COMPETING DEMANDS FOR RURAL HOUSEHOLD'S TIME IN MALAWI: IMPLICATIONS ON HEALTH AND AGRICULTURE.

Master of Arts (Economics) Thesis

by

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DECLARATION

This thesis is my work. Where other people's work has bee used, acknowledgement has been duly made. All mistakes in this thesis are mine. I declare that not at any place or time has this work been submitted for similar purposes.

Candidate..... Date.....

CERTIFICATE OF APPROVAL

This thesis is submitted with our approval on behalf of the University of Malawi, Chancellor College, Zomba.

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DEDICATION

To Phindu Ndilowe my daughter, Felistas my wife and my parents

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ABSTRACT

Time is a scarce resource. Economics is about the allocation of scarce resources to competing uses (Ruuskanen 2004). The problem of the producer's choice (household) can be put as a time allocation problem: How many hours have to be allocated to agricultural and health production. Allocation of time is driven by the desire to produce the optimal possible output from health and agricultural production. This study employs a seemingly unrelated regression method to investigate the relationship that exists on the amount of time allocated to each of the two complementary but competing production processes among rural households in Malawi. The results confirm the apriori that the two production processes compete for household's time. The amount of time allocated to health production reduces the amount of time available for agricultural production.

Chapter One

1.1 Motivation of the study

The analysis of time use is essentially an analysis of the allocation of time to various activities such as work for wages, work on the family farm or enterprise, inside chores in household and outside chores. Time is essential to household welfare in a developing country context where economic agents' interaction with the outside world is relatively restricted through market activities than in developed countries. In particular, rural agricultural households are largely self-sufficient in a number of dimensions such that it is inadequate to concentrate on market exchanges. A lot of literature has emerged on time use within households. Much of this literature has concentrated on intra-household allocation of time. In intra-household allocation of time, the central focus has been the time use between husband and spouse. Some studies have related household chores to non-household chores as pertaining to time allocation; for instance, the study on Natural Resources Collection and Children's Schooling in Malawi (Nankhuni and Findeis, 2003).

Time is a productive resource and is expected to be allocated to an activity till its marginal return is equal to its marginal cost. However, in rural areas from less developing countries labour market constraints in form of transaction costs result into the allocation of labour independent of market prices. Various studies have found that in presence of multiple market failures such as land and insurance, households' marginal valuation of factors of production routinely deviates from prevailing market prices in a structurally predictable manner (Feder, 1985). Households may rationally allocate labour in violation of marginalist principle in the face of price risk (Barret, 1996), yield risk (Srinivasan, 1972), labour market search or transactions costs (Binswanger and Ronsenzweig, 1986), non-cooperative intra-household factor allocation (Udry, 1996) or location preferences as to where they work among other reasons.

Time is an important resource to the households as it affects the welfare through its effect on the livelihood source. Currently, no analysis has been done to relate household welfare

to time use in Malawi. The welfare (poverty) assessment done in Malawi has been based on consumption and is done through the Integrated Household Surveys (IHS). A problem with this measure of poverty is that it glosses over the issue of home production (Ilahi, 2000). Poor rural households' significant part of survival is through home production. In addition, consumption is the end product of utilisation of resources such as time. At the same time, leisure (which is the flip side of work) is a good that individuals obtain welfare from. An important question then is whether we should worry about the utilisation of time as a resource to be an indicator of poverty as much as we think of consumption level as an indicator of poverty.

This study is motivated by the trends in the level of agricultural production and health status Malawians have experienced over time. The level of production of health and agriculture is influenced by various factors of which many have been discussed in different forums and yet one factor, time, has been overlooked. In this case, the output from health production is the health status of the household. Time is a resource naturally endowed to households and affects all household production processes either directly or indirectly. The relationship between health and agriculture with respect to time triggers a quest for deeper understanding through an investigation on how they relate to each other. These two production functions compete for the time resource endowed to the household. While the competition in demand for household time by these two competing production processes may be seen from a loser and a winner perspective, its effects have far reaching consequences on the welfare of the household. Production of health and agriculture not only demand time directly through hours of work but also indirectly through all time associated with the gathering of inputs required by the production processes. It is against this complementary (in terms of welfare) but competing (demand for time) relationship between agricultural and health production that this paper endeavours to investigate. In particular, to investigate how the competing demands for household time affect the time allocation to health and agricultural production processes.

1.2 The Objective of the study

The objective of the study is to investigate how the competing demands for household's time affect the allocation of time to agricultural and health production. The three specific objectives for the study being;

- To investigate how the amount of time allocated to health production affects the amount of time allocated to agricultural production.
- To investigate how the amount of time allocated to agricultural production affect the amount of time allocated to health production.
- To investigate how household characteristics influence the allocation of time to health and agricultural production.

The hypotheses to be tested are:

- Time allocated to health production does not reduce time allocated to agricultural production
- Time allocated to agricultural production does not reduce time allocated health production
- Allocation of time is not influenced by household characteristics

1.3 Contribution of the study

Agricultural production is the main source of livelihood to 75 percent of Malawians (NSO-IHS, 2005). Thus, it generates income and provides food for consumption to households. Health production thrives when there is a good income and consumption base. Health production is considered as the expenditure side of a household economy. A household would do much better if all the time was invested in agricultural production. The problem with this is that health is a derived good and it is a disutility arising from low health status. Households invest in health because it enhances utility the household derives from consumption of goods and this motivates the households to allocate time to health production. Healthy households feel happier and are able to derive the highest utility from any given bundle of goods they consume than a sickly household.

The study findings will contribute to the understanding of how the competing demands for rural households' time affect both health and agricultural production. The relationship between agriculture and health is two-fold. Health enhances utility and productivity in the household and on the other hand competes for household's time with agriculture. Likewise, agriculture supports health status through nourishment and income even though it also competes for time with health. This study explores how the two production functions that compete for time can either improve the household welfare or worsen it. This study sheds more light into how the competing demand for rural household's time impact on household welfare by looking at how time use in each production process constrain the one another.

The results of the analysis of the competing demands for rural households' time will provide a better understanding of the factors that influence time allocation at household level. There are many known factors that influence time use and one of the notable factors is labour markets constraint. If labour markets are absent, then household welfare only depends on the natural resources endowed to the family where their productivity relies on time use. Thus household welfare in this sense will be a direct result of how well the household use time as a productive resource. The comparative statics of time use in production of health and agriculture would trace the rural agricultural households' welfare where markets have constraints.

The knowledge of factors that influence time use will provide a platform from which intervention programs would be designed. Thus, if policy makers know that residence affects time use, then the factors that cause differential time allocation can be rectified hence saving time for those areas where time was not being used productively. For instance, if household members spend a lot of time when accessing health services and agricultural markets, then there is a high likelihood that provision of more hospitals, roads and agricultural markets would bring high returns to health and agricultural production.

