFORMATION CONCERNING HEALTH AND HEALTH SERVICES IN YOUR AREA			
32	Is there any health facility in this community?	No	0
		Yes	1
		Don't know	8
		Refused	9
33	How far is it from where you live to the nearest health facility?	Record as mentioned	
		Don't know	8
		Refused	9
34	How easy is it for you to reach this health facility?	Not easy	0
		Fairly easy	1
		Easy	2
		Very easy	3
		Easiest	4
		Don't know	8
		Refused	9
35	How satisfied are you with the services?	Not satisfied	0
		Fairly satisfied	1
		Satisfied	2
		Very satisfied	3
		Most satisfied	4
		Don't know	8
		Refused	9
37	If not satisfied with services, what are the other options do you use?	Traditional health care services	0
		Local pharmacy	1
		Home care service	2
		Social network	3
		Travel to the town/regional Hospital	4
		Don't know	8
		Refused	9
38	How do you rate the cost of health care services in the community health facility?	Not affordable	0
		Fairly affordable	1
		Affordable	2
		Very affordable	3
		Most affordable	4
		Free services	5
		Don't know	8
		Refused	9
39	What is the major barrier that prevents you from seeking health services?	Nothing	0
		Availability of services needed	1
		Accessibility to health facility	2
		Acceptability of services	3

		provided	
		Others (specify)	7
		Don't know	8
		Refused	9
SECTION E : ADAPTIVE CAPACITY			
40	Now I would like to ask you about what you do to manage or cope during drought, flood events and storm surges? Do you have any coping strategies?	No	0
		Yes	1
		Don't know	8
		Refused	9
41	What specific things did you do to manage the most recent drought, flood/ storm you experienced?	Nothing	0
		Relocate	1
		Sand filling	2
		Drain water	3
		Rely on family or friends	4
		Rely on social network	5
		Rely on government	6
		Others (Specify)...	97
		Don't know	98
		Refused	99
42	Do you receive early warning information about flood/storm events?	No	0
		Yes	1
		Don't know	8
		Refused	9
43	From whom would you get this early warning information? (Circle as mentioned)	Friends and family	0
		Community leader	1
		Social networks	2
		Media	3
		Local government	4
		Central government	5
		Private organization...	6
		NGOs....	7
		Don't know	98
		Refused	99
44	What changes (if any) in your household have you made because of drought, flood/storm?	None	0
		Relocation out of flood/storm prone area	1
		Change job	2
		Change school for children	3
		Construct flood/storm barriers	4
		Clearance of drainage channels	5
		Others (specify)	7
		Don't know	8
		Refused	9
45	How would you rank drought, flood/storm problems relative to other problems in your area?	Very low	0
		Low	1
		At par (same)	2

		High	3
		Top priority	4
		Don't know	8
		Refused	9
46	How would you rate your ability to handle drought, flood/storm related stress?	Very poor	0
		Poor	1
		Satisfactory	2
		Good	3
		Very good	4
		Don't know	8
		Refused	9

SECTION F: SHFC AND FARMER GROUP			
47	Are you a member of the either SFHC/MAFFA program	No	0
		Only SFHC	1
		Only MAFFA	2
		Both	3
		Don't know	8
		Refused	9
48	How long have you been a member of SFHC/MAFFA	7-10Years	0
		6-4Years	1
		3 or lower years	2
		Don't know	98
		Refused	99
49	Do you belong to any other farmer organization apart from MAFFA or SFHC?	No	0
		Yes	1
		Don't know	8
		Refused	9
50	If yes ,how many are you in the group	10 and below	0
		11-20	1
		Above 20	2
		Don't know	98
		Refused	99
51B	Do you belong to any village bank group?	No	0
		Yes	1
51C	Do you have access to loans and credit to undertake your farming activities?	No	0
		Yes	1
51	Has being a member of that group , MAFFA or SFHC helped you in anyway	Yes	1
		No	0
		Don't know	8
		Refused	9
52	If yes, in what ways	Seedling	0
		Knowledge on best farm practice	1
		Market for my produce	2
		Farm implements	3
		Help me form a business	4

