

**DETERMINANTS OF FARM LABOUR MARKET
PARTICIPATION AND LABOUR SUPPLY OF FEMALES IN
MALAWI**

Master of Arts (Economics) Thesis

by

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Candidate's Declaration

I hereby declare that this thesis is my own work. Where other people's work has been used, acknowledgement has been made accordingly. I also declare that it has never been submitted in any other university for similar purposes of academic achievement and publication.

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Approval Page

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

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Dedication

To my late Mum and Dad, I will always remember you.

Finally, very special thanks go to my wife, Patricia Kachingwe Gondwe. May God abundantly bless you my dear for the role you have played during the past two years of my study.

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Many thanks to all my classmates you were extremely wonderful.

Abstract

Female labour supply has been rigorously researched in the literature. In Malawi, however, studies on female labour supply do not exist. The objective of this study is to explore the determinants of farm labour supply of females. The recent IHS survey for 2005 has shown an increase in participation of females in the labour force. In the recent past women have been marginalized in terms of access to employment opportunities henceforth they participated less in the labour market in comparison with men. An integrated household survey conducted by the Government of Malawi through National Statistics Office from 2004 to 2005 provides a data source used for this study.

This study uses Tobit Type II model also known as Heckit after Heckman (1979) because the Heckit Model is simple to apply (Hill, 2003) and secondly, because hours of work as a continuous dependent variable in the sample is censored. The problem of censoring occurs for the dependent variable because it is observed only for labour market participants. Simple use of OLS will be biased and inefficient due to presence of censored observations which may result in selectivity bias. However, using OLS within the Heckit framework allows us to control for selection bias. The model has been adapted to suit local economic conditions since Malawi as a developing country labour markets may not be well developed hence we focus on agricultural labour where hours of work are flexible. Comparison with a simple Tobit is made in order to check for sensitivity of parameters of farm labour supply.

The major findings from this study confirm the hypothesis that there is high labour market participation of females in the rural than urban and there is a presence of a positively sloped female farm labour supply curve with backward bending characteristic. An own female wage elasticity of about 16% and the income compensated cross substitution effect of a spouse' wage is around 3% although not statistically significant at 10%. This indicates that leisure time of the woman is taken jointly with her husband's leisure.

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Acronyms

GOM	Government of Malawi
HIV AND AIDS	Human Immunodeficiency Virus and Acquired Immune Deficiency Syndrome
IHS	Integrated Household Survey
ILO	International Labour Organisation
MDGs	Millennium Development Goals
MGDS	Malawi Growth and Development Strategy
MLE	Maximum Likelihood Estimation
MPRS	Malawi Poverty Reduction Strategy
NSO	National Statistics Office
TEBA	The Employment Bureau of Africa
IV	Instrumental Variable Method
IMR	Inverse Mills Ratio

CHAPTER 1

1.0 INTRODUCTION

Malawi is a developing country that is heavily dependent on the agriculture sector as its backbone. The agriculture sector contributes about 37 percent to total GDP and the tobacco sub-sector is the leading sector in export earnings in Malawi as it contributes about 95% of total foreign exchange in Malawi (NSO, 2000). In terms of total population currently estimated at 13 million people, Malawi is endowed with a large labour force of over 4.5 million who are easy to train and industrious workers (NSO, 1998)¹. Its labour force encompasses all major industrial sectors as classified according to International Standard Industrial Classification (ISIC) system where agriculture sector is the largest employer. In Malawi, labour force outcomes have a great impact on the economy and also on the quality of life of the workers, for example, minimum wages may have complex effects on labour market experiences of the individuals and thereby impact on labour supply qualitative differences among households through participation decisions, unemployment durations and wage offers.

The Malawi Integrated Household Survey (NSO, 2005) reports a higher participation rate for male than for female. Female participation in the labour market is 91.6 percent as shown in Appendix 1 (Table 1). Why is this so? This study tends to focus on determination of female participation in the labour market with a particular focus on agricultural labour. Ideally, it has been observed in the Integrated Household Survey that on average women spend less time per week (1.4 hours) than men (7.1 hours) on wage or salaried work. Of importance to therefore know is why there exists high female labour force participation rate and yet low hours of work are observed. This is equally important for policy implications to find better solutions so as to increase women's active role in the market economy. Already, there are efforts through the Malawi Growth and Development Strategy (MGDS) to specifically target rural women in empowerment programmes in order to achieve its

¹ According to Population and Housing Census (1998), total population was 9.9 million people in Malawi. The population projection for the year 2007 is about 13 million (NSO, 1998)

objectives since rural population comprises over 85% of the total population in Malawi. The ideal situation is possibly to create more job opportunities to increase employment of women in the society considering that gender issues appear to be cross cutting in current development agendas such as Malawi Poverty Reduction Strategy (MPRS) and MGDS.

1.1 BACKGROUND

Labour force is defined as all those people who are above a specified age of 15 years and who during a specified brief period are working or are actively seeking work, according to the International Labour Organisation definition². Labour supply decision can be treated at an individual or family decision making level so that labour supply can be investigated by observing particular characteristics of the population categories especially at an individual or household level. Kaufmann and Hotchkiss (2003) argue that at an individual level or family level, labour supply may involve only two decisions: “to work or not to work” and “how many hours to work”. The former means the decision to participate or join the labour market and the latter conforms to the decision to supply hours of work. Although the two definitions seem to be related they do not imply the same thing. Apparently, labour market outcomes can be regarded as ‘observed facts’ that reflect these two decisions in the market. For instance, we may deduce labour migration outcomes of females from Table 1 which may indicate that most women remain in the village for work related purposes either in casual labour (ganyu) or provide own farm labour. It can also be observed from the same Table 1 that possibly men migrate out of their areas to others in search for labour or ganyu in search of better living standards as a result fewer men remain in the rural areas. This may be supported by high rural labour market participation rate for female (95 percent) vis-à-vis low urban labour market participation (65 percent).

Generally, women are currently being more involved in the labour force as participants or actively searching for jobs unlike in the past years. According to Moser (1993) as cited in Chirwa (2005), these women have three main roles to play in a household: reproductive

² The definition of minimum working age is given in the ILO Convention 183 as shown in the references section.

role, home production and labour market role. The idea that women have been marginalized and consequently have participated less in the labour force has been reported in many studies, Moser (1993) as cited in Chirwa W (2005). The argument is that women have emphasized the reproductive rather than productive role (labour market role) which has been regarded as a man's role. This is supported by the most recent Malawi Integrated Household Survey (NSO, 2005) where it is reported that women unemployment was almost twice that of men (42 % of total female population versus 22.5 % of total male population in the survey were unemployed). Chirwa (2005) asserts that the marginalization of women is due to unequal opportunities in economic activities and inequality in access towards productive resources. On aggregate, Malawian labour markets are characterised by the fact more women than men have been reported to work in the agricultural sector indicating that there is an increase in the participation among women (NSO, 2005).

In Malawi, national household surveys are conducted every five consecutive years by the National Statistics Office and the first Integrated Household Survey (IHS) was conducted in 1998. Both, the 1998 and 2005 Integrated Household surveys focussed among other things on female participation in the labour force and cited demographic characteristics as the main determinants behind their labour market participation. Killingsworth M, (1983) argues that some stylized facts do exist from research in labour supply in developed countries, for example, the fact that there is a gradual decline in labour supply for men as a whole but for women there is a substantial increase in participation gradually with time. Although, it is difficult to establish such facts in developing countries like Malawi, but higher participation levels for women suggests that there is now a greater number of women joining the labour force and gaining jobs which in the past were associated with men. It has also been reported that the gender gap in participation is small such that there may not be any significant difference between women and men in terms of probability of entry into the labour force (NSO, 2005:47)

1.2 PROBLEM STATEMENT

In the past, most studies on labour supply concentrated on men because female participation in the labour market was more often complicated by child care and home work or home production. But now the increase in female labour market participation has stimulated interest in research on economic determinants of a woman's decision to work. Therefore, understanding female participation in the labour force and their labour supply is fundamental to improving welfare of women in Malawi.

Understanding female labour market participation can lead us to know more about markets for labour which are characterised as segmented markets. In as much as labour markets are distinct from each other due to gender, skill, location and profession knowing the determination of female farm labour market participation and their labour supply for the Malawian economy is crucial. To the contrary, we are not aware of any empirical evidence and knowledge about determinants of female farm labour market participation and labour supply in Malawi. A gap in knowledge about which factors exactly determine the pattern of female farm labour market participation and labour supply exist which means there is need for an empirical breakthrough through this study.

1.3 OBJECTIVES OF THE STUDY

This study is aimed at investigating the factors that may influence the decision for female farm labour market participation and labour supply in the urban and rural labour markets of Malawi. The general aim will be to estimate the determinants of labour market participation and labour supply using female Malawian households.

The specific aims are to:

- i. find out the determinants of labour force participation and labour supply of women, and ;
- ii. find out the determinants labour supply of women.

In order to study the stated objectives above the following hypotheses will be tested on Malawian household data:

- i. age does not influence female farm labour market participation and labour supply decisions;
- ii. education level does not influence female farm labour market participation and labour supply decisions;
- iii. household size does not influence female farm labour market participation decision;
- iv. fertility does not influence female farm labour market participation and labour supply decisions;
- v. real wage does not influence female farm labour supply decision;
- vi. non labour income does not affect female farm labour supply decision;
- vii. migration does not affect female farm labour market participation decision;
- viii. health status does not influence female farm labour market participation and labour supply decisions;
- ix. marital status does not affect female farm labour market participation and labour supply decision;
- x. Region does not affect female farm labour market participation decision and
- xi. Rural female farm labour market participation is not higher than urban female farm labour market participation.

1.4 SIGNIFICANCE OF THE STUDY

Generally, labour supply plays a crucial role in an economy based on the fact that an increase in participation rate of female labour force is a necessary condition for economic development. In most developing countries, Malawi in particular, labour is the most abundant factor of production and it is fair to say that in the long run any country's well being depends heavily on the willingness of its people to work. In Malawi, women take up about 30% of total household headship in the rural areas and as such economic empowerment of a woman could improve lives of many people (NSO, 2005).

The study therefore contributes to literature in the following ways: firstly the addition to knowledge about determinants of female farm labour market participation and labour supply and how women decide to allocate their hours of work in various sectors in Malawi. Secondly, the study attempts to provide an understanding of the nature of farm labour supply for women as to whether it is normal or backward bending since it is an area that has been under researched. In Malawi, some studies³ on labour markets investigated livelihood of ganyu workers based on qualitative approaches whereas others attempted to study impact of growth in money wages from a macroeconomics perspective unlike the intention in this study. Actually, no systematic studies specifically targeting female farm labour supply curve exist in Malawi but what we know are some stylized facts about farm labour supply. For example, Whiteside (2000) observes that ganyu wages fall in a bad year when labour supply is high. However, when food aid was distributed in 1993 farm labour supply (ganyu) dried up and large farms had difficulties recruiting sufficient labour. According to Whiteside (2000) there is a possibility of a backward bending labour supply curve with smallholders rationing labour supply to allow them to work only on their fields. It is in this vain that the study contributes to literature on female farm labour supply since the findings could as well be useful in academics.

1.5 ORGANISATION OF THE THESIS

This thesis is organised as follows: The next chapter provides an overview of the Malawian economy in particular with an emphasis to employment policy developments. Then a review of theoretical and empirical literature follows in Chapter 3 which seeks to highlight some theories of labour supply and how other empirical studies were done on labour market participation and labour supply. Chapter 4 provides the methodology adopted and model specification issues understudy. Finally, Chapter 5 presents the findings from the study and Chapter 6 summarises the findings.

³ Zgovu (1994) found that money wages had inflationary impact on the economy and rate of inflation and growth in money wages and salaries were determined simultaneously;
Whiteside (2000) concluded that ganyu is a crucial poverty issue being a major source of livelihood among the poor. Notwithstanding, it is very under-researched and there is need for a study dynamics of ganyu.

CHAPTER 2

OVERVIEW OF EMPLOYMENT AND LABOUR MARKET POLICIES

This chapter provides a brief explanation on the labour market and other employment policies with a view to promoting economic growth and development in Malawi. We also present agricultural labour force and non agricultural labour force trends versus total labour force in Malawi for a period of 1970 to 2005.

2.1 NATIONAL EMPLOYMENT POLICIES

Firstly, exact and overarching stand-alone national employment policies aimed at promoting economic growth, reducing poverty and inequality in Malawi do not exist in Malawi. However, the government developed mid-term strategies such as the Malawi Poverty Reduction Strategy (MPRS) in the year 2002 as a national strategy for economic development with a focus on the four main thematic areas aligned to the Millennium Development Goals (MDGs). The MPRS presented a first attempt to translate long-term strategy of Malawi Vision 2020 into medium term focused action plans. In this vain, the MPRS became the overarching medium term strategy of the Government for reducing poverty in the country. The goal of the MPRS was to achieve “sustainable poverty reduction through empowerment of the poor.” The MPRS focussed on four strategic pillars namely: sustainable pro-poor growth; human capital development; improving the quality of life of the most vulnerable; and governance and also on four key cross cutting issues namely: “HIV and AIDS, gender, environment, science and technology.” The implementation period for the MPRS was for a period of three years and it came to an end in the fiscal year 2004/05. The MPRS agenda articulated the sectors that had the priorities to generate required economic growth. MPRS incorporated public works programmes (PWPs) which had direct impacts on incomes of low skilled labour force through creation of employment. In this vain that it acts as an employment policy. MPRS did not achieve the desired targets due failure in implementation of the programme, citing funding and failure to translate programme strategies into budgeted activities. It has been argued that poverty in Malawi has not been

reduced significantly for the past seven years in Malawi which shows failure in translating goals into desired outputs (GOM, 2005). Current statistics show that poverty head rate is around 52.4% is high in Malawi although it is not possible to compare poverty indicators since countries have different levels of endowment NSO (2005).