1.4 Organisation of the thesis

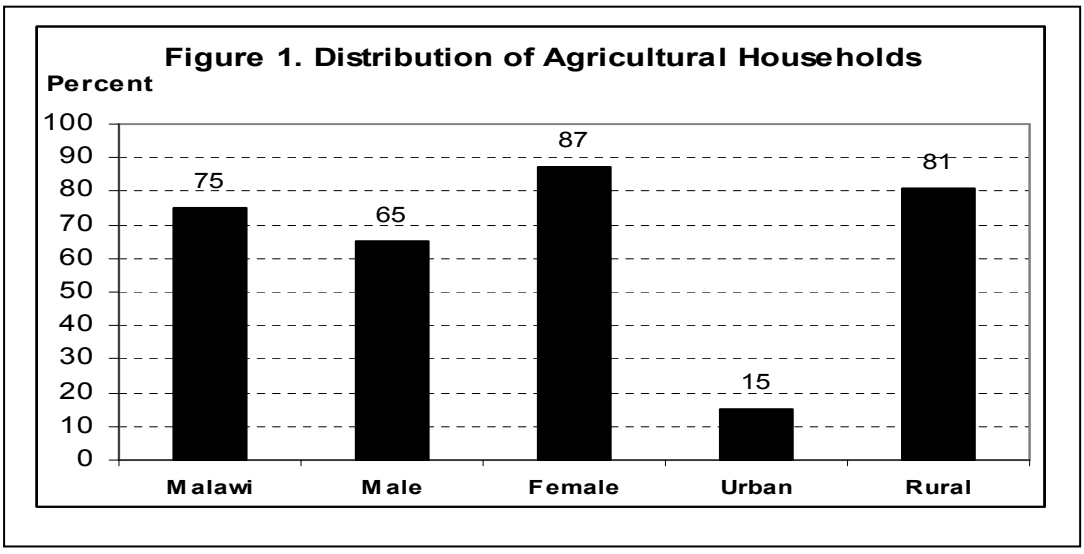
The rest of the thesis is organised as follows; Chapter 2 presents the overview of the agricultural households in Malawi. Chapter 3 presents the literature review and this comprises of theoretical and empirical literature. Chapter 4 presents the methodology, sources of data, model specification and definition of variables. Chapter 5 presents results of econometric analysis. Chapter 6 presents conclusion and policy recommendations.

Chapter Two

Overview of Agricultural Rural Households in Malawi

An agricultural household in this study is defined as a household whose livelihood is dependent on agricultural production. Agricultural production is not limited to crop production but also includes livestock farming. Crop farming in Malawi is done in two phases. The first phase is the rain-fed cultivation and the second is the dimba cultivation that relies on residual moisture.

In Malawi, about 75 percent of the population earn their living through agriculture. There are more female-headed households that are engaged into agriculture than male headed households. Most of these agricultural households are based in the rural areas and are relatively poor compared to urban households.



The poverty status shows that about 56 percent of rural households are poor compared to 18 percent urban households that are considered poor. Similarly, the rural households have an average size of 4.6 people and dependency ratio of 1.1, unlike urban households, which have an average size of 4.3 people and a dependency ratio of 0.8. The male headed households have relatively larger households with about 4.7 people compared to 3.8

people among female-headed household. The female-headed households have a higher dependency ratio of 1.4 compared to a dependency ration of 1 for male-headed households.

The agricultural households spend on average 45 percent of their daily time on agricultural activities. The distribution of landholdings is mostly concentrated between 0.2 and 2 hectares and about 30 percent of smallholder farmers cultivate less than 0.5 hectares. Very few households about 4 percent cultivate less than 0.2 hectare of land. They cultivate about 0.87 hectares during the rain season and about 0.07 hectares for dimba cultivation in the dry season. The dominant food crop in Malawi is maize and is grown by 97 percent of the agricultural households independently of region, poverty status, land size or expenditure.

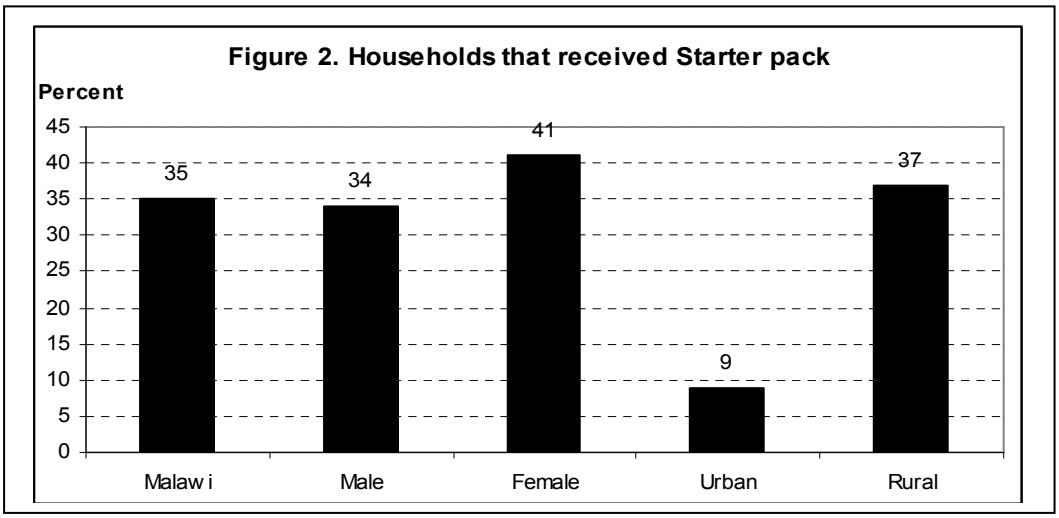
Table 1. Selected Agricultural Indicators from IHS-2 Data

Mean hectarage of land used for agriculture		1
Average percentage time allocated to agricultural production		45
Average cost of agricultural inputs		MK 9 102
Average annual income from agricultural production		MK 19 681
Percentage households with inadequate food		
	Malawi	57
	Urban	48
	Rural	58