		Other specify	6
		Don't know	8
		Refused	9
53	How would you rate your knowledge of best agricultural practices?	Very poor	0
		Poor	1
		Satisfactory	2
		Good	3
		Very good	4
		Don't know	8
		Refused	9
53a	Do you apply legimious residue in your cropping	No	0
		Yes	1
		Don't know	8
		Refused	99
		Stopped	7
54	Which of these crops do you grow?	Only Orange maize	0
		Only Yellow maize	1
		Only Pigeon peas	2
		Only Cowpeas	3
		Only Soya beans	4
		Only groundnut	5
		Other(Specify)	6
		At least two of these crops	7
		Three or more crops	8
55	How many acres farm land did you cultivate in the last growing season?	Enter number	
		Don't know	999998
		Refused	999999
56	Were you to sell all your produce, how much do you think you will make	Enter amount	
		Don't know	999998
		Refused	999999
57	Are you planting any crops this dimba	No	0
		Yes	1
		Don't know	8
		Refused	9
58	If yes to 57 , how many acres	Enter amount	
		Don't know	999998
		Refused	999999
59	If yes to 57 , how much do expect to earn from dimba	Enter amount	
		Don't know	999998
		Refused	999999
60	Apart from your own farm, do provide any farm labor/ <i>Ganyu</i> for others?	No	0
		Yes	1
		Don't know	8
		Refused	9
61	If yes to 60 , how much do you earn annually from it	Enter amount	
		Don't know	999998
		Refused	999999
62	Apart from agriculture, do you do any other	No	0

	work for income? E.g. sell, do construction work,sew,build,rear animals, sell charcoal e.t.c	Yes	1
		Don't know	8
		Refused	9
63	If yes to 62 , how much do you earn annually	Enter amount	
		Don't know	999998
		Refused	999999
64	How would you rate your access to market to sell your produce? Either by yourself or buyers coming to the village.	No access at all	0
		Very difficult to get market	1
		Not so easy	2
		Easy access	3
		Don't know	9

SECTION G: SOCIO-DEMOGRAPHIC PROFILE

65	How old are you?	18-25	0
		26-30	1
		31-35	2
		36-40	3
		41-45	4
		46-50	5
		51-55	6
		56-60	7
		61-65	8
		65+	9
		Refused	99
66	What is your marital status?	Single	0
		Married	1
		Separated	2
		Divorced	3
		Widowed	4
		Refused	9
67	What is your position in the household?	Non-head	0
		Head	1
		Refused	9
68	[If Non-head only] What is your relation to the household head?	Wife	0
		Husband	1
		Parent	2
		Child	3
		Others (Specify)	7
		Refused	9
69	What is the total number of people living in your household?	1 to 3	0
		4 to 5	1
		6 or more	2
		Refused	9
70	What is your ethnicity?	Tumbuka	0
		Tongas	1

		Ngonis	2
		Chewas	3
		Nyanja	4
		Others	7
		Don't know	8
		Refused	9
71	What is your religion?	Christian	0
		Muslim	1
		Traditional religion	2
		Others (Specify)	7
		Refused	9
72	Can you tell me your level of education	No education	0
		At least primary	1
		Secondary education	2
		Tertiary	3
73	Can you tell me the educational level of your spouse?	No education	0
		At least primary	1
		Secondary education	2
		Tertiary	3

74	Do you know the value/cost of putting up your house?	Yes	0
		No	1
		Don't know	2
		Refused	9
75	What is the cost of your house?	Record as mentioned:	
		Refused	999999

SECTION H: The Household Assets

	76) Do your household own any of the following items Yes....1 if yes kindly tell me the number NO.....2	78) Can you tell me the current market value of each category of asset?
ITEM	77)Number of item	
a)A bicycle		
b)A radio		
c)A music system		
d)Jewellery and clothing		
e)A motor vehicle		
f)A fridge		
g)A television		
h)A mobile phone		
i)Quantity of land		
j)Number of Cattle		
k)Tobacco		
l) Goats		
m)Poultry		
n)Sheep		

o)Pigs			
p)Buffalo			
q)Farm implements			
r)Ox-carts			
s)Rigders/Plough			
t) Bags of Pepper			
s)Bags of Maize			
u) Legumes			
v) Cassava/Sweet potatoes			
w)Solar electricity			
x) Beans			
y) Number of Children			

79	Since joining SFHC would you say your income status have improved	Yes	1
		No	0
		Don't know	9
80	If yes How?	Improved	1
		Stayed the same	2
		Worsened	3
		Don't know	9
		Refused	8

6.3 Curriculum Vitae

Joseph Kangmennaang

Department of Geography, Social Science Center
Western University, London, ON N6A 5C2, Canada

EDUCATION

- 2013 — Present Masters Candidate, Geography (Specialising in Health and development)
Western University
Dissertation: Impact of food security program on food security and income level of farmers in Northern Malawi.
- 2006 — 2010 B.A. (Honours), Economics and Mathematics
University of Ghana

RESEARCH AND WORK EXPERIENCE

- E-Business Officer
2011 – 2013
(Midland savings and loans) Supervised operations of the Midland cards, E-tranzact and e-zwich cards.
Worked with cocoa farmers to develop an easy payment system and inclusive banking for rural farmers.
- E-Business Officer
2010 – 2011
(GhIPSS) Ghana interbank payments and settlements system (GhIPSS) — Assist with the operations of e-zwich, National cheque clearing and gathering of data on banks transactions.