From the year 2006, the overall government agenda for achieving economic growth and economic development is based on the Malawi Growth and Development Strategy (MGDS) which summarised the Malawi Economic Growth Strategy (MEGS) incorporating lessons learnt from the implementation of the MPRS. It has been stated that the MGDS is centred on achieving strong and sustainable economic growth, social protection, social development, infrastructure development and governance. This agenda has translated MDGs in local context for Malawi, for instance, targets the following key MDGs: to reduce poverty by 8% per annum; reduce proportion of population suffering from hunger and improve their nutrition status significantly; to increase enrolment by 95% and reduce drop out rates by 5%; integrate targeted programs for women to enable them contribute to economic growth such as creation of business and microfinance programmes; other issues include child and maternal mortality, HIV and AIDS, environmental sustainability and access to water (GOM, 2006). However, the success of this strategy dwells on its keys assumptions one of which targets attainment of economic growth rate of 6% per annum. Therefore, we can observe that the MGDS provides key employment policy framework that aims to create employment at various stages of production in all priority areas.

2.2 LABOUR MARKET POLICIES

2.2.1 THE EMPLOYMENT ACT OF 2000 and MINIMUM WAGE LAW

Microeconomic theory predicts that labour is paid the value of its marginal product (MP_L) which is a contribution of labour to total output. In Malawi, minimum wage legislation was first done in the 1960's ideally to protect the disadvantaged groups in society who are suppliers of labour because labour is frequently not being paid according to the value of its marginal productivity. This is due to the fact that agricultural low skilled labour supply is high and it can be noted by the ease with which labour can be substituted for capital so that

the marginal productivity is nearly zero, so that labour supply is elastic at the low skill spectrum. However, the minimum wage is not very effective since the real minimum wage is almost zero indicating it has very low purchasing power.

Table 3: Minimum wage per Day / (Hour)

Year	Nominal		Real	
	Urban	Rural	Urban	Rural
2001	K50(K8.25)	K37(K4.63)	0.23	0.17
2004	K86(K10.75) ⁴	K66(K8.25) ⁵	0.39	0.3

Source: Author computed from Annual Labour Report (2002) and NSO (2005)

The subgroup of the labour force often affected is especially urban and rural unskilled workers often casual labourers who work on farms as a source of livelihood for their poorer households. Whiteside (2000) asserts that income from off own-farm labour (ganyu) contributes about 57% of their total livelihood. This type of labour supply often employed as off own-farm labour locally known as ganyu which is a coping mechanism against poverty. Often the casual workers use the earnings from ganyu to buy seed, fertilizer and food for their families. On a different note, it is also worthy to know that women comprise a high percentage (about 57%) of labour supply in agricultural sector (NSO, 2005).

However, the key issue in labour supply economics is the issue of quality of labour supply vis-à-vis quantity of labour supply. Various factors including natural endowments, comparative advantages, population, cultural factors, and long run economic performance may contribute differently to labour market performance across countries and also within each country. Such differences are reflected in labour supply and working conditions. For example, it is argued that economic performance is the primary determinant of better labour market conditions among countries (World Bank, 2002b). The argument is that a number of dimensions are central to developments relating to labour supply, for example: growth rate of the labour force, age composition, female participation, and education and skill levels of workers and migration patterns of the population.

⁴ The figure in brackets is the Real Daily Minimum Wage computed on assumption that an individual works 8 hours/ day

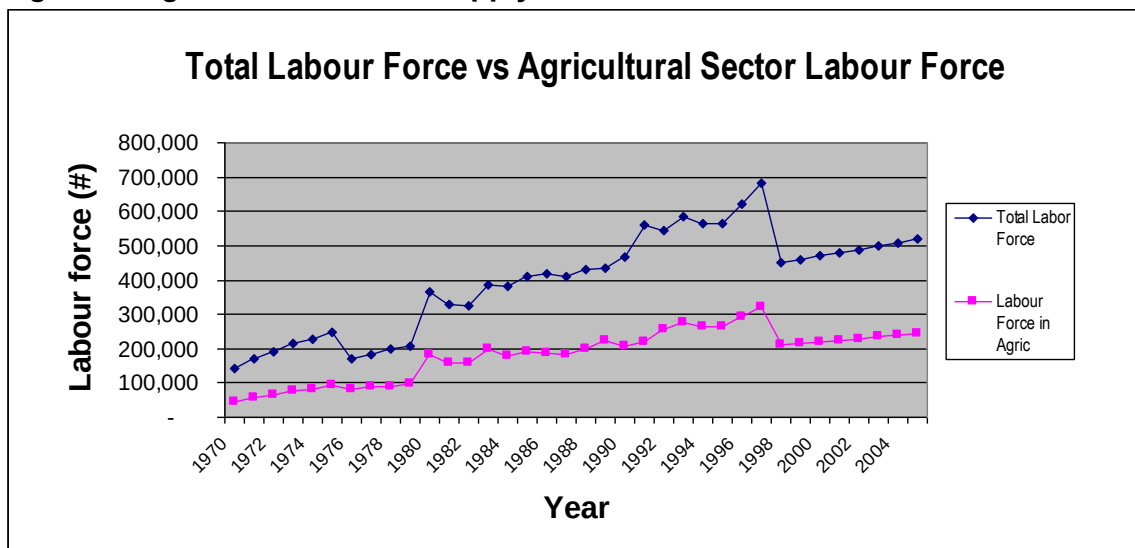
⁵ Minimum wage as calculated by the author using a Composite Consumer Price index of 2001 and 2004 to find real minimum wages for 2001 and 2004 respectively

Globally, the working age population (15-64 years) was nearly four billion people with Asia contributing over 50% (World Bank, 2002). In Malawi, the female working age population makes up about 16% of the total labour force in Malawi (NSO, 2005).

2.3 AGRICULTURAL LABOUR SUPPLY

Generally, agricultural labour supply has been increasing in the past 20 years as depicted from Figure 1 below. The trend shows that agricultural labour force has been increasing in from 1970 with a sharp fall in 1975 and also in 1998. The most notable feature in this figure is that labour force reached its highest in 1997 and this is a period when Malawi's total population peaked highest at 9.9 million people. A sharp fall in the total labour force in 1976 was due to the end of TEBA after the closure of recruiting operations of then Witwatersrand Native Labour Association of South Africa and the Rhodesian Native Labour Bureau by the former Head of State, Dr. Hastings Kamuzu Banda as most Malawians returning from South Africa reported as non participants during that period. The subsequent rise after 1970's was due to rapid growth in estate agriculture in Malawi.

Figure 1: Agricultural Labour Supply



Source: NSO (2005)

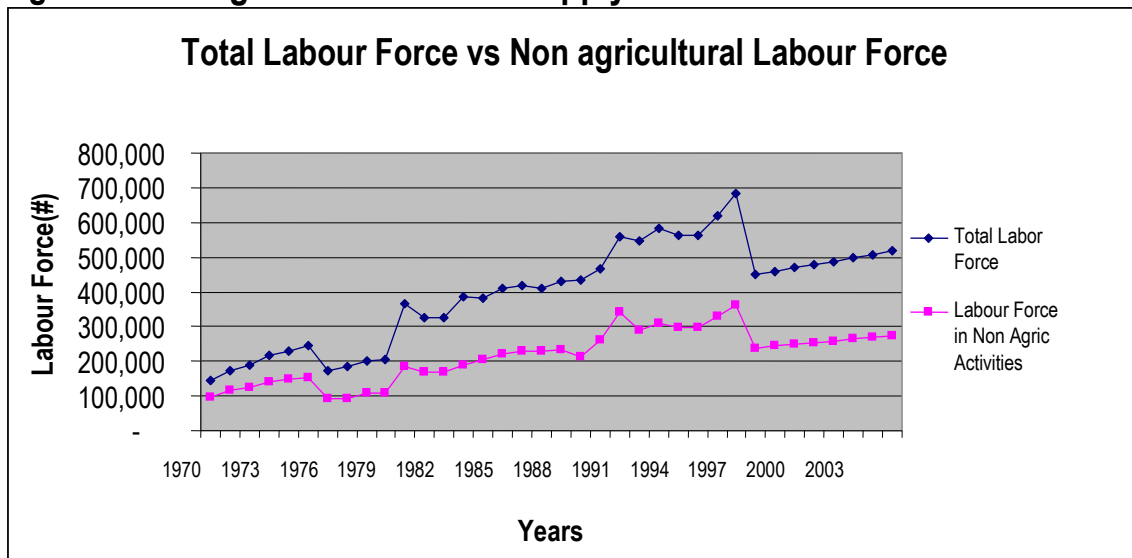
Secondly, the drop of the year 1998-2000 can be attributed to the drought that occurred country-wide. The hunger crisis reduced demand for labour in the farms and forced

individuals to withdraw their hired labour in the labour market in order to avert the food crisis (Chirwa W.C, 1996).

2.4 NON AGRICULTURAL LABOUR SUPPLY

The trend for non agricultural labour force is similar to the trend for agricultural sector labour force. Both total labour force and non agricultural labour force have been increasing over the years, although the rates of increase of non agricultural labour force has been slow compared to the labour force growth rate (Figure 2 below). This can be attributed to the spill-over effects of the increase in population in rural and urban areas.

Figure 2: Non Agricultural Labour Supply



Source: NSO (2005)

Although both agricultural labour force and non agricultural labour force have been increasing, actual working hours are very low in the non agricultural sector as observed in figure 3, 4, 5 and 6 in Appendix 1 generated from the sample understudy. Eyeball evidence shows that hours worked in the agricultural (farm) sector are higher than in the non agricultural sector among women for both urban and rural areas possibly due to the fact that the major activity of the females is farming. More working hours are observed in the rural unlike urban areas for women who pursued agricultural activities whereas women who pursued non agricultural activities have less working hours in the rural areas.

CHAPTER 3

LITERATURE REVIEW

3.1 THEORETICAL LITERATURE REVIEW

This section reviews theoretical literature on labour force participation and labour supply and the next section introduces empirical literature on labour supply. Specific theoretical literature on female labour supply theory is very scanty therefore in the study we only introduce labour supply theories in a general context.

3.1.1 STATIC LABOUR SUPPLY MODEL

Generally, the neoclassical one period static labour supply model is the building block of this study. This theory posits that an individual has two main decisions in the labour force:

- (i) To work or not to work
- (ii) If an individual decides to work, then the number of hours of work to supply can be known.

Although, the static labour supply model assumes the impression that an individual can freely choose hours of work and select a wage offer, this does not really happen (Blundell and MaCurdy, 1999). On the other hand, participation decisions concerns the willingness of the individual to supply labour at the going wage and hence the decision to work may imply that the hours of labour supply should be observed otherwise the individual would be regarded as not being in the labour force. If an individual is not working at the going wage rate, then such an individual will have a corner solution implying that the reservation wage is higher than the market wage rate. In the static theory, an individual's utility function is defined in terms of consumption of goods and leisure meaning that labour supply is based on fundamental concepts of consumer theory (Killingsworth, 1979) as cited in (Killingsworth, 1983). The idea being that an individual has time endowment, t with which he allocates to leisure and consumption of goods.

The individual maximises utility of consumption of goods (C) and leisure (L) subject to a budget constraint (PC).

$$\text{Max}_{C,L} U(C,L) \quad \dots\dots\dots [1]$$

s.t

$$PC = W(T - L) + V \quad \dots\dots[1.1]$$

Where P is the price of a unit of C, W is the fixed price of an hour of leisure, L (wage per hour).
T is the total time endowment in hours, and may be allocated between leisure, L and work, H

The model $U(\bullet)$ assumes a well behaved utility function having quasi concavity properties or meaning that it is twice differentiable so that the marginal utilities of consumption and leisure are easily obtainable as $\partial u / \partial C$ and $\partial u / \partial L$ respectively.

In the static model, labour supply is observed at an equilibrium point where the marginal rate of substitution of consumption for leisure equals real wage rate

$$MRS_{L,C} = \frac{\partial u / \partial L}{\partial u / \partial C} = M(C,L) = \frac{W}{P} = w \quad \dots\dots\dots[2]$$

In this static model, a corner solution may be observed and the other key assumption is that of fixed exogenous wage for each individual worker and that the worker can supply as many hours as desired on the labour market (for example, suppose each working week has a maximum of 40 hours, an individual may be willing to supply a maximum of 20 hours a week out of the total 40 weekly hours hence it can be noticed that the static model is an individual decision making level model).

From the duality concept, the Marshallian reduced demand functions can be obtained as follows for leisure and consumption:

$$C = g(p,w,M) \quad \dots\dots\dots [3]$$

$$L = g_0(p,w,M) \quad \dots\dots\dots[4]$$

At constant utility, the Hicksian demand functions at constant utility can be derived as follows:

$$C = f(p,w,u^0) \quad \dots\dots\dots [5]$$

$$L = f_0(p,w,u^0) \quad \dots\dots\dots[6]$$

Hence, labour supply, h, is defined as the difference between time endowment and leisure which is computed as follows:

$$\dots\dots\dots[7]$$

$$H = T - f_0(p, w, M)$$

Then equation (7) is a labour supply function which can be decomposed into substitution and income effects of a wage change.

$$\left. \frac{\partial h}{\partial w} \right|_y = \left. \frac{\partial h}{\partial w} \right|_{u^0} + h \frac{\partial h}{\partial M} \quad \dots\dots\dots[8]$$

Holding income constant the effect of a wage change could be decomposed in terms of substitution and income effects.