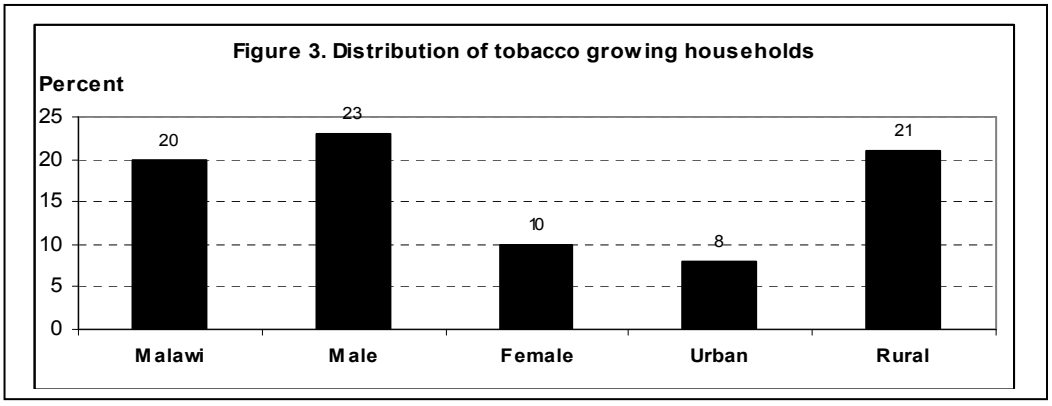
Agricultural Crop production is dependent on many factors, one of which is farm inputs. The common inputs are fertiliser and insect/pesticides. In the 2004/5 growing season, agricultural households spent an average of MK 9, 102 on agricultural inputs. The average annual income earned from agricultural production was MK 19, 681 in the 2004/5 growing season. Most rural households in Malawi are dependent on own agricultural production through subsistence farming. In Malawi, households have been food insecure; per capita maize production (major staple food crop) has been below the recommended 195 kilograms per capita for adequate caloric intake except in 1999 and 2000 at the peak of free input distribution (Tsoka, 2005). In the 2004/5 growing season,

about 57 percent had inadequate food due to low own agricultural production. This problem was high in urban compared to rural areas.

In an attempt to promote food security among vulnerable rural households, the government embarked on the Targeted Input Programme (TIP) in 1998/99 growing season. In 2004/5 agriculture season, about 35 percent of the households received the starter pack that comprised of seeds and fertiliser. The starter packs were distributed to more households in the rural area than urban areas.



Cash crops grown in Malawi include tobacco, cotton and sugar cane to mention a few. Very few households, about 20 percent, grow tobacco. Most of these tobacco growing households are based in rural areas. A high proportion of the tobacco growers, about 93 percent, have been members of a farmers' club in the last five years. Most of these tobacco farmers, about 93 percent grow burley.



Livestock is another of the main activities that agricultural households engage in. On average an agricultural household keeps 9 chickens and are kept by about 89 percent of households in Malawi. Goats are the second common livestock kept by about 35 percent of households and with an average of 6 goats per household. Only about 8 percent of agricultural households on average keep 5 herds of cattle. These animals are mainly kept in rural areas.

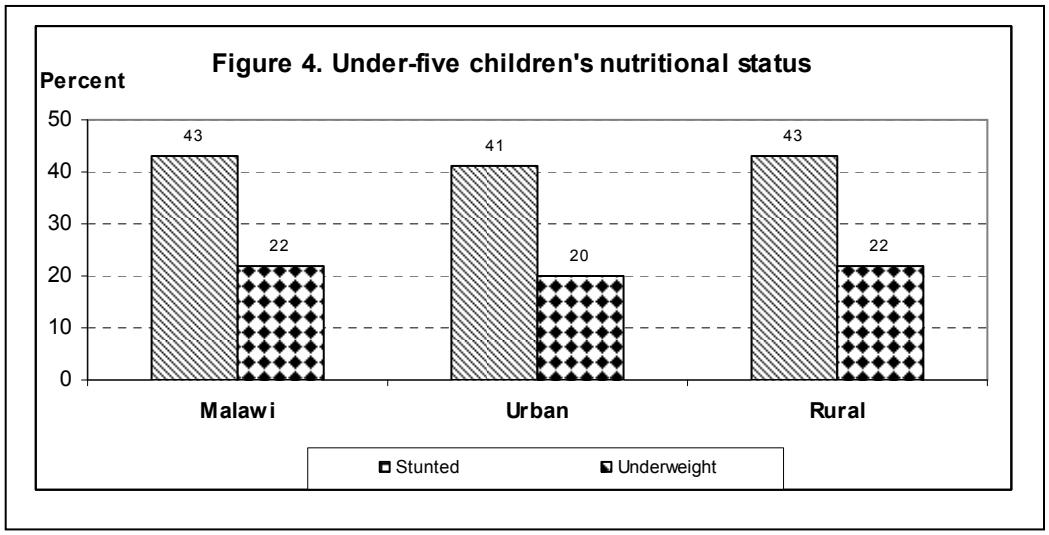
In addition to agricultural production, health status contributes to the welfare of the household. Households produce health as a commodity for two reasons. Firstly, as a consumption commodity, it directly enters into household preference functions, or indirectly, for example, sick days are sources of disutility. Secondly, as an investment commodity, it determines the total amount of time available for market and non-market activities (Grossman 1972). Most households had good health status for an average of 67 percent of their time during the IHS survey period.

Table 2. Selected Health Indicators from IHS-2 Data

Percentage mean time sick		67
Percentage mean time allocated to health production		27
Average cost of health inputs		MK 1 340
Percentage households with inadequate health care		
	Malawi	60
	Urban	53
	Rural	61

They spend on average 27 percent of their daily time to production of health. This is against a backdrop of about 60 percent of households expressing that they had inadequate health care. This dissatisfaction with health care was higher in rural areas than urban. The second most common health problem in Malawi has been malnutrition especially for the under five children. The malnutrition has remained relatively high over the years with current stunted rate at 43 percent and 22 percent underweight.

Malaria is another major public health problem apart from HIV and AIDS. In economic terms, malaria has both direct and indirect costs. Direct costs borne by individuals, households and government include cost of treatment. The indirect costs of malaria include not only the negative economic impact of morbidity and mortality in work days lost in agriculture and industry, but also absenteeism in education system, which further contributes to loss in productivity (MOHP, 2002). Malaria therefore aggravates poverty.
A relatively high rate of incidences of malaria sicknesses was reported by about 39 percent of households in the IHS 2005 survey.



Against this background, rural agricultural household will combine time with other productive resources such as land, seeds and fertilizer in agricultural production and medicine in the health production and human capital development. Agricultural production has a number of obstacles such as erratic rains, lack of land, fertilizers and seeds of which are important constraints to livelihood security. Similarly, health production has its own obstacles such as inadequate medical personnel, drugs and poor public health knowledge among the population. The HIV and AIDS epidemic has also worsened the already poor health status of rural populations.

Chapter Three

LITERATURE REVIEW

This section reviews both the theoretical and empirical literature related to agricultural household behaviour as production units.

3.1 Theoretical literature

The construction of household models started with the work of Chayanov in the 1920s as part of the debate between the Populists and Bolsheviks in Russia, where households faced no labour markets and had flexible access to land, yielding the concept of demographic differentiation as the optimum work effort changed through the life cycle (Harrison, 1975). Becker (1965) formalized the household in the new home economics, where the process of time allocation within the household when labour opportunity cost and utility is derived not directly from goods purchased but from Z-goods[1] produced in the household with purchased goods and family time. Barnum and Squire (1979) developed the full version of the neo-classical farm household model.