Teaching experience

- 2013-2014 Fundamentals of Geography (Geo 1100); Department of Geography, Western
- 2014 Geography of Sub-Saharan Africa (Geo 2030); Department of Geography, Western
- 2015 Geography of Tourism (Geo 2030); Department of Geography, Western
- 2014 Geography 2030A – Food security class, November 2014.

HONOURS, AWARDS AND FUNDING

- 2014 Western Green award winner
- 2013 Western World Challenge Challenge Winner
- 2013-2015 Western Graduate Research Scholarship (WGRS)

PUBLICATIONS

Accepted Articles

Kangmennaang, J., Thogarapalli, N., Mkandawire, P & Luginaah, . Investigating the disparities in cervical cancer screening among Namibian women. *Gynecologic Oncology* (accepted).

Kangmennaang, J., Osei, L., G. O., Armah & Luginaah, . GMOs and the Age of (Un) Reason? A Critical Examination of the Rhetoric in the Public Policy Debates in Ghana. *Futures* (accepted)

Kangmennaang, J., Osei, L., Mkandawire, P & Luginaah, . Circumcision status and time to first sex in Sub-Saharan Africa: Evidence from six Demographic and Health Survey. *Aids and Behaviour* (Accepted with minor corrections)

Submitted Articles

Kangmennaang, J., & Luginaah, . The influences of health insurance, information and knowledge access on prostate cancer screening among Dominican Republic men. *Public health Journal* (under review)

Kangmennaang, J., Thogarapalli, N., Mkandawire, P & Luginaah, . Influence of health insurance coverage on professional breast cancer screening among women in Namibia. *Cancer* (Revise resubmit)

Kangmennaang, J., Tenkorang, E., & Luginaah, . Determinants of Risky Sexual Behaviours among Adolescents in Central Africa, Swaziland and Ghana: Evidence from Three Countries Multi Indicator Cluster surveys. *African Geographical review* (Under review)

Osei, L., **Kangmennaang, J.**, Amoyaw, J., G. O., Armah & Luginaah, . Untangling the Confusion around Climate Change: Assessing the Policy-making Debates in the Parliament of Ghana. *Journal of Public Policy* (Under review)

Atuoye, K, **Kangmennaang, J.**, Kuire, V., Antabe, R., & Luginaah, . Impact of remittance on food security status of urban and rural households in Upper west Region of Ghana (Abstract accepted for publication in special issue on migration and food security). *Food Security*.

Un-submitted manuscripts

Kangmennaang, J., Luginaah, & Bezner Kerr, . Impact of agroecological practices and farmer-led knowledge exchanges on household wealth and food security in Central and Northern Malawi

Kangmennaang, J., Luginaah, & Bezner Kerr, . Impact of Migration, and remittance receipt on household food security and asset levels in Northern and Central Malawi

Tenkorang, E, Amoyaw, J, **Kangmennaang, J.**, & Nwabunike, . Determinants of HIV testing in Nigeria: Evidence from the Nigeria Demographic and Health Survey

Kuire, V., **Kangmennaang, J.**, **Antabe, R.**, Atuoye, K., & Luginaah. The influence of residential wealth on maternal health care services utilization in Nigeria and Malawi.

Atuoye, K., Kuire, V., **Kangmennaang, J.**, **Antabe, R.**, & Luginaah. Access to and Utilization

of Skilled Birth Attendants in the Context of MDG 5 in Sub-Saharan Africa

Conference Presentations

Kangmennaang, J. Impact of food security program on income and asset levels of farmers participating in an agro-ecological program in Northern Malawi. Africa heads East, Western University, November 2014, London Ontario.

Kuire, V., **Kangmennaang, J., Antabe, R.,** Atuoye, K., & Luginaah. The influence of residential wealth on maternal health care services utilization over time in Nigeria and Malawi. Abstract accepted for presentation at the Health in Africa and Post-2015 Millennium Development Goals Agenda Symposium, May 2015, Urbana Champaign.

Kangmennaang, J., Osei, L., Paul Mkandawire., & Luginaah. Circumcision status and time to first sex in Sub-Saharan Africa: Evidence from six Demographic and Health Surveys". Abstract accepted for presentation in Association of American Geographers, April 2015, Chicago Illinois.

Participant at "Beyond GDP" conference held in Humburg College, Toronto on May 01, 2015

SERVICE

Judge- Western World Challenge Challenge

Reviewer- AIDS and behaviour journal

Social committee Member— Ghana Association of London Middlesex (GALM)

Media Coordinator — Ghana Association of London Middlesex (GALM)

PROFESSIONAL MEMBERSHIP

Association American of Geographers

Canadian Association of Geographers