Meyer and Rosenbaum (2001) and Blundell and MaCurdy (1999) argue that the major criticism levelled against static analysis is that in the real world an individual does not have complete choice over the number of hours that they can work. This forms the basis, on the other hand of the nature of two models of labour markets. Tight labour markets where an individual may decide to participate and also choose how many hours of work to supply due to the fact that demand for labour outstrips supply of labour. Loose labour market exists where an individual can not choose her desired hours of work but put simply he/she accepts the contract to work the hours specified as a working condition. The fixed hours of work model characterizes developing economies and underdeveloped economies labour markets. This model deals with the individual labour supply, (H) and consumption goods, (C) which are derived as functions of prices (P, W) and non labour income (V). The unit of analysis in the study is the individual who may either be a female household head where his/her decision to participate reflects a comparison between gains from market earnings and the opportunity costs in terms of forgone household production. The other problem with the theory is that it implicitly assumes that future events play no role in determining current behaviour in the labour market. For example, it has been observed that an individual's current work behaviour may be influenced by expectations such as expected wage rate yet static labour supply model does not consider such factors hence it is considered myopic in nature. However, some useful observations have been made in the neo-classical static model of labour supply without uncertainty.

(i) The income compensated own-wage substitution effect with respect to leisure is negative: Meaning that an increase in the wage rate may induce a decrease in the demand

for leisure and therefore inducing an increase in labour supply so that the income compensated own wage elasticity of labour supply may be negative and finally;

(ii) The labour supply elasticity of income is negative: Meaning that an increase in an individual's income due to a rise in the wage rate may induce demand for more leisure and consequently may lead to lower labour supply by the individual.

The two observations therefore mean that in a static model you cannot say apriori which of the two effects (substitution or income) will outweigh the other.

Within the static framework, there are alternative models are available which incorporate more realistic assumptions although there is empirical evidence that such models may introduce other complications (Kalb and Scutella, 2003). Such models may include chauvinistic model, family utility/ family budget constraint model and Becker's model of optimal allocation of time and to estimate such models where all household members have their own utility functions hence more information is needed on private consumption of the individuals.

3.1.2 LIFE CYCLE MODEL OF LABOUR SUPPLY

The motivation behind this model is to understand labour supply over a lifecycle of an individual after being born as he/she grows and goes to school and later joins the labour force and finally when he/she eventually retires. Bosworth et al (1986) argue that there are two frameworks / variants. Firstly, models where wages are exogenous where attempt is made to explain how much labour an individual supplies now rather than in the future. Secondly, models where wages are endogenous where focus on the individual's education and training activity is made.

Structure of the model:

$$\text{Max } U = \sum_{t=0}^T \frac{U(C_t, L_t)}{(1 + \delta)^t} \quad \dots\dots\dots[9]$$

s.t

$$A_0 + \sum (1+r)^{-t} H_t W_t = \sum (1+\delta)^{-t} P_t C_t \quad \dots[9.1]$$

where the equation above represents a lifetime budget constraint. A_0 is the initial asset holding, H_t is the hours of work at time t , W_t is the wage rate at time t . W may be exogenous or endogenous. The r is the market rate of interest, δ is the rate of time preference of consumption / discount rate

Bosworth *et al* (1996) argue that labour supply is positively related with wage and time depending on three forces: 'efficiency' effect, 'interest rate' effect and 'time preference rate' effect. An 'efficiency' effect which is due to inter-temporal substitution effect which makes an individual work more during periods of higher wage rates than in periods of low wage rates. In this case, a rise in the wage rate at any time period would reduce leisure and consequently increase hours of work. Secondly, an 'interest rate' effect which makes an individual to work more in initial period and work less later on because of the possibility of saving as the individual effectively banks some part of earnings to earn higher interests. Because of increased opportunities to work and save, individuals tend to work more early in their life cycle and then reduce their hours of work as they near retirement stage. Finally, a 'time preference rate' effect where an individual tends to work less at first and more later because of a natural desire to take leisure now and put off work at a later date. Thus it can be argued that when one has a positive rate of time preference, individuals tends to work less now and enjoy more leisure in the present period. Whereas the effect of a wage change is ambiguous in a static model, it is certain in life cycle model in period of higher wages as an individual is going to work more hence there is no ambiguity.

3.1.3 DYNAMIC LABOUR SUPPLY

One of the central features of dynamic labour supply theory is that one's hours of work response to a wage increase will differ according to whether it was anticipated or not (Blundell and MaCurdy, 1999). The initial wealth and an individual's accumulated income minus expenditure forms the budget constraint in the dynamic framework. It is assumed for simplicity that planned wealth of the individual when they die is zero. The individual

therefore is assumed to maximise lifetime utility, subject to the budget constraint. Similar to the lifecycle labour supply theory there are three effects that influence labour supply decision: 'efficiency effect', 'interest rate effect' and 'time preference rate effect'.

Bosworth, et al (1996) modelled dynamic labour supply under further simplifying assumptions as follows.

$$\dot{H}(t) = \alpha \dot{w}(t)/w(t) + \beta(\varphi - r) \quad \dots\dots[10]$$

Where $\dot{}$ indicates a change over time and $\dot{H}(t)$ indicates the path of H over time

$$\alpha = u_L(t)u_{GG}(t)/D(t) > 0 \quad \dots[10.1]$$

$$\beta = [u_L(t)u_{GG}(t) - u_G(t)u_{LG}(t)]/D(t) > 0 \quad \dots[10.2]$$

$$\varphi = \text{An individual's rate of time preference} \quad \dots[10.3]$$

$$r = \text{interest rate effect} \quad \dots[10.4]$$

In the dynamic model, the effect of a change in the exogenous variables is often complicated and usually depends upon whether the changes are anticipated or not. Generally, as in lifecycle models the effect of a wage change results in an increase in labour supply between any two periods.

The dynamic model with endogenous wage rate point of departure is that the wage is a function of the individual's productivity in employment, which is assumed to be determined by their stock of human capital. Three main types can be distinguished in the literature as follows: training models, experience models through learning by doing and models which contain the main features of both of the first two (Bosworth et al, 1996). The major criticism of dynamic models is that analysis is usually complicated especially where individual human capital decision are taken into consideration in labour supply over a lifetime even though ambiguity of wage effect may not arise. Similar to the inter-temporal lifecycle framework, dynamic models may only be applicable in longitudinal data.

3.2 EMPIRICAL LITERATURE REVIEW

Many scholars have studied labour supply determination and many empirical studies have found a significantly positively sloped labour supply schedule as a function of wage. For example: Sackey (2005), Kalb and Scutella (2003), Maglad (1998), Aromolaran (2004),

Shirley Dex, et al (1995), Miller (1985), Kooreman and Kapteyn (1985), Hill (1984), Nakamura and Nakamura (1983), Smith (1980), Heckman and McCurdy (1980), Ntuli (2004), Mincer (1962) and Crespo (2005).

Empirical evidence in Africa does exist partially, however. With respect to developing countries in Africa, Maglad (1998) studied Sudanese labour supply of women using experience and a second degree polynomial of experience, schooling years as explanatory variables for labour supply equation and adopted education, children (less than five years), husband's wage, assets as additional variables for the participation equation where it was found that there was a significant positive robust relationship between labour market entry and a woman's years of education. Boserup (1970) as cited in Maglad (1998) observe that the contribution of African women to modern sector is a recent phenomenon as in the past they used to devote their entire time in non market or informal sector. Maglad (1998) using a probit model with selection noted that the Maximum Likelihood (ML) was consistent but not asymptotically efficient hence Full Information Maximum Likelihood approach (FIML) was used in estimation of the parameters. One notable observation from the study may be the simultaneity of fertility variable and hours of work (labour supply decision) because they are both endogenously determined in such a model rendering the importance of carrying out endogeneity test of the error term and the independent variables. The results indicate that investment in a woman's education would lead to expansion of women's involvement in market activities as education directly affected their decision to participate in the market.

Sackey (2005) obtained similar robust results from Ghana on female labour force participation using cross-sectional data. Acknowledging likelihood of simultaneity bias between fertility decision and labour force participation decision led the author to estimate a multinomial logit for wage employment, self employment and unpaid family labour. His findings revealed that female schooling impacts on labour force participation in the stated employment categories and that gender wage gap exists for the Ghanaian economy at that level of study. It was also revealed that age has a non linear relationship in labour force participation equation indicating increased probability of participation at a younger age and low probability at a higher age. Using Hausman Test at 10% significant level the author

accepted the null hypothesis that no endogeneity exists among the variables and the error term. However, Sackey (2005) study failed to take into account possible existence of selection bias among participants and non participants among women in the labour force.

Ntuli (2004) using logit and bivariate probit models checked robustness in the estimation and unveiled that female participation rate in the Republic of South Africa (RSA) labour markets is positively associated with education especially in the first decade of South African democracy (1990-2000). Another variable used in the model included expected wage, age, the second degree polynomial of age, race, non-labour income, marital status, number of young children and region of residence. Apparently, the results found indicate presence of robustness for both bivariate probit (to consider causality issues) or logit (non causality). The negative relationship between labour force participation and fertility and marital status was also confirmed in the results. However, the author ignored the fact that including a wage in the participation equation could result in bias since wage could be endogenous with the error term because of its joint determination with labour force participation variable.

Most of these scholars indicated above have supplemented on a comprehensive analysis done by Mincer (1962) and later by Killingsworth (1979) who pioneered studies of labour supply in the past decades. For example, Killingsworth and Heckman (1986) reports estimates from a large number of studies⁶. The study differs from others on measure of labour supply measure used (participation, hours) and statistical procedures. Uncompensated elasticities are generally positive with mean (for the United States) of 0.6. Estimated compensated elasticity of hours of work with respect to the wage is nearly always positive, with an eyeball average of about 1.0. Income effects are negative with a central tendency of -0.3.

Shirley Dex et al (1995) in a study on cross national comparison of labour force participation of women married to unemployed men used a conventional logistic regression

⁶ Shown in Table 2.26 in the paper by Killingsworth and Heckman(1986)

to estimate probability of participation among married women. We learn from their study that wage could be endogenous to the error term in the regression hence the authors used an instrumental variable that is correlated with wage but not correlated with the error term. As explanatory variables they included demographic, health factors like sickness/illnesses and labour market conditions as determinants of participation in the labour market. Although, economic theory was confirmed in the sense that unemployment benefits had an impact on probability of working of wives of unemployed husbands, there appears evidence that such characteristics do not explain all the gaps in participation of working wives in the labour market.

Kooreman and Kapteyn (1985) used an Almost Ideal Demand System model to estimate labour supply for Netherlands and found that elasticity of female labour supply depends at the particular point of evaluation in the labour market. It was concluded that labour supply is a positive function of wage rate and there is a positive own wage elasticity (0.98) also close to unity for females in Netherlands. This indicated that income effect of a wage change is offset by the substitution effect which means that as wage increases women do not necessarily reduce their hours of work as compared to men.

Crespo (2005) using weekly hours of work as a dependent variable for labour supply equation in estimating and testing labour supply using Generalised Method of Moments (GMM) for Spain also found concurring results. Hourly wage rates were computed as a ratio of monthly earnings and number of hours worked per month. Chiappori (1988, 1992, 2002) as cited in Crespo (2005) used a parametric semi-logarithmic unrestricted labour supply model where labour supply for men and women were estimated in separate equations. The results revealed that female own wage labour supply elasticity is positive (0.14) and less than unity. The participation equation included variables such as age, a second order polynomial of age, dummy variables for high schooling and graduate studies and their interactions with that polynomial to capture combined effect of age and schooling.

However, Nakamura and Nakamura (1983) as cited in Miller (1985) concluded differently for the US economy. It was found that if labour supply was conditioned on hours of work, female labour supply is backward bending which led to the conclusion that income effect of a wage rate change among women may exceed the associated positive substitution effect. The authors further observe that the wage elasticity of around unity commonly reported in studies derived from variation in labour market entry unlike through variations in hours of work among the employed. Nakamura and Nakamura (1983) as cited in Miller (1985) therefore concluded that working wives work fewer hours when paid higher hourly wage rates. Similar results to Nakamura (1983) as cited in Miller (1985) were reported on Australia after adoption of a similar methodology using cross sectional data. Estimates confirmed a backward bending female labour supply with a wage elasticity of nearly unity. The dual possible explanation was that fixed costs of labour market entry may be a very important issue to consider in estimation of female labour supply or the backward bending confirmed the stylized fact that wives were secondary workers in the labour market in order to satisfy a transitory income requirement hence income effect may offset the substitution effect.

The general consensus derived from most empirical studies about the determination of female labour supply is that labour supply is positively related to their own wage and significant with an elasticity coefficient typically close to unity indicative of a substitution effect of a wage change exceeding the associated income effect (Miller, 1985:287). It was concluded that generally for men, the labour supply function is backward bending at higher wage rates for Australian labour market but for women it is positively sloped. In conclusion, although most empirical studies found concurring results, some studies done for labour markets in developing countries, Africa in particular failed to account for selection bias in estimation methods used in labour force participation and labour supply. It is known that wages are observed for workers unlike for non workers hence it is possible that results may be biased if correction is not taken into account in estimating parameters of labour force participation and labour supply equations.

3.2.1 THEORETICAL PREDICTIONS OF SOME VARIABLES

3.2.1.1 Expected wage

Since Mincer (1962), the decision to participate in the labour force and the expected wage are postulated as being positively related. Basically, this is explained by the concept of income and substitution effects where, the substitution effect implies that an increase in the own wage rate results in a high opportunity cost of non-market activities. The increase in the opportunity cost implies that unpaid time (price of leisure) is costly and less leisure time will be demanded since the reservation wage is lower than the wage rate. Hence the individual decides to participate and therefore offer to work positive hours of work (she will therefore select herself to join the labour market). The increase in wage rate has an income effect which means an individual can buy more leisure at the higher wage rate. Therefore, the static model predicts that it all depends on net effect of substitution and income effect of a wage change hence the effect of wage may be positive or negative.