The household model highlights the interdependence of consumption and production decisions in the farm household. Home production is subdivided into what is separable and inseparable/nonseparable. Either household and subsistence production can be categorised as separable or market replaceable and such activities are can be delegated to paid workers because the outputs are exchangeable in the market. These are conceptually different from inseparable production. Correct modelling of household production decisions thus requires knowledge of whether a specific household is likely to behave according to separability or nonseparability decision rules.

[1] This is a symbolic presentation of the number of goods the household either produce or buy

Separability allows production decisions in the household to be made independent of consumption decisions although the later depends on the former through the budget constraint. Thus separability is attained occurs when there are no market constraints that affect home production decisions such that production activities are exchangeable in the market. Separability is attained whenever prices are exogenous and markets are used even if sale and purchase prices are not identical. The only problem is that both price of output and wage rate enter into both the production and consumption decisions. This separability is of interest because it justifies a large number of well developed methodological approaches in farm household studies among these being the various duality approaches. Sasaki and Maruyama (1966) and Jorgenson and Lau (1969) both independently found the existence of perfectly competitive goods and factor markets to be sufficient for the existence of separability under deterministic conditions. There are a large number of things that can upset this result even in the deterministic setting, e.g. non-homogeneity of labour as in Kuroda and Yotopoulos (1980) and the recognition of the role of risk threatens separability even in a competitive setting as pointed out by Barnum and Squire (1979). When contingent claims markets exist or households are risk neutral, separability exists under risk situations. Fabella (1989) argued that risk does not generally lead to nonseparability, which seems to be a product of a multiplicative risk allowing for marginal risk increasing inputs. Multiplicative yield risk allowing for a marginal decreasing input (e.g., the Poper-Kramer specification) allows "asymptotic" separability, i.e., the influence of the disturbance term becomes progressively negligible as farm production scale increases. Additive risk through crop diversification renders the household production model separable in the sense of efficiency only. Thus additive risk in production or monetary revenue results in separability regardless of risk attitude. By contrast, production and consumption decisions are nonseparable when there are market failures: in this case variables that affect consumption decisions (such as wealth, household's total family labour endowment, consumer goods prices and household characteristics affecting consumption) also affect production decisions.

Nonseparability of household production and consumption decisions on the other hand occurs when the effective price of a commodity used both in production and consumption

is not exogenous to the household, but is determined endogenously by household demand and supply (Kuiper and Tongeren (not dated)). In this case production decisions will affect supply of the commodity, which affects its shadow price and hence consumption decisions and vice versa. Such nonseparability occurs if households are not price-takers in a market, if markets are missing, or if there is a gap between buying and selling prices (Lofgren and Robinson 1999). Since market exchanges are restricted under the inseparable model, most production activities are classified as social production. These productive processes are carried out by members of the household and can not be handed over to paid workers and are commonly referred to as grants (Engberg et al). Their classification of grants was based on the examination of three categories of social production. (i) Intra-household activities such as bringing up[children, caring for the sick and elderly and serving as mediators inside the family. (ii) Inter-household activities such as helping members of extended family or neighbours and contributing towards weddings and funerals. (iii) Community service such as working as volunteers in socio-economic groups or self-help projects. Thus inseparability in household production will account for how rational behaviour of farmers in combination with market failures may give rise to sluggish or counterintuive household responses. Nonseparability/inseparability from the discussion is mainly a feature of the indigenous economics.

Tests of separation/complete markets have been carried out in order to ascertain the applicability of the separability of household decision-making. Benjamin (1992) finds no evidence that changes in household composition affect labour demand on farms in Indonesia, and thus cannot reject the separation theorem. Similarly, using the same Indonesian data, Pitt and Rosenzweig (1986) found no effect of illness of either the household head or wife on farm profits and could not reject separation. Benjamin (1992) and Bowlus and Sicular (2003) could not reject separability for households in Java and China, respectively. On the other hand, there are other contexts in which there is nearly complete absence of a set of factor markets that makes the separation hypothesis untenable. Fafchamps (1993) finds that there are severe seasonal labour constraints in rural Burkina Faso. Production plans are developed in order to work around these constraints. Production decisions therefore are no longer as simple as is the case when

separation is valid. Fafchamps (Ibid) estimates the non-stationary stochastic control problem which farmers face. This is the first such estimation procedure which uses continuous decision variables to appear in the economics literature. Jacoby (1993) estimates an agricultural production function for households in the Peruvian Sierra. The households' labour supply decisions are then estimated using shadow wages which can be inferred from the production function. Jacoby finds that the market wage does not equal the estimated marginal product of labour, violating the separation theorem. Jere et al. (1996) and Foster and Rosenzweig (1994a, 1994b) find that productivity of a worker is affected by his or her nutritional status, but that wages do not fully reflect the increased productivity resulting from improved nutrition, violating the separation hypothesis. Lopez (1984) and Grimard (2000) reject separation theorem for households in Canada and Cote d'Ivoire, respectively.

In this study a more plausible assumption of nonseparability is adopted. Nonseparability arises in Malawian rural agricultural household for several reasons. Binding hour's constraints in off-farm employment may prevent complete adjustment in agricultural labour markets (Benjamin, 1992). Farmers may have preferences towards working on or off the farm (Lopez, 1984). Under any of the preceding circumstances, the production and consumption decisions of farm households must be treated as nonseparable in the sense that their labour supply choices cannot be considered independently of their labour needs on the family farm (vice versa). In addition, production is considered inseparable because of the social inter-personal relationships involved. Only a member of the household or family carries out the activities identified as social production, and they cannot be handed over to paid workers. According to Kenneth Boulding, such activities may be considered as 'grants' namely one-way transfers of goods and services rather than exchanges and are said to serve a necessary integrating function within family and community.

3.2 Empirical literature review

Household production is an important part of economic activity, although generally ignored in national income accounting. The value of home production is estimated to account for 40-50 percent of total production in Western countries and in less advanced economies this fraction is presumably even higher (Bonke, 1992).

The productive role of households was ignored in the early neoclassical models where all non-labour time aspects like health production were addressed as leisure. Now, the household production theory is an established economic theory. In 1960s mainstream economists began to pay serious attention to household decisions, when Mincer's (1962, 1963) and Becker's (1965) pioneering work in new home economics imported quantitative methodologies to analyze household decision-making. In this new home economics, Becker (1965) and later Gronau (1977) extended the conventional labour supply model of consumption and leisure by incorporating home production as yet another activity that requires human capital.

A lot of studies have been carried out on time use. Some studies have carried out their analysis using the agricultural household models with or without the separation hypothesis. Others have carried out an intra-household analysis of time allocation testing for the assumption of unitary preferences model.

Apriori it is difficult to obtain the direction of changes in wages. This is because income and substitution effects of a wage increase work in opposite direction and the end result depends on which portion of the labour supply function an individual is located. Skoufias (1993) using panel data from India finds a positive and significant effect of wage on market labour. Khandker (1988) finds own wage is positively associated with female labour participation in Bangladesh. Ilahi and Grimard (1999) who model time allocation to water collection also find wage reduces women's time in water collection and increase their time in housework. This shows that time use is allocated in such a way that the households attain the highest possible utility. Accessibility of basic services such as

natural resources also affects the allocation of time in rural households. Nakhuni and Findeis (2003) using data from Malawi find that fewer children from districts where there is high deterioration of natural resources are likely to be in school. These children spend most of their time gathering firewood and other resources and have little time for schooling. Kumar and Hotchkiss (1988) who use a sample of households from hilly regions of Nepal find that a deterioration in access to forest wood tend to increase the total time women spend in collecting firewood and lowers their time in on-farm activities. Engberg et al (1987) using a descriptive analysis of two sample villages in Malawi found out that women spend a substantial amount of their time compared to men in home production. Likewise, men were seen to work more in tobacco farming than males despite the fact that they both participate in both market and home production.

The health status in the household greatly affects time allocated to various activities. First in order to maintain incomes and to complete household chores, non-sick members have to substitute for work of sick individuals by reducing their own leisure a "substitution" effect. Second, sick members require direct attention from non-members a "care" effect. For these two reasons, the sickness of adults and children would have different effects on household time use (Ilahi, 2000). The impact of sickness on adult time use and that is assumed to have household-level effects, i.e., they are generated as a household rather than at an individual level process Ilahi (1999a, b). The results are that sickness affects the composition of adult time. Mortality has also been found to have an effect on time use. Anglewicz *et. al.* (2005) finds that HIV and AIDS-related mortality and morbidity at the household level induces diversification of income sources, with women reallocating their time from work-intensive (typically farming and heavy chores) to cash generating tasks (such as Ganyu) in Malawi. Ganyu is a part-time work that an individual does for an agreed wage basically on temporal basis and this is common for unskilled individuals and in rural areas. Vulnerability of a household or an individual also affects time use especially among orphans (Guarcello et al, 2004). In this study a bivariate probit was used to estimate the probability of working as a function of a set of individual, household and individual characteristics that were well known and relevant for such decision. The found a clear relationship between orphan hood and time use. Becoming an orphan

appeared to increase child vulnerability by making it more likely that a child is denied schooling. Differences in terms of probable time use were also established through simulation analysis across orphans and non-orphans.

The empirical evidence indicates that time is a major resource to the rural agricultural household. In whatever the household does the only resource they have ultimate control of is time. Preferences and household assets influence the allocation of time in households. Likewise, this study puts agricultural production as the remunerative part of time use where as health production as the expenditure part of time use. The primary goal of the rural household is to maximise the income and consumption from agricultural production.

Chapter Four

METHODOLOGY

4.1 Introduction

This chapter focuses on four areas. Firstly, a brief description of the data source for the empirical analysis. Secondly, the specific form of the econometric model and the expected signs of the variables are presented. Finally, the presentation of the specific types of the econometric and statistical packages used to analyse the data and the procedure used to estimate the econometric models.

4.2 Data Source

The data for analysis were obtained from The Second Integrated Household Survey (IHS 2, 2004/5) conducted by National Statistical Office (NSO) from March 2004 – April 2005 and the sample size had 11,280 households. The data were collected from a national wide sample of Malawian households. The survey had two structured questionnaires, community and household. This study makes use of the data collected through the household questionnaire. The survey collected data on demographic and socio-economic characteristics of the households. Specifically, data were collected on household demographic characteristics, time use, education, health, agriculture, income sources, consumption expenditure, security, access to credit, HIV and AIDS and a few more. This data source was selected because it has data that on agriculture, time use, health indicators and income variables required by this study.

4.3 The Model Specification

In order to address the research questions and to empirically test the competing demands for rural households' time and then assessing their implications on agricultural and health production, the empirical model is presented. This is done taking into account the fact

that the choice of the functional form in an empirical study is important, since the functional form can affect results (Kebede, 2001). There are several functional forms that have been developed to measure relationships. The most common forms are the log-linear and the transcendental logarithmic (translog) functions. This study adopted the log-linear function in order to empirically analyse how households allocate time to the competing but complementary production functions. The log-linear model gives parameter estimates that are elasticities, which are relatively easy to interpret than the translog function. Additionally, its specification is simpler compared to the translog function. The log-linear function is chosen because of its ease and relevance to the study objectives.

The model is adopted from the generalised form of the log-linear production function developed by Wilcoxen, (2000). The equations specified below will be estimated as a system of equations. The log-linear functions are specified as,

$$T_a = \beta_0 + \beta_1 X + \beta_2 A_i + \beta_3 T_h + \beta_4 \overline{L} + \beta_5 M_a + \beta_6 T_s + \nu \ldots\ldots 1$$

$$T_h = \alpha_0 + \alpha_1 X + \alpha_2 T_a + \alpha_3 H_i + \alpha_4 M_h + \alpha_5 T_s + \psi \ldots\ldots\ldots\ldots\ldots 2$$

Where

T_a = Log of percentage mean amount of time allocated to agricultural production by household i(i=1, 2 …n)

T_h = Log of percentage mean amount of time allocated to health production by household i(i=1, 2 …n)

A_i = The log of total value of agriculture output for household i(i=1, 2 …n)

H_i = Log of the health status of household i;(i=1, 2 …n)

$\overline{L}$ = Log of total land used for agricultural purposes by a household i(i=1, 2 …n)

M_a = Log of total cost of agricultural inputs used by the household i(i=1, 2 …n)

M_h = Log of total cost of health inputs used by the household i(i=1, 2 …n)

T_s = Log of percentage mean amount of time allocated to sale of labour by household i

X = Household characteristics

ν, Ψ = Stochastic disturbance terms which take care of the measurement errors in the time, production variables and errors in specification of relationships.

In this study only amounts of time allocated to health, agriculture and casual labour have been excluded from the analysis. The data collection process did not use a diary of time expenditure, which normally has an identical period of reference. Home production encompasses a wide range of activities that would be difficult to disaggregate it from time allocated to health production in the absence of the diary of expenditure of time.

4.4 Definition of variables

Land – The total land in hectares that is either owned and used or rented by the household. The land considered in this study is one used for household own agricultural purposes only.

Inputs – This is the total cost of all inputs that are either used in agricultural production or health production. The monetary value is used for easy aggregation. The inputs into agricultural production include fertilizer, pesticides/insecticides, tools like hoes and any expenditure on materials used for agriculture. In case of health, all expenditures on preventive measures such as expenditure on mosquito nets, insecticides and treatment both modern and traditional.