3.2.1.2 Education

Lam and Duryea (1999) found that for Brazilian economy education may have an ambiguous effect (positive or a negative) on labour force participation. The theoretical explanation for the pro-labour force participation situation dwelt on the fact that educational attainment increases an individual's earning capacity meaning that it increases the opportunity cost of non-market time (Mincer, 1974) as cited in (Ntuli, 2004) whereas the negative impact of education is an outcome due to linkages among education, fertility and labour force participation of women. The argument is that the first years of schooling for a woman will increase both home production and labour market productivity and relate negatively to fertility (Lam and Duryea, 1999). A woman who is educated will make some adjustments in child quality and quantity thereby leading into a reduction in the quantity of children, which may also be accompanied by an increase in the desire for high quality investment in the children. In this case, a reduction in the number of children will not be accompanied by a high opportunity cost of non-market time, implying that the reservation wage will be equal to or higher than the market wage offer. According to Lam and Duryea

(1999), it was not clear whether education should increase or reduce the time that will be devoted to labour market activities. On the other hand, Psacharopoulos (1988) studied labour market outcomes and returns to education for many countries including Brazil found that education was positively related to earnings in the labour market hence there is a positive relationship between education and labour supply.

3.2.1.3 Non-labour income

Killingsworth and Heckman (1986) argue that family budget model of labour supply postulates that a negative relationship exists between non labour income and labour force participation. A wife labour supply takes husband's wage as her non labour income. This can be explained on the basis of the income effect. Theoretically, an increase in any form of non-labour income for example, her husband's wage enables a woman to afford a higher demand for goods including unpaid time or leisure (assuming leisure is a normal good). Thus, she will value her non-labour time more than the opportunity cost of leisure which will negatively influence her labour force participation (Killingsworth and Heckman, 1986). The central tenet of Becker's household production model maintains that a spouse will devote all his or her time to an activity where they are more productive. Assume that the wife will specialize in domestic activities meanwhile the husband spends all his time in the labour market. This means that the husband will be more productive and get a higher wage because of the wife's choice to be a non-participant. However, this study treats non-labour income as exogenous to the wife's choice due to data limitations.

3.2.1.4 Fertility

Theoretically fertility defined as a demographic concept related to the percentage of children born to mothers aged 15-44 or percentage of mothers giving birth yearly and attending antenatal services. This can either have a positive or a negative effect on

women's labour force participation (Glick and Sahn, 1997). This stems from the fact that childcare is costly in terms of both time and money. Since childcare is a time intensive non-market activity, it is a cost. Consequentially, it leads to a reduction in the mean wage rate thereby reducing labour market hours such that very high child care costs may imply that reservation wage is higher as compared to the market wage. Hence reduction in labour market participation may be the result which is compatible with conventional consumption leisure model (Kaufmann and Hotchkiss, 2003).

3.2.1.5 Age and Age squared

Joll et al (1993) cited in Ntuli (2004) postulates an inverted U profile between age and labour force participation. The relation between age and women's labour force participation is complicated by the fact that the participation decision is also related to changes in requirements and responsibilities over the female life cycles which also are age dependent. The requirements and responsibilities include school attendance, marriage, both child rearing and bearing and changes in the value attached to leisure with age. In turn, these will introduce changes in demand for and marginal costs of homework and leisure. For instance, when one is young they go to school and thus place a higher value on non-labour time, which reduces participation in economic activities and the converse holds after completing school. Also, child bearing and rearing will shift labour supply earlier in the life cycle. However, as one advances in age the utility of enjoying leisure increases, (probably due to health concerns) which reduce market valuation of their time.

3.2.1.6 Marital Status

Generally, marital status indicates the presence or absence of such roles as child bearing and rearing which competes with women's market work outside the home. The impact on labour force participation can be analyzed with reference to the marriage market. Moreover, in an attempt to integrate the theories of marriage and labour markets, Grossbard, S.A. (1984) argued that spouses can be viewed as providing a type of home production such as house cleaning, cooking and childbearing (for which there are market substitutes). Women who expect to marry need to invest less in skills valued in the labour market outside the

home (Angrist, 2001). Consequently, the increased shadow wage outweighs the expected market wage offer thereby, reducing female labour force participation outside the home. Lee (2005) argues that marital status and participation may be endogenous because of presence of cultural factors. The author argues that preferences for marriage and career development are heterogeneous across individuals adding that women who want to advance with their careers are less likely to marry. Hence any form of estimation that fails to control for unobserved heterogeneity in career development under-estimates the negative effect of marriage on participation.

3.2.1.7 Region of residence

The region variable is presupposed to either encourage or depress women's labour force participation. Regional dummy variables have been used to control for all the three regions in Malawi and their potential influence on labour market participation. Labour force participation is directly determined by social economic characteristics in each particular region so that it becomes difficult to tell the direction of influence of region on labour market participation.

CHAPTER 4

METHODOLOGY

This Chapter explains the econometric methodology used and finally explains the estimation technique applied in the study.

4.0 Economic Model

We apply the static model in this female labour supply study. Considering Slutsky substitution and income effects, the effect of a wage increase on labour supply is ambiguous. It may increase or decrease labour supply depending on the dominance of substitution or income effect. However, a basic labour supply function states that labour supply is a positive function of wage rate and negatively related to non-labour income at low wage rates (Blomquist S, 1995). This means an individual would like to supply hours of work given wage rate offered in the labour market and also given non-labour income. Mijara (1994) and Maglad (1998) proposed a similar static economic model for an individual's labour supply:

$$\begin{aligned} H &= h(W, V, Z) && \text{if } W > W_r && \dots\dots[11] \\ H &= 0 && \text{if } W \leq W_r \end{aligned}$$

Where H is hours worked per period and W is Wage Rate and V is non wage-income and Z represents a vector of variables determining labour supply, W_r is the reservation wage.

4.1 Empirical Specification

Since the decision to work or not is often coupled with the decision of how long one can work. Then we may ask a question relevant to find a suitable methodology for the study as follows: If a woman is employed then how many hours does she work? Firstly, it must be known that labour force participation is observed as a dichotomous variable that assumes a value of 1 or 0. Hence labour force participation is modelled as decision variable whereas labour supply is modelled as a quantity measure in terms of hours worked (Maglad, 1998). It is from this realisation that labour supply is further analysed since for those who are

working, their wages and hours of work are observed unlike for those who are not working. Therefore, labour supply determination is characterized by presence of censored data which poses a problem in econometric analysis because it biases the slope coefficient estimates of wage or hours worked equations. For those employed their hours of work can be observed while for those not employed their hours of work are regarded as zero.

In this study, a Tobit Type II model (Amemiya, 1985) otherwise known as Heckit model (Heckman, 1976) is adopted because of its ability to analyze censored data and can provide consistent and asymptotically efficient estimates for both participation decision and hours of work conditional upon employed (Heij et al, 2004). This model has been used in many studies for instance, Heckman (1979), Hill et. al (2003). The specification of a Heckit Model (a hybrid model) combines discrete-continuous distributions to determine the factors that affect the decision to participate in the labour market and the wage or hours of work associated with those employed (Heij et al, 2004:500).

4.2 Specification of the Econometric Model

4.2.1 Participation and Labour Supply Model

As discussed earlier, it is common knowledge that both rural and urban female households tend to participate in the labour force because unemployment is an economic evil. Nobody wants to be unemployed and therefore a woman's welfare depends on her labour market status. Fundamentally, work is a major source of income as such women may obtain their income by working and may therefore afford higher utility in consumption of goods and services. Although workers seek wage increases firms may face high operating costs in the short term and this may force them to lay off some workers. Even in periods of high unemployment, we know that any worker is still influenced by socio-economic factors to participate in the labour market. For instance, a worker may decide to join labour force as a result of a multitude of factors such as attainment of education, healthy factors, ease with which an individual can migrate among areas and marital status among other factors.

Labour market participation is observed as dichotomous variable of 1 or 0, leads to the following labour market participation equation which becomes a selection equation:

4.2.1.1 Participation equation:

$$lpd^* = x'\beta + \mu \quad \dots[12]$$

Where lpd^* is a latent variable for propensity to work, which cannot be observed. What is observed is whether one is employed or not. X is a vector of demographic characteristics influencing the decision to work and μ is an error term distributed as $N(0, \sigma_\mu^2)$. This is a probabilistic model where the latent dependent variable is dichotomous assuming a value of 1 if one is a participant and 0 otherwise. The latent variable lpd^* is continuous while the observed lpd (without a star) is binary. This equation can be estimated using maximum likelihood by using a probit regression to predict the odds ratio or the probability of participation in the labour market. Adopting Model by Crespo (2005) we can parameterize equation (12) above to obtain:

$$lpd_i^* = \beta_0 + \beta_1 agehh_i + \beta_2 agesq_i + \beta_3 mst_i + \beta_4 hsize_i + \beta_5 kds_i + \beta_6 dasst_i + \beta_7 durbi + \beta_8 hlthst_i + \beta_9 migrt_i + \beta_{10} schlng_i + \beta_{11} dnor + \beta_{12} dcen_i + \mu_i \quad \dots[13]$$

Where all the variables are defined in section 4.5.3 and parameters

$$\beta_1 > 0; \beta_2 < 0; \beta_3 < 0; \beta_4 > 0; \beta_5 < 0; \beta_6 < 0; \beta_7 > 0; \beta_8 < 0; \beta_9 < 0; \beta_{10} > 0; \beta_{11} > 0; \beta_{12} > 0 \dots[14]$$

As pointed out earlier in the study, labour supply involves both participation and hours of work (Maglad, 1998). Therefore, our interest will be to estimate parameters for farm labour market participation regression and also hours worked equation hence we must determine our second equation. An individual decides to participate in the labour market upon knowing that her wage offer in the market is more than her reservation wage ($W > W_r$). Therefore, we can formulate labour supply equation which has parameters of interest with which can be used to predict mean hours worked (hours) for an individual given her socio-economic characteristics. We therefore adopt a model by Maglad (1998) with some modifications to the vector of explanatory variables to control for regional location, urban location as possible causes of segmentation. For this reason, dummy variables are added

to capture the impact of regional location, rural-urban differences, marital status, ownership of real assets, and health status of women on labour supply as follows:

4.2.1.2 Labour supply equation:

$$\text{hours} = w' \alpha + \varepsilon \quad \dots[15]$$

Where hours represents hours worked as dependent variable, w' is a vector of explanatory variables for hours of work for an individual household head, α is a vector of its associated coefficients and ε is a random error term distributed as $N(0, \sigma_\varepsilon^2)$. The equation is parameterised as follows:

$$\begin{aligned} \text{hours}_i = & \alpha_0 + \alpha_1 \text{agehh}_i + \alpha_2 \text{agesq}_i + \alpha_3 \text{rwage}_i + \alpha_4 \text{rwagesq}_i + \alpha_5 \text{rwagehus}_i + \alpha_6 \text{only}_i \\ & + \alpha_7 \text{hlthst}_i + \alpha_8 \text{durb}_i + \alpha_9 \text{schlng}_i + \varepsilon_i \end{aligned} \quad \dots [16]$$

Where all the variables are defined in section 4.5.3 and

$$\alpha_1 > 0; \alpha_2 < 0; \alpha_3 > 0; \alpha_4 < 0; \alpha_5 = ?; \alpha_6 < 0; \alpha_7 < 0; \alpha_8 > 0; \alpha_9 > 0 \quad \dots [17]$$

Real wage rate is included because of hypothesis (v) and also to find out if there is a backward bending effect. The square of real wage rate is included for that purpose and the expected sign for real wage is positive and for real wage squared is negative as described in equation 17 above. Real wage rate is used because of the assumption that workers does not suffer from money illusion in the classical case. The spouse wage is included to measure cross substitution effects of wage changes on labour supply. Economic theory predicts that income compensated cross substitution effect of one's spouse wage offer on the woman's labour supply may be negative or positive. This depends on whether leisure time of one's spouse is a substitute or complement for leisure time of another spouse in the household.

4.2.2 Model Adaptation

Empirical estimation of equation 15 using OLS would be biased and inconsistent if selection problem arises in the data then the error term from the regression in such samples used to estimate parameters of labour supply will not be white noise. Therefore, use of techniques such as a Heckit Model to estimate jointly the parameters of a

probabilistic participation equation and labour supply equation must be adopted. The sample selection model applies very well for European labour markets which are well organised or simply put economies with tight labour markets. Hence, we therefore adapt the selection model to suit our undeveloped economy of Malawi by estimating labour supply for the farm sector for two reasons. Firstly, farming is the dominant activity in the rural economy in Malawi. This means that high labour market participation in the rural economy is likely to be linked with workers in the farm sector. Secondly, the common form of agricultural labour is casual labour or ganyu which usually occurs in the farm or estate sub-sectors where workers are paid just above the rural minimum wage. As observed earlier, ganyu is a major source of livelihood for poorer households. The Heckit Model has the advantage of computing a hazard variable also known as Inverse Mills Ratio (IMR) and testing and controlling for selection bias in the second stage of estimation of parameters.