Time allocated to an activity – this is the percentage of the mean time allocated to that related activity i.e. health to the total time available to the household with particular emphasis to the reference period in the questionnaire. This is the average time that the household spends in carrying out activities that are classified as contributing to agriculture, health or sale of labour. Time allocated to health includes caring for the sick,

travelling to access medical or traditional treatment and preventive materials. Time for sale of labour includes the time the household engages in temporal remunerative activities (ganyu). Time for agriculture includes all time spent working on the farm, herding animals and accessing the inputs.

Agricultural output – this is the total production realised from agricultural production and this include crop and livestock production all expressed in monetary values for easy aggregation.

Health status – This is represented as the percentage of the mean number of days the household did not experience a sickness to total number of days (Within the question's reference period). The higher the percentage the better the health status is for the household and otherwise.

Household characteristics – These include sex, age, education level, economic activity and residence of household head, household size, and participation in cash crop growing and being a beneficiary of the starter pack program. Sex is included as a dummy variable with one representing male and zero for female. Age and size are represented as continuous variables converted into a logarithmic form. Residence is included as a dummy variable with one representing rural and zero for urban. Education level of household head is a dummy variable with one for household head with some education and zero for no education. Economic activity dummy assumed the value of one if the head is involved in farming and zero for non-farming activities. A household was assigned a value of one if it participated in tobacco growing for the past five years prior to the survey and zero if it did not grow tobacco. Tobacco was a proxy for participation in cash crop farming. If a household received starter pack it was assigned the value of one and zero if it did not receive the starter pack.

4.5 The Expected Signs

The expected signs of the coefficients of the regressors as predicted by the models depend on how the change in the variable relates to time allocated to agricultural production. Any change in a variable that affects production in either agriculture or health affects how the household allocates its time. Thus the coefficient of the influencing variable should have either a positive or a negative sign. For instance, if an increase in time allocated to sale of labour reduces time allocated to agricultural production output, then it should have a negative sign on its coefficient.

The expected sign for land is positive. An increase in land available to the household for agricultural production increases time allocation because the household would increase agricultural production by increasing the size of land it cultivates. When more land in available, more agricultural activities are carried out and this results in an increase in time allocated to agriculture.

The expected sign for inputs into agricultural production is positive. An increase in the utilisation of inputs like fertiliser, pesticides and improved seeds increases agricultural output and time for agricultural activities. Increased use of fertiliser increases agricultural output since the application of fertiliser itself demands time and likewise for the other inputs. The process of procuring the inputs in the rural areas demands a lot of time due to poor infrastructure and availability of input markets.

The expected sign for household size is positive. An increase in household size implies that the households have to produce more in order to meet their needs. This result in an increase in time they will allocate to agricultural production through venturing into more agricultural activities like dimba cultivation or livestock farming. This will hold only where access to land is not limited.

The expected sign for total time allocated to health production is negative. An increase in time the rural households allocate to maintenance of health results into less time available

to agricultural production, for instance, caring for the sick and searching for health facilities. The time use in maintaining the household health reduces time use for other activities like agriculture.

The expected sign for total time allocated to sale of labour is negative. An increase in time the rural households allocate to off-household's farm work results into less time for own agricultural production. Working on other households' farms, public works programmes and others reduce time the household labour can be used for own agricultural production. The time they work for money or food elsewhere reduces the amount of time available for own agricultural production.

The expected sign for inputs to time allocated to health is positive. An increase in the utilisation of inputs like vaccines, medication and medical check-ups require allocation of time. Visits to health facilities are associated with travel and waiting time and this add to time allocated to health production. In rural areas, the absence of good roads and low access to health facilities contributes to high demand for households' time by health production process.

The expected sign for total time allocated to agricultural production is negative. An increase in time the rural households allocate to agricultural production leaves less time available to health production. Households that combine both rain-fed and dimba cultivation allocate more time to agriculture than those who rely only on rain-fed cultivation.

The expected sign for total time allocated to sale of labour is negative. An increase in time the rural households allocate to off-household's farm work reduces time available to other activities such as health production. Working on other households' farms, public works programmes and others reduce time the household allocate to own health production. The time they work for money or food elsewhere reduces time use for health production.

The expected sign for agricultural output is positive. A household is expected to produce more agricultural output only if it invested more into agriculture. One of the inputs that a household can increase is time allocation. A higher output level in agricultural production can be realised if more time is allocated to agricultural production.

The expected signs for household characteristics are as follows; expected sign for the age of the head of household and the household size should be positive. As the household head ages, the household size increases with it, thus the demand for good health and food (agricultural production) rises with it and hence the time required producing both agriculture and health. The education level of the household head is expected to relate negatively to level of agricultural production. When the education level is high, the tendency is that the household heads engage in other activities different from agriculture such as formal employment. The education level of the household head is expected to be positively related to time for health production. Education increases the knowledge for good health practices and hence raises its demand.

The expected sign for residence is positive. The rural residence is expected to be positively associated with the amount of time allocated to both health and agricultural production. In rural areas, the most common economic activity is farming and households are expected to invest more time in this activity than their urban counterparts can. Low access to markets and health facilities also affect how the households allocate time to these two production functions.

4.6 Data Analysis

The analysis of data was done using both econometric and descriptive analysis. The computer program of Stata 8 was used to estimate the log-linear functions and Statistical Package for Social Scientists is used in conducting descriptive analysis. Most of the statistical analysis included aggregating the individual household members' time use to a household average time allocation of time to the activities such as casual labour. In the

case of inputs and production, the items were converted into monetary terms and aggregated in some instances where the data was collected at plot level.

4.7 Estimation Technique

In this study, Stata 8 software was in carrying out the Seemingly Unrelated Regression (SUR) technique of estimation. The SUR estimation procedure yields coefficient estimators at least asymptotically more efficient than single-equation least-squares estimators. The estimated model facilitates a more efficient estimation by consideration of a possible correlation of latent explanatory factors in household time allocation function. In this procedure, regression coefficients in all equations are estimated simultaneously by applying Aitken's generalised least-squares to the whole system of equations (Zellner, 1962). The Aitken's estimators are constructed by employing the estimates of the disturbance terms' variances and covariances based on the residuals derived from an equation-by-equation application of least-squares.

The SUR was chosen in this instance not only because of the highlighted advantages but also the nature of the analysis that was to be carried out. In the studies by Nankhuni et al and Guarcello et al, they used probit analysis because they were looking at the probability of having certain attributes affect the use of time. In both these studies they dwelt much on schooling versus the status of an individual or household. In the study by Engberg et al they carried out a comparative analysis using a descriptive approach. In this study they were looking at time use in two sampled villages with slightly differentiated attributes. In one village, farmers grew tobacco and the other did not. Their analysis was to relate how tobacco farming affects food production and consumption as they relate to nutrition status across the seasons. The probit methodology in this case would not lead to the achievement of the stated objectives. The probit usually give the probability of an occurrence given some information. In this study, the purpose is to investigate how time is allocated to competing household production processes and to establish this a system of equations in form of SUR was to be estimated. The theoretical underpinning of this study, the nonseparable household model implies that that there is dependency in the

latent variables of time allocation and as such a more efficient estimation technique be used in order to obtain estimators that would be asymptotically efficient.