4.2.3 Distribution assumptions of the error terms, μ and ε

To simplify this framework, the Heckit Model assumes that:

- i. there is a joint distribution of the error term, μ in the select equation and the error term in the structural equation, ε which is not zero ($\rho \neq 0$) i.e. they are bivariate normal; and
- ii. the hazard variable, λ must be statistically significant for sample selection to exist;

Therefore, a Heckit Model can be formulated as follows:

$$lpd^* = \begin{cases} 1 & \text{if } lpd_i^* > 0 \\ 0 & \text{if } lpd_i^* \leq 0 \end{cases} \dots\dots[18]$$

$$hours = \begin{cases} w' \alpha + \varepsilon & \text{if } lpd_i^* > 0 \\ 0 & \text{if } lpd_i^* \leq 0 \end{cases} \dots\dots[19]$$

Where lpd^* is a latent variable as defined in equation 12 and hours is a censored continuous variable for hours of work as defined in equation 15. It is important to take note that in the Heckit model shown above, equation (18) is the selection equation that contains at-least one variable that is not in the outcome equation (19) ideally the reason is that we

want to identify the equations and also to avoid unnecessary and excessively large multicollinearity among regressors, $\mathbf{x}'$ and $\mathbf{w}'$ (Heij et al, 2004:504).

From equation 18 and 19, we know that the random disturbances are assumed to be jointly distributed. Since the decision to participate is directly related to the choice of positive hours of work (wage), therefore in matrix form we shall represent assumption (i) as follows:

$$\begin{bmatrix} \mu_i \\ \varepsilon_i \end{bmatrix} \sim N \left[\begin{pmatrix} 0 \\ 0 \end{pmatrix}, \begin{pmatrix} 1 & \rho \\ \rho & \sigma_u \end{pmatrix} \right] \quad \dots\dots[20]$$

Where if $\rho \neq 0$, then the basis for estimating parameter coefficients is the conditional regression function incorporating the inverse mills ratio obtained from the probabilistic selection model in the Heckit framework shown as follows:

$$E[\text{hrs} | \text{lpd} > 0] = E[\text{hrs} | \mu > -\mathbf{x}'\beta] = \mathbf{w}'\alpha + E[\varepsilon | \mu > -\mathbf{x}'\beta] = \mathbf{w}'\alpha + (\rho \cdot \sigma_\varepsilon)\lambda_i \quad \dots\dots[21]$$

$$\text{Where } \lambda = \frac{\phi(\mathbf{x}'\beta)}{\Phi(\mathbf{x}'\beta)} \quad \dots\dots[22]$$

Lambda represents a non selection hazard variable also known as the Inverse Mills Ratio. The numerator is the standard normal distribution and the denominator is the cumulative normal distribution of the labour force participation (probit) regression. What we shall do then is to estimate equation 16 to find the estimated coefficients for female farm labour supply equation using Heckit Model. Our basic empirical estimation procedure will be to estimate equation 16 firstly by jointly estimating a structural labour supply equation with selection equation using Heckman Two stage estimator and in the second stage using the non selection hazard variable to estimate labour supply regression for workers only using OLS in order to correct for bias (Averett and Hotchkiss, 1997).

4.3 Simultaneity bias

While it is important to check the appropriateness of the stochastic specification of the model and its consistency with economic theory, care has been taken not to adopt a model that is theory consistent which imposes over strong restrictions on behaviour exhibited by workers in the labour market. The equations specified above are not determined in a

simultaneous fashion but alternatively both capture labour supply in terms of participation and hours of work. As observed by Sackey (1998), variables entering labour supply equations are supposed to be exogenous however, such may not be the case because some variables such as education and fertility may well be related with the error term. There is potential likelihood of simultaneity bias caused by the fertility decision and labour supply decision as both tend to be influenced by education as predicted in section 3.2.1.2. A woman's education affects decisions on the quantity of children and quality of children's education. Thus, we are required to test for exogeneity of the covariates using the Hausman test. The advantage of using this test is that if some variables are found endogenous then full information maximum likelihood techniques can be applied, for example, the Instrumental Variable Methods (IVM) can be applied in the selection models.

4.4 Estimation Technique

Generally, there are two ways of estimating Heckman Selection Models:

- 1) The Two step procedure (commonly known as Heckit), where in the first step you estimate the participation equation by using a probit to compute the IMR and the second step you use OLS to estimate the hours (wage) equation where the IMR is one of the regressors. This methodology has been applied in many studies considering possibility of selection bias, for instance, Averett and Hotchkiss, (1997) and Masanjala, W.H. (2004).
- 2) The second procedure is to use maximum likelihood estimation. This technique has been reported by Maglad (1998). The two methodologies provide similar results, although the coefficients from maximum likelihood estimation are more efficient than the former. The only difference is that maximum likelihood estimation requires exclusion restrictions for identification of selection and structural equations unlike in Heckit.

Presence of censoring of the dependent variable makes Ordinary Least Squares (OLS) estimation technique unsuitable in such studies because coefficient estimates are biased and inefficient, however by using selection models, OLS can still be applied conditional on the employed workers only while incorporating IMR in the equation as shown in equation

(21). We shall estimate parameters using a Heckit Technique because of its simplicity in estimating the selection and structural parameter equations. The Heckman Two-step Technique adopted in this study maximizes a sum of two likelihood functions for working and non working women in order to estimate the parameters of the labour supply.

4.5 Definition of Variables

The labour supply model is estimated for women using cross sectional data for ages between 15 and 85 adopting (Blundell and Meghir, 1986). We allow for female age to be lower than 21 years where one is categorised as an adult due to the expected high incidence of HIV and AIDS in poor countries like Malawi which might have led some of the women in some households into assuming responsibilities of the household head.

4.5.1 The dependent Variable

LPD is the dependent variable in the selection equation (probit model for labour force participation) which is a latent or indicator variable with only two outcomes (1 if a participant and 0 if not a participant). Hours worked (HOURS1) is the dependent variable for labour supply in the agricultural sector.

4.5.2 The independent variables

The independent variables used in the estimation can be grouped as follows: individual, household, socio-economic characteristics and demographic characteristics. Other factors such as workplace and social characteristics that may possibly add to the fit of the model have not been captured fully due to limitations in the data. Individual characteristics may include age, marital status, years of education attained by a woman. Household characteristics may include the size of a household and the number of under-five children in a household as a proxy measure for fertility rate of a household and economic characteristics include real wage of the woman and husband. Social and demographic characteristics include urban location dummy variable and regional location variables

(north, central and south). Some other variables such as political attitudes and other institutional factors have not been captured in the study.

4.5.3 Description and Justification of the Variables

LPD represents labour market participation dummy variable. Where LPD equals 1 if an individual is working or LPD equals zero (0) otherwise. The question used to capture this is “did the respondent work any hours at these tasks? This is the decision variable for labour market entry as it captures all individuals that participate meaning that their reservation wage is lower than the market wage rate.

HOURS1 represents a continuous variable for hours worked in the agricultural sector by women in the sample. Women in the sample reported to have been doing agricultural activities for a wage. The individual was asked whether she spent any hours doing agricultural activities like farming.

HOURS2 represents a continuous variable for hours worked in the non agricultural sector by women. The individual was asked whether she worked any hours doing non agricultural activities in other sectors.

AGEHH is the age of the female household head. This is a continuous variable AGEHH is postulated to have a positive effect on labour participation and labour supply as asserted by Ntuli (2004)

AGESQ represents the square of the age variable used to capture non linear effect of age on the probability of working. Joll et al (1993) as cited in Ntuli (2004) postulated an inverted U shape for the relationship between age and square of age. At a younger age an individual is likely to participate more in the labour market than at a higher age.

MST represents a dummy variable for marital status. MST equals 1 if a woman is married and 0 otherwise. Marital status in most studies is postulated to have a negative impact on

female labour market participation because women view their husband's income as non labour income which has a negative effect on labour supply.

HSIZE represents a continuous variable for number of people dwelling in a single household. This variable is used for capturing demographic effects on labour market participation. For a larger household, a female household head may be more likely to work in order to fulfil the requirements and needs of her household than for a smaller one.

DURB represents a dummy variable for location in the urban area. DURB equal to 1 if live in urban and DURB equals 0 if lives in the rural. This variable is used to capture the urban-rural differential in labour market participation rate because of the fact that farm labour market participation may potentially be influenced by location.

SCHLNG represents a continuous variable for years of schooling for an individual woman in the sample. Education is expected to positively influence labour force participation for an individual because it represents a form of an investment in human capital. Individuals who spend more years on education therefore expect to earn a better return such as a higher wage rate hence a linkage between education and labour market participation exists.

RWAGE represents real wage rate of a household head (woman) per day. An individual was asked how much was her daily wage she received upon doing the task in the past week. Real wage is important because it measures the purchasing power of the nominal wage (That is the nominal daily wage rate adjusted for inflation). We compute real wage by dividing observed wage rate by average Consumer Price Index (CPI) for 2004 and 2005 since the survey period varied from March 2004 to March 2005

RWAGESQ represents a second degree polynomial of real wage. The higher the wage the lower the hours of work an individual works. The use of the square of real wage is to capture non linear effects of labour supply curve. Hypothetically, at very high wage rate labour supply curve can be positively sloped or backward bending. The use of this variable is to measure the direction of the curve.

RWAGEHUS represents real wage of the spouse to the female household head. Spouse wage rate is allowed to have an effect on labour supply that is different from the impact of sources of income other than the labour income. This is different from non labour income because it measure cross substitution effect of wage changes on spouse's response to work (Blau and Kahn, 2005).

HLTHST represents a dummy variable for health status of women. Hlthst equals 1 if a respondent responded a 'yes' to suffering from a diagnosed illness such as TB, Malaria, Cholera, Birhazia, Cough, etc during the past week of the survey or Hlthst equals zero (0) otherwise (Shirley D. et al, 1995)

KDS represents number of children less than 5 years old. This is a proxy for fertility level of each household in the sample. The idea for using this measure is based on the fact that women have three main roles one of which is a reproductive role. If a woman has more children she may spend more time in child care and less time on the labour market activities.

NLY represents non labour income. Economic theory predicts that a rise in non labour income has a negative effect on labour supply. In this study, non labour income is a scale variable surrogated by total sales earned from a non farm enterprise.

DASST represents a dummy variable for asset holding. Equals 1 if a woman owns a 'house' or if a woman household head owns a 'commercial building' or if owns 'other assets e.g. land. The variable is used in labour supply analysis because of the idea that an individual's worth status affects her labour market status as it is expected that those who are rich will be less willing to work.

DNOR represents a dummy variable for Northern location. DNOR equals 1 if respondent comes from northern region or equals zero (0) otherwise. The use of this variable is to control for northern geographical location and its effect on labour supply

DCEN represents a dummy variable for Central location. DCEN equals 1 if respondent comes from Central region or equals 0 otherwise. The use of this variable is to control for Central geographical location and its effect on labour supply

DSOU represents a dummy variable for Southern location. DSOU equals 1 if respondent comes from southern region or equals 0 otherwise. The use of this variable is to control for Southern geographical location and its effect on labour supply

MIGRT represents a dummy variable for migration status of a woman. Equals 1 if migrant or equals 0 otherwise. We shall use a migration dummy because the sample is characterised internal migration between rural and urban since there are household members who responded a 'YES' or 'NO' to a question "whether they have been living in that particular area"

4.6 Data Sources

This study uses secondary data sets obtained from the Malawi Integrated Household Survey data conducted from 2004 to 2005 by the National Statistics Office with technical assistance from The World Bank (NSO, 2005). The survey collected information from a total sample size of 11,280 households from 20 households per Enumeration Planning Area covering 564 EPA's using a two-stage stratified random sampling. In the raw sample, total number of women respondents initially observed was 26,777 covering all the 27 districts in Malawi. In this study, female farming households are the target group and their characteristics were observed. The study observed characteristics for 3,290 female farmers and 1,045 women worked in non agricultural sector. 2,229 women had observed wages greater than zero in the agricultural sector and 124 had observed wages in the non agricultural sector. To generate all the required variables used and to estimate the model both SPSS version 10.0 and STATA version 9.1 were applied.

4.7 Sample Characteristics

As stated above, this sample composed of 3,290 workers in agricultural sector and about 1,044 workers in the non-agricultural sector. It is interesting to learn that the Integrated Household Survey Report for 2005 indicates that an average of 92% of women were participants in the labour force which means less than 10% of women in the labour market were non participants. The target group is the sample of female farming household heads employed or not employed during the reference week of this survey in the year 2004. Whiteside (2000) argues that farm labour, in particular ganyu provides a major source of livelihood among the poorer household. Most of these workers report as farmers as being their major economic activity. The simple criteria used to select household heads involved choosing females who responded to be heads in each household. We observed hours of work for those who worked during the reference week of the survey meaning that they were employed for pay in the agricultural sector in terms of casual labour (ganyu), tenant system of farming, off own-farm labour and other project works in form of safety nets. Hill (1984) argues that labour market participation occurs when a person (a woman) leaves home and works for someone else for pay. Although, there might be other more concrete definitions, this study adopted this definition because most agricultural labour markets are characterised with predominance of casual labour which is a common form of work for pay in both rural and urban sectors in Malawi. The descriptive statistics of the data have been explained in Chapter 5 as part of results of the study. The summary in Table 4 below reveals some observed characteristics for female farm labour force in Malawi. Presented are selected scale and continuous variables only for demographic characteristics in the agricultural sector between participants and non participants. The average age in the sample of women is 38, which implies that the average woman in the sample under study is not very old. In the sample, participating women are characterised by higher years of education than the non participating women in the both the agricultural and non agricultural sectors. The difference in the means of all variables for participants and non-participants farmers is also statistically significant using the Anova Test.

Table 4: Demographic and other socioeconomic characteristics of the sample

Variable	Non participants Mean	Participants Mean	All Households Mean	Anova Test	
				F	Sig.
Age	37	38	38	25.50	0.00
Household size	5	5	5	4.71	0.03
Hours (agriculture sector hours)	0.00	16	14	43.95	0.00
Schooling years	4	5	4	65.12	0.00
Children*	3	3	3	11.398	0.00
Daily wage (K per hour)	0.00	17	14	11.33	0.00
RWAGE (Female)	0.00	7.79	7.72	24.32	0.00
RWAGE(Husband)	0.00	0.06	0.06	12.00	0.00
Non labour income(k)	K6,352	K1,254	K2,900	59.98	0.00

*Children less than 5 yrs old

4.8 Diagnostic Tests

Model Specification Tests

Generally model specification error may occur due to omission of a relevant explanatory variable(s) or addition of unnecessary explanatory variable in the model or functional form misspecification. Ramsey reset Test are for linear models and thus may not apply in a Heckit Model since the model is non linear in parameters.

Multicollinearity

Before carrying out regressions it is necessary to carry out multicollinearity test among all the explanatory variables in the regressions. Excessive collinearity must be avoided although Gujarati (2003:363) argues that multicollinearity is God's will and it is bound to occur in multiple linear regression. One possible way to detect multicollinearity is by carrying out pair-wise correlation t-tests.

Heteroskedasticity

Generally, heteroskedasticity is expected in cross-sectional data due to the fact that in cross-sectional data we observe values for households which have very different

characteristics at a particular time and this may introduce variability. Such variability may be captured by the error term in the regression. However, we shall therefore control for heteroskedasticity in the regressions by estimating robust standard errors or using bootstrapped standard errors in Heckit Model. In STATA 9.0 most of the empirical estimators, for example OLS, simple logit and probit are able to correct for non constant variance using the robust command, however, in Heckit model, this command is not available as a result one has to resort to different methods in order to obtain constant variance. There are two methods to consider according to Cribari-Neto and Zarkos (1999). The first method commonly applied when using pooled data is to convert the data and use an integral regression, which allows robust standard errors. The second method is to obtain bootstrapped standard errors. Cribari-Neto and Zarkos (1999) suggest that bootstrap methods can be successfully used to obtain variances of linear parameters under non-normality.

4.9 Goodness of Fit

There are many measures of goodness of fit in the case of models with qualitative dependent variables. The conventional R^2 type measure poses a problem if the dependent variable is a latent variable hence we shall report alternatives provided in STATA 9.1 such as Pseudo R^2 .

Log Likelihood Ratio Test

We want to test the null hypothesis that all parameter coefficients are equal to zero against the hypothesis that not parameters are equal to zero. If the LR Chi square value is significant then we may conclude that all variables are jointly significant. Non linearity effects in the Heckit model can also be tested using LR test. This hypothesis may be rejected if the loss in the log likelihood is too large. If this log likelihood ratio is significantly different from zero then there we can reject the hypothesis of linearity.

Wald Test

Using Wald Test we can also test the significance of particular explanatory variables in a Heckit Model. The Wald Test is one of a number of ways of testing whether parameters of

associated with a group of explanatory variables in the model are equal to zero. F-Test is not applicable in such models because parameters are non linear in the model. We may use Log Likelihood Ratio Test or Wald Test for carrying out parameter restriction test in the non linear models because these tests are asymptotic in nature and parameters are nonlinear in the model hence allows application of these tests. We will therefore conclude whether there is loss or not in the log likelihood. For example, if p-value is less than 0.05 then we may conclude that the model is well specified and parameters are jointly significant at 5% significance level.

CHAPTER 5

RESULTS AND INTERPRETATION

The estimated results using Heckit Model provide findings that explain the probability of participation and hours of work among females in the sample. The study also carried out a sensitivity analysis by estimating labour supply regression using OLS, Tobit model and Heckit to see how estimated coefficients behave when other selection models are applied.

Table 5: Descriptive Results

Variable	Mean	Std dev.	Min	Max
Female labour force participation dummy(LPD)	0.67	0.46	0.0	1
Age of female respondent in a household (AGEHH)	38	15.5	15	85
Square of age (AGEAGESQ)	1707	1385.1	225.0	7225
Female marital status(MSTATUS)	0.78	0.4	0.0	1
Number of children under five years of age(KDS)	3	1.4	1.0	12
Number of household members(HSIZE)	5	2.3	1.0	27
Dummy variable for urban location of a female household member(DURB)	0.123	0.3	0.0	1
Daily Wage rate observed for female (WAGE) per day	K14	33.9	0.0	400
Real Wage Rate(RWAGE)	0.08	0.17	0	2.27
Real Wage Rate of Spouse (RWAGEHUS)	0.06	0.5	0	31
Hours worked per week in agric sector (HOURS1)	14	1.97	0	80
Hours worked per week in non agric sector(HOURS2)	3	5.64	0	105
Non labour income (NLY)	K2,900	250	0	K1,200,000
Dummy variable for owning assets by a female household head (DASST)	0.0	0.2	0.0	1
Dummy variable for female migration characteristics of a household member(MIGRT)	0.6	0.5	0.0	1
Years of schooling for a female household member (SCHLNG)	4	4.7	0.0	48
Dummy variable for central region location (DCEN)	0.4	0.5	0.0	1
Dummy variable for Urban location (DURB)	0.12	0.33	0	1
Dummy variable for northern location(DNOR)	0.2	0.4	0.0	1
Dummy variable for southern location(DSOU)	0.5	0.5	0.0	1

Source: Author's- calculated from Integrated Household Survey, NSO (2005)

NOTE: For all categorical variables the mean is the proportion of all those women respondents with a dummy value equal to 1

The statistics reveal that female farm participation is very indeed high and about 67% of women are participants in the agricultural labour force. Among this farming population about 12% live in the urban areas and 88% live in the rural areas. Therefore, it is likely that the majority of farming households in the agricultural sector are rural based. The mean nominal daily wage rate was K14 per day for all farmers in this sample. If conditioned on workers only the mean wage is still low at K17 per day. This means that there are some workers who have hidden employment as they have positive hours yet they are not willing to reveal their wages. The average age of woman is 38 years and their mean years of schooling is 4 years which is very low confirming that very few completed their education whether especially primary as such it should be less surprising if education is found not to significantly explain labour participation and labour supply in this sample. Descriptive statistics also reveal that average household has about 3 children less than 5 years of age on average. This captures the fact that fertility in Malawian rural households is really high. Finally the results reveals that the mean household size is around 5 and on average a household has non labour income of around K2,900 per month from sales of non farm produce or other forms of enterprises owned by female households.

5.2 Econometric Analysis of the Variables in the Model

We shall present the estimation results in Table 6 based on Heckman Two-Step procedure and explain our findings.

5.2.1 Heckman Two-step Model Results (Agricultural Labour Supply)

This section presents results of Heckit Model equation 18 and equation 19. Correlation analysis was done to detect possible multicollinearity among explanatory variables in the system of equations. Based on pair-wise t-tests, results reveal absence of serious multicollinearity among covariates as shown by the correlation matrix in Table 9, and 10 except for age and age squared which may be expected to be highly collinear because they are related variables.

Table 6: Heckman Two-Step Estimation (Heckit) for Agricultural Labour Supply

Number of obs	3,290	Censored obs	1,061	
		Uncensored obs	2,229	
Probit Regression		Heckman Selection Model		
LR chi2(12)	581.62	Wald chi2(13)	77.46	
Prob > chi2	0.000	Prob > chi2	0.000	
Log Likelihood	-1752	Log likelihood	-2967.41	
Pseudo R2	0.1406			
Variable	Coef	Bootstr. Std err.	z	p>z
HOURS1				
AGEHH	0.002	0.001	1.05	0.242
AGESQ	-0.145	0.123	-1.18	0.193
RWAGE	15.77*	3.320	4.75	0.000
RWAGESQ	-12.78*	3.977	-3.21	0.001
RWAGEHUS	0.033	0.226	0.15	0.885
NLY	-0.000	0.000	-0.97	0.272
HLTHST	0.971	0.687	1.41	0.154
DURB	7.93**	3.81	2.08	0.023
SCHLNG	0.101	0.089	1.13	0.259
CONS	28.45*	3.47	8.10	0.000
LPD				
AGEHH	0.03*	0.01	3.75	0.00
AGESQ	-0.00*	0.00	-3.15	0.00
MSTATUS	0.30*	0.07	4.40	0.00
HSIZE	0.01	0.02	0.71	0.48
KDS	-0.01	0.03	-0.42	0.67
DASST	-0.25**	0.13	-1.98	0.05
DURB	-1.44*	0.08	-17.40	0.00
HLTHST	-0.05	0.05	-0.85	0.39
MIGRT	-0.26*	0.05	-5.00	0.00
SCHLNG	0.02*	0.01	3.35	0.00
DNOR	0.15*	0.07	2.16	0.03
DCEN	0.01	0.06	0.18	0.86
CONS	-0.12	0.19	-0.62	0.53
Lambda	-12.31	3.73	-3.30	0.00
Rho	-0.79			
Sigma	15.67			

NOTE: *, **, *** represent significance at 1%, 5%, 10% levels. z statistics are based on bootstrapped standard errors.

Interpretation of Results

From estimation of labour supply using Heckit model whose results are shown in Table 6 above, the following conclusions can be made: Firstly, the Log likelihood Ratio Test is highly significant at 1% meaning that all parameters are jointly significant in the first probit estimates explaining labour force participation decision. The Wald Test is also highly significant meaning that all parameters are jointly significant in the labour supply regression in the bi-variate regression.

Secondly, the correlation coefficient of the error terms as shown in equation (20) is not zero ($\rho = -0.79$) meaning that the error term in the decision to participate in the farm labour markets is negatively associated with the decision to supply specified amount of working time by farmers.

Thirdly, the non selection hazard coefficient (inverse mills ratio) is highly significantly different from zero ($\lambda = 12.31$, p-value 0.001). Therefore, the significance of inverse mills ratio means that there is selection bias in the sample. We can therefore conclude that it was equally useful to estimate structural labour supply equation using Heckit Model because the methodology can control for selection bias.

Finally, post estimation tests were carried out to find out if residuals in the labour supply were endogenous with some covariates in the regression. The results shown in Table 11 reveal that we cannot reject the null hypothesis of no endogeneity of the error term at 10% significance level. Therefore, we do not need to use Instrumental variables for education and fertility variables in the Heckit Model. At this level it may be necessary to interpret the results and correct for selection bias in the second stage.

5.2.1.1 Participation Equation

The lower section of Heckit regression results from Table 6 are with respect to probit estimates for female participation controlling for rural and urban labour markets and regional location. Therefore we can interpret results as follows:

Firstly, AGEHH has an expected positive sign apriori and highly statistically significant effect on female labour force participation. On the other hand, AGESQ has an expected negative impact on participation and is also highly statistically significant at 1%. It may be

worthwhile to argue that the second degree polynomial of age has a non linear effect on female decision to join labour market which means at younger age female farmers may be eager to join the agricultural labour market because they are energetic however, the older women grow the less willing they are to work in the agricultural labour market.

Marital status (MST) has an unexpected positive sign a priori, although its impact is also highly statistically significant at 1%. The interpretation is that if we replace a sample of unmarried household heads with married, the probability of participation by women in the market will increase. This result does not confirm those findings by Lee (2005) for South Korea that women who are married may not interested to work. However, in Malawi, this implies that a female farmer takes marriage as an opportunity to increase her joint labour supply with her spouse hence possibility of obtaining a positive coefficient for labour participation.

The coefficient of household size (HSIZE) is positive as expected a priori although not statistically significant at 5% level. Thus, we may infer that cultural heritage of extended family system is a cause of higher household sizes and this has a bearing on the insignificance of the coefficient. Although, farming households may have larger household sizes this might not directly influence the household head to participate in the farms. This means farming households are not at all influenced by their household sizes.

The coefficient of KDS has an expected sign and is not statistically significant at 5% level. Households with more under-five children imply that they have a higher fertility level. We may expect that such households might be emphasizing the reproductive role other than the labour market role, hence the lower the expectation to participate in agricultural activities.

The coefficient of asset dummy variable (DASST) capturing ownership of real assets (non financial assets) by a household head has an expected negative impact on farm labour market participation and is statistically significant at 5% level. This means that if a woman owns an asset(s) they will be less willing to work compared to women who do not have any asset at all in their household. This result is very fundamental in this analysis. We know that

the asset dummy variable indicates a measure of wealth at a particular point in time for each household. It is very likely to expect that wealthier farmers are unlikely to supply hours of work in the agricultural sector in form of casual labour.

The coefficient for urban dummy variable (DURB) has an unexpected sign and is highly significant statistically at 1% level. This means that if we replace a sample of urban women with rural women the probability of working on agricultural farms by women is more likely to increase. Although we expect urban women to participate more than rural women because of having better job opportunities, we find most women participants are rural based because the sample is highly skewed towards agricultural activities. Thus there is a rural-urban differential in hours of work in favour of rural areas.

The coefficient of health status of a farmer has an expected negative sign and is statistically insignificant at 10%. This is fundamental because it informs us that decisions to work are made on the basis of health status of the woman. If a woman is ill, then the likelihood of participating in the farm labour markets is reduced. Actually, a sick farmer cannot be expected to work off farm or own farm.

The migration dummy variable (MIGRT) has a negative impact on agricultural labour market participation and is highly statistically significant at 1% level. Possible explanation could be that if we replace a sample of farming non migrants with a sample of farming migrants, it can be expected that they will be less willing to work. The reason is that migration behaviour tends to be influenced by factors other than farming.

The impact of region has some important findings on farm labour participation based on the same regression. Only the dummy variable for north is highly statistically significant at 1%. This means that regional location may have an impact on labour market participation. Using south, as a reference category, the results indicate that if a woman comes from south she is likely to participate in the agricultural labour market as shown by a positive intercept. However, if a woman comes from the northern region she is likely to participate more compared to a woman from south or central regions since the coefficient is positive and significant at 5%.