The log-linear function is chosen because of the ease with which the coefficients can be interpreted. This has the advantage that the results presented are elaciticities that indicate the relationship between the independent and the dependent variables. In this study, the SUR is used because of its efficiency gains that it provides in this nature of relationships being studied.

Chapter Five

EMPIRICAL RESULTS AND INTERPRETATION

5.1 Introduction

This chapter presents and interprets the results of econometric analyses. The SUR is used to estimate the time allocation to health and agricultural production equations.

5.2 Results for the Seemingly Unrelated Regression Method

The purpose is to test how the time allocation is influenced at household level. The time allocation functions to health and agricultural production are estimated using SUR. The system of equations and the results of the estimation are presented and evaluated below.

The time allocation system of equations performs reasonably well despite the low R^2 – squared. The low R^2 –squared is a common statistic in cross-sectional studies and does not imply poor performance of the regression model (Gujarati 1995). The overall system of regression equations best fits the model since the chi-squared statistics of 10870.92 and 13049.34 are statistically significant, both with p-values of 0.00.

Table 3. Overall significance of the system of equations

Equation	Obs	Parms	RMSE	R-sq	chi2	P
Time allocatedto health	5549	13	0.17	0.38	10870.92	0.00
Time allocatedto agriculture	5549	13	0.62	0.48	13049.34	0.00

Table 4. The estimated SUR model of time allocation

Variable	Time for Agriculture production		Time for Health Production	
	Coefficient	z	Coefficient	z
sex	0.09	4.31*	0.01	2.31**
reside	0.41	8.84*	0.11	8.32*
edulevel	0.06	3.04*	0.01	2.91*
econacti	0.36	19.32*	0.07	13.3*
cashcrop	0.04	1.86***	0.01	1.73***
starter	0.06	3.37*	0.01	2.99*
lnhhage	0.09	4.01*	0.03	4.49*
lnhhsize	-0.35	-21.44*	-0.08	-16.89*
lnvtotcrop	0.01	2.55***		
lnhealthti	-3.33	-103.28*		
lnagrictim .			-0.25	-103.19*
lnland	0.01	2.41**		
lnstatushe			0.01	0.8
lninputagr	0.01	0.81		
lnhealcost			-0.001	-0.79
lncaslabou	0.03	2.4**	0.01	1.6
_cons	7.95	50.89*	2.31	56.23*

*** denotes Significance at 10% ; ** Significance at 5% ; * Significanceat 1%

The sex dummy is statistically significant meaning that male-headed households allocate more time to health and agriculture than do female-headed households. The result reveals a different trend in time allocation. It is expected that female-headed households would allocate more time to household production than male headed households due to their vulnerability. On the other hand male-headed households allocated more time to agriculture than do the female-headed households. This result conforms to the findings in the hilly region of Nepal by Kumar and Hotchkiss, 1998 where it was found out that even though both females and males work together in agriculture, men contribute more. This is the case because male headed households are more likely to be engaged in cash crop growing than female-headed households as indicated by high proportions of male heads that grow cash crops (figure3). Thus more male heads, about 23 percent grew tobacco than about 10 percent of females in the last five years.

The residence dummy is statistically different from zero. Thus, this implies that rural households allocate more time to health than their urban. Rural households spend more time searching for health facilities than do the urban counterparts because health facilities

are fewer in rural than urban areas. In rural areas of developing countries the infrastructure for provision of basic facilities is poor or non-existent. In Malawi, about 67 percent of the population in rural areas travel more than one hour to access the nearest health facility compared to about 43 percent of their urban counter parts (NSO-WMS 2005). Thus this supports the result that rural households allocate more time to health than those in urban areas. On the other hand the dummy for rural residence is positively related to time allocated to agriculture. Most agricultural household are based in rural areas where there are few or no industries that can offer alternative employment apart from farming. Thus the majority of rural households, 75 percent engage in the only available form of economic activity, agriculture, and allocate more time to it than any other economic activity.

Education level is positive and significant in both equations. In the case of health time, the result is as expected. This relationship arises from the fact that education increases awareness of incidences of diseases and best health practices. Thus, households whose head is educated are expected to invest a lot of time into health production. In the time for agriculture equation, the results do not conform to expectations. Fafchamps and Quisumbing, 1997, found out that in rural Pakistan, households with better educated males earned higher off-farm income and divert labour resources away from farm activities towards non-farm work. They confirmed that better educated households put significantly less emphasis on farming.

The economic activity of the household head is significant and positive. This result is partly influenced by the residence. Most farmers are located in rural areas. The fact that they are in rural areas implies that their primary occupation is farming and hence allocate more time to agriculture. In case of health, the farmers being in rural where health facilities are few and are compelled to allocate more time to health production than those engaged in off-farm economic activities since they are based in urban areas. The same applies to the participation in cash crop farming and beneficiaries of starter pack affect time allocated to agricultural production. The cultivation of cash crops makes the household allocate more time to agriculture since cash crops are grown to supplement

income shortfalls from food crop production. In case of starter pack, the inputs received induce more time allocation to agricultural production through the use of the inputs. Fertiliser and insecticides application requires labour and hence time to be spared for such activities. On the other hand, the cash crop and starter pack dummies indicate a positive relationship with time allocated to health production. This relationship deviates from the apriori since the expectation is that they should have a negative impact on health production time. The results are not surprising as they are influenced by the residence factor. Most recipients of starter pack and cash crop growers are resident in rural areas where health facilities are scarce.

The household size has a negative sign and statistically significant from zero. This is in conflict with the expected sign since as the household size increases, the demand for health and agriculture rises and too with time allocated to health and agricultural production. This may be a result of fixed and scarce land resources. Most households have limited access to land and as the household grows in size, the amount of time they require to work declines. On the other hand, the amount of time an individual invests in health will have its benefits spread over a large number of people (economies of scale), thereby reducing the amount of time allocated to health. The household size will definitely affect the composition of time within the household through reallocation of time within the household members.

The age of the household head is positive and is statistically different from zero. Thus as the household head ages, the household grows in size and hence the demand for health products rises with it. This result concurs with the findings in Botswana by Mueller (not dated). Thus as the household head ages, the household grows larger and hence the demand for agricultural and health products rise with it. The age of household head and household size are expected to be highly collinear from a demographic point of view. As the head of household grows old, the household size rises with it such that their influence on time allocation is similar.

The results of the household characteristics show that time allocation in households is influenced by the household characteristics. The results dispute the hypothesis that household characteristics do not influence time allocation. This implies that household with different characteristics allocate time to various activities differently.

The health status is positive and statistically different from zero. It is expected that a household with good health status should allocate less time to health production. Thus the household will have more time to generate income and consume more leisure. This result may be attributed to the fact those people who have better health status become more cautious about their health and spend more time investing in health care (Strauss and Thomas, 1998).

The time allocated to agricultural and health productions have the expected signs and statistically different from zero. This conforms to expectations that as more time is allocated to one production process, less time will be available to the other production processes. Ilahi and Grimard, and Ilahi and Jafarey (1999) found similar results in studying the access to basic utilities and time use. They found out that deterioration in the access to water in rural Pakistan was positively associated with the amount of time women allocate to water collection but also negatively associated with time allocated to other activities. In general, the household demand for health is likely to be inelastic where as that for agricultural work may not be since it has a number of substitutes such as small scale trading businesses. Thus the negative relationship between time allocated to health production and time allocated to agricultural production in both equations show that the amount of time allocated to one production function reduces the amount of time allocated to the other. The results dispel the null hypotheses of the study that time allocated to health/agricultural production function does not reduce the amount of time allocated to the agricultural/health production processes. The results then account for the existence of competition for the household's available time between health and agricultural production.

The cost of health inputs has the unexpected sign and is not statistically different from zero. The result concurs with the findings of Anglewicz, et al (2005). This implies that the more the household buys health care the lesser disruptions they will face from poor health status. A priori, the demand for health inputs was expected to be positively associated with increased time allocation to health. Thus, medical check-ups, vaccination and treatment are associated with travelling and waiting time at the health facilities.

The level of agricultural output is positive and statistically significant from zero. It is expected that a household's level of production increase only when the household allocates more time to agricultural production. The households in this study realised high production because they had invested more time into agricultural production. The time allocated to health production has the right sign and statistically significant from zero.
Land is significant and positively related to time allocated to agriculture. This conforms to the *a priori* that as land available for agriculture increases, the household expands its agricultural activities and so the time for agriculture. This result is only applicable in cases where land is not a constraint.

The cost of agricultural inputs carries unexpected sign and is not statistically different from zero. This deviates from the expected results, as use of agricultural inputs requires more time to be allocated into agricultural production. Use of inputs in this case does not increase time allocated to agriculture even though the use of the inputs themselves for instance application of fertiliser consume households' time.

The time allocated to casual labour carries unexpected sign and is not significantly different from zero. The results in both equations confirm the existence of households that are net sellers of labour. Households sell extra labour in order to supplement on other goods the households demand but do not produce themselves. That is to say households make decisions in advance as to how labour will be exploited in order to meet various needs. This result indicates that a household reduces time from leisure rather than time allocated to agriculture. This is in line with the findings of Gutierrez (1998) who assessed

how a mother's care time responded to unexpected changes in health status of a child. She found out that mothers absorb the shock through their leisure.

Chapter Six

CONCLUSIONS AND ITS IMPLICATIONS

6.1 Introduction

This chapter presents the conclusions on the findings and policy recommendations derived from the results. The study used the seemingly unrelated regression method to investigate the relationship between time allocated to household agricultural and health production processes. The results conformed to the apriori that agricultural and health productions compete for household's time. Thus an increase in hours allocated to one production process reduces the amount of time left for the other production process.

6.2 Conclusion

The study results indicate that time allocated to agricultural production is negatively related to time allocated to health production. Agriculture being the main livelihood source is considered the main activity and health as the secondary activity that is demanded since it enhances utility and productive capacity. A household that has poor health status will allocate more time to health production through resting and searching for medical care. A household spend most of its productive time if health facilities are inaccessible. The time is wasted in the sense of agricultural production through travel and queuing at the scarce health facilities. The time the household spends in accessing health care and resting directly reduce the time the household can work in agriculture. Agricultural time is lost through sick days of an individual and of the household through the care they will provide to the sick member of the household. An agricultural household that has good health status will work more and produce more from agriculture given the necessary inputs and adequate land than a sickly household.

The increased productivity in agriculture also augments health status of the household through nourishment and income. Through agricultural production, the household obtain foodstuffs and income upon sale of the surplus produce. Time allocated to agriculture as established from the results reduce time available for health production. Agricultural production demand more time when cash crops are grown, markets for inputs and outputs are inaccessible as shown by the results of the residence of the household.

The results on time allocated to casual labour (sale of labour) were contrary to the expected results. This result does not imply that involvement in casual labour has no effect on household time allocation. This result has revealed the need to include leisure time in such type of analysis as it is implied that the households forgo leisure to when they engage into casual labour. This does not come out clearly in this study because time for leisure was not included among the explanatory variables.

The results of the analyses revealed a residence effect. Generally, rural areas have fewer health facilities and non-farming job opportunities. The presence of fewer health facilities in rural areas has a direct and an indirect influence on time use as regards health production. Similarly, a narrow range of off-farm economic activities leaves the household with no other opportunities but farming. Thus all economic activities a rural household can be engaged in is agricultural related in nature.

6.3 Study Implications

The study result reveals competition for households' time by the production processes of health and agriculture. The amount of time the households allocated to health production is dependent on the location of the household and hence affects time allocation to other production processes. The results of the study have also shown that most heads of households who have better education tend to be engaged in non-farming activities. By the same results it implies that they allocate more time to other productive processes other than agriculture. Thus competition for time use is between health production and the main economic activity they are engaged into. Residence and education level

influence the way households allocate their time to agricultural and health production. Household characteristics to some extent influence time allocation especially age of the household head and house hold size. This reasoning requires further research in order to fully understand how time use and leisure are related in rural households of Malawi considering that the data set used had no time allocated to leisure.

The sex of household head also has an effect on time allocated to health. The results revealed that male headed households tend to allocate more time to both agricultural and health production. This result does not conform with the apriori especially for time allocated to health. Further studies need to be carried out but using an appropriate data collection tools such as a diary of time use so that an in-depth analysis of time dynamics at household level across gender is done.

6.4 Limitations of the study

The study had one major limitation on the type of data used in the analysis. The data was collected from a questionnaire that was designed to collect cross-sectional data for poverty measurement through consumption expenditure. Juster and Stafford (1991) argued that the method of measurement is more critical when it comes to time use than in other measurement typically undertaken in economics. The module that collected data on time use was not designed as a diary of time expenditure; as such the data was not as precise as would be if the diary were used. The responses relied on respondents' ability to recall and considering the complicacy of time use it was very difficult to come up with reliable data. The reference periods for various allocation of time to particular activities were different such that a meaningful analysis is difficult to be carried out. The study should in as much as possible collect much data on all possible time allocations. A study on the same that would collect data using the diary of time use would provide better understanding and analysis of time use dynamic within the Malawian households.

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