The role of education towards labour market participation of women is a very important element in this study. The coefficient for years of schooling has a negative impact on farm labour participation and highly statistically significant at 1%. This means that the decision to work on the farms by women farmers based on this sample is not influenced by the level of an individual's education. Although education is necessary to a farmer in terms of adoption of technology and the application, we find that about 83% of agricultural workers mostly farmers have not completed formal primary education and only 11% have completed hence it may not be surprising to find that the decision to participate in the farm does not depend on education level.

5.2.1.2 Marginal Effects in Agricultural Labour Supply Regression

It is advisable to interpret agricultural labour supply in terms of marginal effects calculated based on Table 6 whose results are shown below in Table 7. Marginal effects have been obtained from the Heckit regression above because it jointly estimates hours worked and market participation hence more relevant for interpretation.

Table 7: Marginal Effects in Heckit for Agricultural Labour Supply

Variable	Hours worked = Fitted values (predict) = 28		z	p-value
	Elasticity (dy/dx)	Std. err.		
AGEHH	0.01	0.10	1.12	0.264
AGESQ	-0.145	0.21	-1.26	0.208
RWAGE	15.8*	3.31	4.53	0.000
RWAGESQ	-12.8*	3.97	-3.16	0.002
RWAGEHUS	0.03	0.23	0.15	0.885
NLY	-0.001	0.00	-0.97	0.330
HLTHST	0.968	0.01	1.53	0.126
DURB	7.92*	0.01	2.26	0.024
SCHLNG	0.085	0.086	0.99	0.323

Firstly, the model predicts an average farm labour supply of approximately 28 hours per week. This means that a farming household head supplies about 28 hours per week in the agricultural sector usually working as a family unit.

The coefficient for age of the household head has an expected positive sign a priori and is highly statistically significant at 1%. An increase in the age of the woman household head by 1 additional year increases the probability to participate by almost 1%. Women's labour supply is more responsive to increases in age at younger age than at higher age. The reason is that as they grow older they tend to depend on their extended families to provide for their needs.

The coefficient for real wage of the household head has an expected positive sign a priori and is also highly statistically significant at 1%. An increase in the real wage rate by 1% increases agricultural labour supply by almost 16% at mean. The coefficient of real wage is positive and implies that a woman's farm labour supply is directly influenced by real wage rate. This means that workers are not myopic hence they are rational economic agents in the labour market. Workers are able to translate effects of changes in price on their nominal wages such that any increase in real wages cannot fool the workers in the short term. Workers base their labour supply decisions on the real wage rate. The significance of the square of real wage in the sample provides evidence for presence of a backward bending female agricultural labour supply. The positive coefficient of real wage therefore suggests a positive labour supply curve with respect to wage rate exists in the farm labour markets. However, if the square of real wage increases by 1% then female agricultural labour supply falls by almost 13%. We can therefore conclude that as wage rate increases beyond a certain limit, further increase induces an income effect as a result farm labour supply falls. This signifies presence of a backward bending labour supply curve for farm labour markets in this sample.

The coefficient for husband's real wage is positive although not statistically significant at 10%. The positive coefficient of a spouse real wage implies that a woman labour supply in this framework is positively affected by her husband's wage rate. As seen under participation regression that marital status positively impacts on female labour supply, we may also conclude that there is no crowding out effect of a husband's real wage rate implying that a woman and her spouse make joint labour market decisions. The positive coefficient of the spouse' real wage implies that their leisure times are complementary.

Allowing an additional year of schooling by a woman head would increase her hours of work in the agricultural sector labour supply by almost 2%.

The coefficient of non labour income is negative apriori although not statistically significant at 10%. An increase in non labour income will have a downward shifting effect on farm labour supply which means an individual will work less.

The coefficient for health status dummy has unexpected sign apriori and statistically significant at 10%.

The coefficient of urban dummy is positive apriori and statistically significant at 5%. Unlike in the participation regression where the coefficient had an unexpected sign in favour of rural labour market participation in this scenario, there is urban – rural differential in hours of work in favour of urban agricultural workers. This result reveals some hidden characteristics of the farm labour markets that there are white collar jobs commonly in the urban where women may work more hours than in the rural labour markets.

5.2.1.3 Agricultural Labour Supply - OLS Conditional Regression Results

As a two-step approach, results for farm labour market participation conditional on the employed and corrected for bias using the inverse mills ratio as an additional variable in the regression have been presented in Table 8 below.

Table 8: Agricultural Labour Supply -OLS Regression (Bias corrected)

Hours worked in agricultural sector conditional on participants		Number of obs	2229
		F(10,2218)	5.752
		p>F	0.000
Wald chi2=1067.55		R-squared	0.18
Prob > chi2=0.000		Root MSE	15.32

Variable	Coef.	Bootstrap. Std. err.	Z	P>z
AGEHH	0.00	0.00	1.16	0.244
AGESQ	-0.17	0.13	-1.32	0.188
RWAGE	15.78*	2.95	5.35	0.000
RWAGESQ	-12.79*	3.25	-3.94	0.000
RWAGEHUS	0.04	0.71	0.06	0.951
NLY	-0.00	0.00	-0.97	0.330
HLTHST	1.00**	0.53	1.88	0.061
DURB	9.13*	3.84	2.38	0.017
SCHLNG	0.10	0.08	1.19	0.234
INVMRATIO	-13.59*	3.91	-3.48	0.001
CONST	29.35*	3.35	8.76	0.000

Note: t-statistics are based on bootstrapped standard errors.

From the results above, it can be shown that age and age square still do not explain hours of work at 5% statistical significance level. However, we observe that the exact levels of significance of variables are slightly lower after correcting for bias compared to results in Table 6. In addition, more variables are now statistically significant. We also find that the dummy variable for health status of a woman now becomes statistically significant at 10%. The conclusion, therefore, is that all other variables do not change as before. The real wage has a positive effect and the square of real wage has a negative effect on labour supply indicative of a backward bending labour supply curve. This result confirms the hypothesized economic phenomenon of a backward bending agricultural labour supply with a non-linear curve based on this sample.

The results above indicate an own-wage farm labour supply elasticity of around 0.16. This is well below 0.78 by Blundell, R and MaCurdy, T (1999), 0.77 for Jacobsen (1998) as cited in Blau and Kahn (2005) and below 0.44 and 0.30 by Hill (2005). In the case of farm labour supply of females in Malawi, labour supply is inelastic and less responsive to changes in

the exogenous wage rate of a female worker at low wage rate. An interesting result is that we can expect a backward bending non linear farm labour supply curve for females in this sample.

MLE results have been included in Appendix 2 for further reference and explanation of Table 12 is not provided because results are similar to the Heckit model.

5.2.1.4 Sensitivity Analysis

In this study, Heckit Methodology was applied in estimation of joint decision to participate in the farm labour market and hours worked. Furthermore, presented in Table 15 in Appendix 2 are results for sensitivity analysis by comparing estimates of labour supply using three different techniques: Conditional OLS, Tobit and Heckit models. What is observed is that coefficient estimates for variables in the regression are more insignificant at 5% if simple OLS is used. The reason is that parameters are being inefficiently estimated since the dependent variable is censored. Applying a Heckman selection model allows us to obtain asymptotically consistent estimates of labour supply regression because of estimating a nonlinear relationship. Coefficient estimates of variables have similar signs in the Heckit regression and the conditional OLS regression although some coefficients become statistically significant as we correct for bias in the OLS regression using Inverse Mills Ratio, for example, variable for health status of a woman. The results appear very different if a Tobit Model is applied to this sample of women in the agricultural sector. Although coefficient estimates for urban dummy variable and education are significant statistically, the signs of coefficients are opposite those apriori.

5.2.2 Heckman Two-step Model Results (Non Agricultural Farm Labour Supply)

Similarly, results for non agricultural female labour supply are shown in Table 13a in Appendix 2. The results are based on a regression of labour market participants in the non agricultural sector and therefore we shall interpret results with a focus on off farm labour markets. Important to note is the fact that most variables hypothesized to influence non agricultural labour force participation are statistically insignificant at the conventional level

except for age square, marital status, household size and urban dummy variable. Non agricultural labour supply is also influenced by square of real wage rate, spouse's wage and female education level which are all statistically significant.

5.2.2.1 Non agricultural Labour Supply - OLS Conditional Regression Results

Most variables that were statistically insignificant are now statistically significant except for real wage rate for female, spouse real wage and non labour income after conditioning the OLS regression on workers (Table 13b). Insignificance of wage rate in explaining labour supply in the non agriculture sector is due to the fact that most workers do not reveal their true wage and neither do workers truly reveal their earning from other investments (non labour income).

Education significantly influences non agricultural labour supply with respect to females in this sample. Most workers who have attained some level of education are probably working in white collar jobs expecting a better return on their investment in education.

The results reveal that the mean hours worked is lower (24 hours) in the non agricultural sector than in the agricultural sector (28 hours). These findings may be important for policy implications in the analysis of labour markets.

CHAPTER 6

6.1 SUMMARY AND CONCLUSION

This thesis began by identifying the main theme of determinants of farm labour market participation and labour supply for females in Malawi which are two different things. Labour market participation captures a decision to work or not to work and the latter is a quantity measure of hours of work. Despite contrasts from other studies on labour market participation and labour supply elsewhere, this cross-sectional study has provided a glimpse on the nature of determinants of farm labour market participation and labour supply and its associated farm labour supply elasticity in Malawi.

Looking at the first section of results, our findings reveal that farm labour market participation is highly determined by individual factors and household/family characteristics, economic factors such as real wage and level of wealth, demographic and other socio-economic factors. These results are consistent with previous studies as indicated in the literature review for instance, Sackey (1999), Aromolaran (2004), Maglad (1998), Ntuli (2004), Miller (1985) and Hill (1984).

As expected, education increases the probability of participating in market work by raising the opportunity cost of home time/leisure for women. An additional year of schooling has a significant influence on both farm labour and non agricultural labour participation regressions. However, years of schooling do not explain changes in hours of work among farmers and non agricultural workers.

Another essential result is the positive impact of marital status on farm labour market participation where it was argued that farm labour is done jointly as a family a decision hence it can be expected for marital status to have a negative coefficient. In view of non agricultural labour participation marital status has a negative impact. This result does not confirm Lee (2005) findings that marriage is deterrent to market work.

Finally, findings do not support the hypothesis that women with more young children are less likely to work as compared to those who have few young children. Although, fertility and education decisions can be endogenous in determining labour market participation (Lam and Duryea, 1999), fertility variable and education had low correlation and the Hausman test revealed absence of endogeneity among education and fertility and labour supply and that allowed us to use both as explanatory variables for labour supply.

As argued earlier, labour supply involves both participation decision and hours of work (Maglad, 1998:6), the study on determinants of female farm labour supply is positively influenced by age, real wage, husband's wage, education attainment, household size, marital status and health condition of the woman. Another batch of factors that negatively may affect female labour in the farm includes non-labour income, number of children in a household and wealth status of a household. Other variables were used to control for regional bias in labour supply and in addition results reveal that there is urban-rural farm labour supply differential based on this sample. This result does confirm the Lewis and Todaro hypothesis that asserts there is unlimited agricultural labour supply in the rural which is a possible cause for rural-urban migration.

Other results reveal that an increase in real wage can positively increase female labour supply. The uncompensated own wage elasticity of farm labour supply is highly inelastic at +0.16 implying that as the real wage increases by 1%, hours of work increase by almost 16% indicating the dominance of substitution effect over associated income effect. Similar to the non agricultural sector, the coefficient for real wage is positive indicating dominance of substitution effect. This supports the empirical evidence that most women do not substitute work for leisure they tend to work more hours as wage rate increases. However, the square of wage reveals that as real wage rise over and above a certain threshold, labour supply falls. This confirms presence of the backward bending effect of wage change on labour supply.

The impact of non labour income on labour supply is found to be negative and statistically insignificant at 10% which confirms a priori expectation of the effect of non labour income on labour supply in both sectors. *Ceteris paribus*, if non labour income increases then an

individual may achieve higher utility indifference curves as a result of having an increased budget constraint causing women to increase leisure and reduce working time.

The results exhibited in this section portray significant findings for labour force participation and labour supply of Malawian women in the agricultural and non agricultural sector. Actually, literature on labour supply is enriched since other studies, like Miller (1985) who confirmed backward bending labour supply curve. In this study, the square of real wage has a negative influence on labour supply. The statistical significance of the coefficient confirms with sufficient evidence that a backward bending farm labour supply curve exists for Malawi. The results generally confirm those of other empirical studies such as Miller (1985) and Nakamura and Nakamura (1983).

6.2 POLICY IMPLICATIONS

The results in this study provide a direction for assessing the likely impact on farm labour supply of current labour market and employment policies. Labour force participation targets for sectors targeted in the economic development policies do not exist in Malawi (MOG, 2005). Nevertheless, a rise in female farm labour supply is desirable because farming is an activity of the poor as such it may lead to an increase in production and standards of living of agricultural households where incidence of poverty is high (NSO, 2000). Total output could be increased as a result of a more efficient allocation of human resources.

Firstly, high rural farm labour market participation rate of women in the farms implies that there is high rural labour supply and farmers in the agricultural sector work more hours than workers in non agricultural sector who are in white collar jobs. However, results show that women in the farm sector work less than the maximum 48 hours per week as gazetted in the employment act of 2000.

Secondly, the statistical significance of real wage with respect to farm labour implies that workers in this sector are rational economic beings. This seems to suggest that employment and labour market policies that may effectively affect real wages such as

periodic reviews of minimum wages might directly or indirectly influence agricultural or farm labour supply of females in the short and medium term. In addition, prospects of labour market institutions not working well is being revealed in the study, real wage however, low (with a mean of 0.08) matters in labour supply decisions. The backward bending farm labour supply curve imply that during periods of food shortages and hunger usually labour supply is high especially with respect to ganyu labour. However, there is evidence of lack of coherence in relation to government policies, for instance, the Employment Act of 2000 and MPRS or MGDS are seen not to be fully aligned. Without enforcing labour market institutions there may be difficulties in sustaining economic growth through influencing growth in money wages and reallocating human capital resources from low productivity to higher productivity sectors.

Finally, the linkage between education and employment performance has not been explored fully in this study but much of the evidence from this study appears to suggest that a labour force with solid education skills foundation is an essential determinant of farm labour supply. Education is necessary to every farmer in both smallholder and estates terms of adoption and application of technology which can increase productivity and output.

6.3 LIMITATIONS OF THE STUDY AND DIRECTIONS FOR FUTURE RESEARCH

This essay is not an end all discussion on this topic of farm labour supply in Malawi as some observations on limitations have been suggested earlier. This research used secondary data collected by the National Statistical Office (NSO). There are some limitations regarding use of such data because not all variables of interest are available. The data is based on integrated survey and most variables may have potential measurement errors in estimating female farm labour supply. This is a common problem in labour market research. Such limitations can be addressed if primary data is collected by the researcher.

Although test for endogeneity were done signifying that education and fertility were exogenous in the model, some other variables such as marital status were not tested. For poor countries like Malawi, poorer households spend significantly less on education as a form of investment. It is also believed that marital decisions may not depend directly on career development for the poor households hence marital status was assumed exogenous in the model. However, Lee (2005) argued that marital status may potentially be endogenous with labour market participation because some women who target career development are less likely to marry. Therefore, there ought to be a control for unobserved heterogeneity which affects both participation and marriage in estimation of labour supply equation.

Finally, use of longitudinal data is heavily supported because of ability to control for heterogeneity of micro units used in the study. It may be important to study female farm labour supply in a dynamic perspective.

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APPENDICES

APPENDIX 1: Figures and Graphs

Figure 3: Hours worked in agricultural sector by all women in the sample

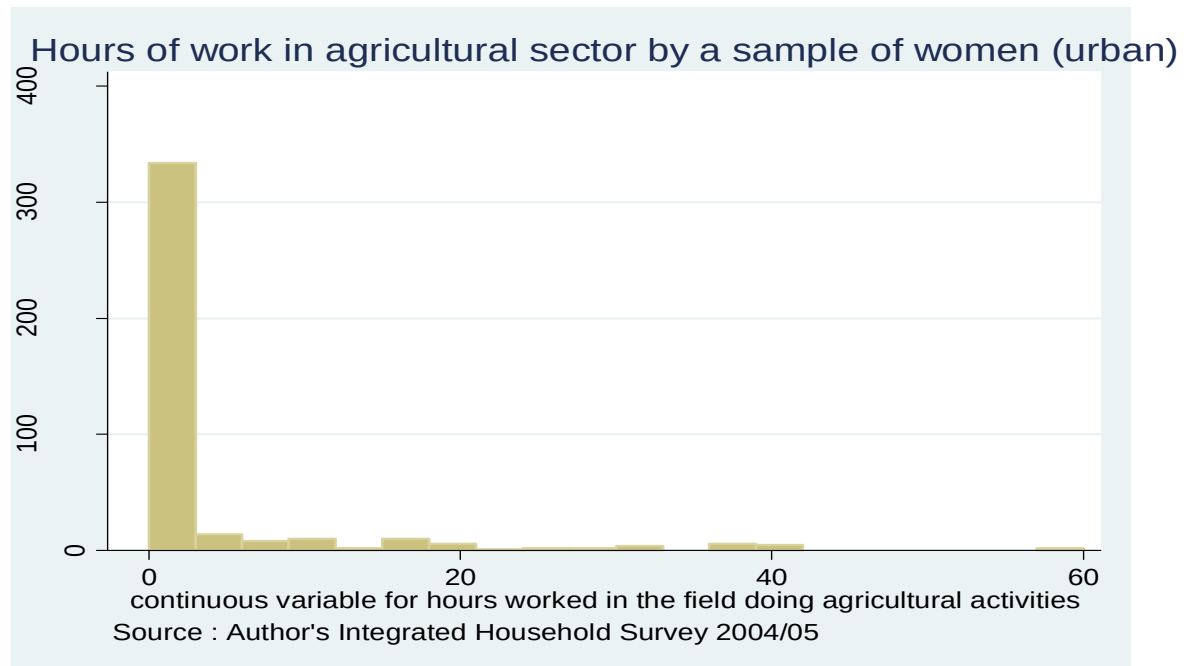


Figure 4: Hours worked in agricultural sector by all women in the sample

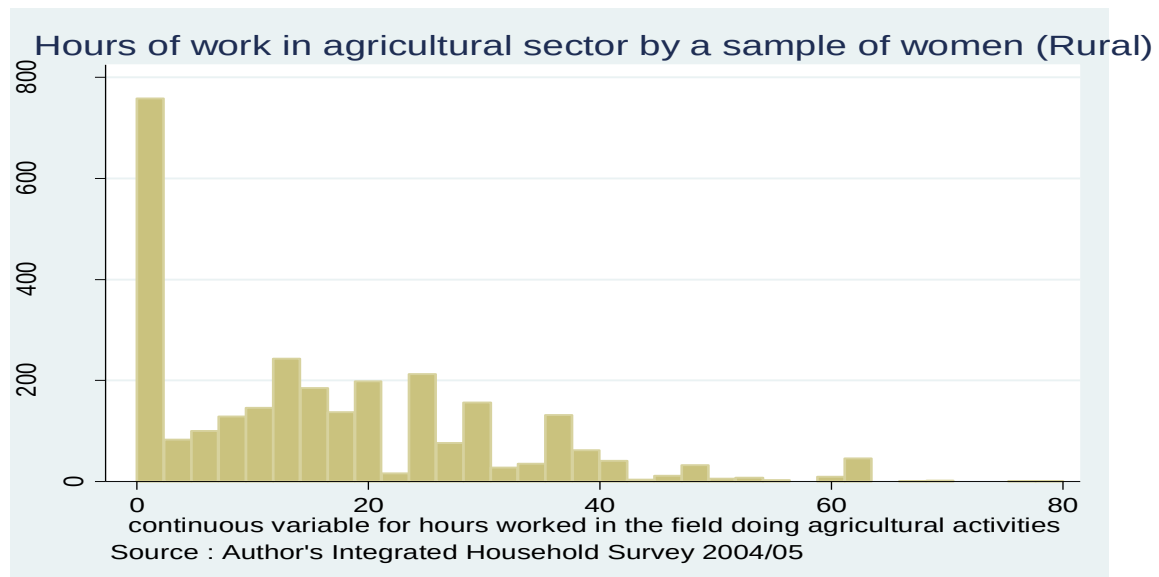


Figure 5: Hours worked in non-agricultural sector by all women in the sample

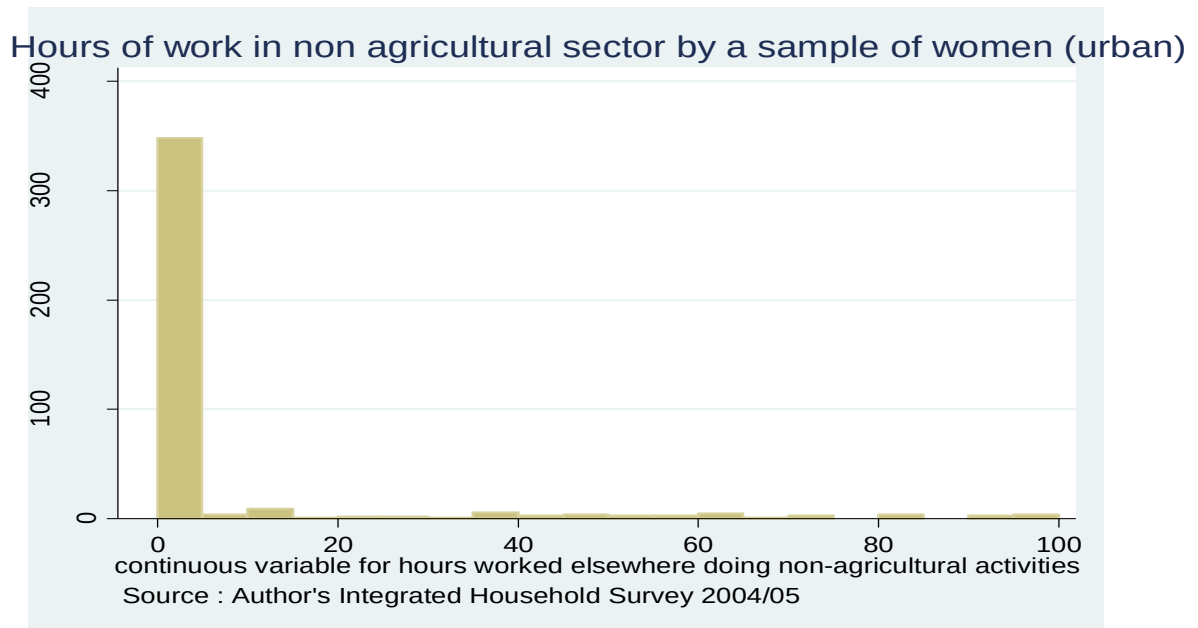
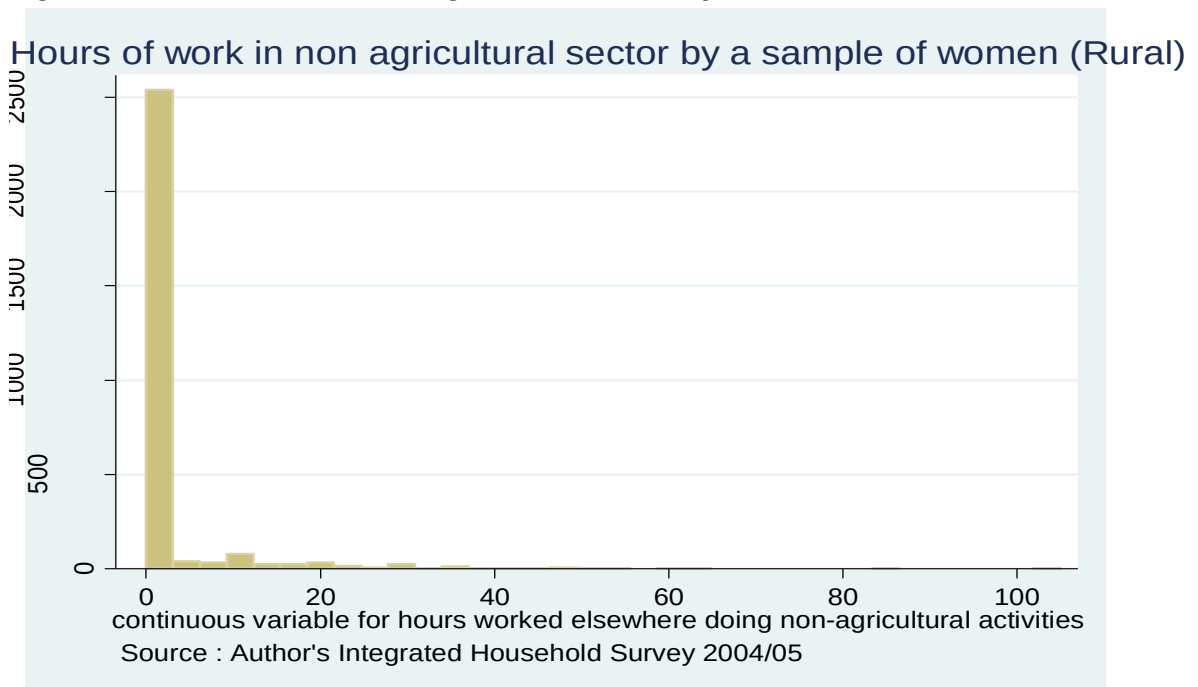


Figure 6: Hours worked in non-agricultural sector by all women in the sample



APPENDIX 2 -Tables

Table 1: Malawi Labor Force Participation, Employment and Unemployment Rates

Background characteristics	Labor force participation rate			Employment rate			Unemployment rate		
	Male	Female	All	Male	Female	All	Male	Female	All
Malawi	93.9	91.6	92.7	94.6	90.0	92.2	5.4	10.0	7.8
Area of res.									
Urban	82.9	66.9	75.5	88.4	69.4	80.6	11.6	30.6	19.4
Rural	95.6	94.8	95.2	95.5	91.8	93.6	4.5	8.2	6.4

Source: NSO (2005:48)

Table 2: Female Percentage of Labour force in the World

Region	1980	2002
East Asia & Pacific	42.6	44.5
E. Europe & Central Asia	46.7	46.3
Latin America & Caribbean	27.8	35.2
Middle East & Northern Africa	23.8	28.6
South Asia	33.8	33.6
Sub-Saharan AFRICA	42.0	42.0
High-income	38.4	43.4
World	39.1	40.7

World Development Indicators (2004)

Table 9: Pairwise Correlation t-test Matrix for Explanatory Variables (Participation Equation)

	Age	agesq	Mst	Hsize	Kds	durb	dasst	Migrt	Hlthst	schlng	dnor	dcen
Age	1.00											
sig level												
Agesq	0.98	1.00										
sig level	0.000											
Mst	-0.39	-0.39	1.00									
sig level	0.000	0.000										
Hsize	0.02	-0.05	0.24	1.00								
sig level	0.020	0.000	0.000									
Kds	0.07	0.01	0.03	0.75	1.00							
sig level	0.000	0.284	0.000	0.000								
Durb	-0.10	-0.11	0.05	0.00	0.00	1.00						
sig level	0.000	0.000	0.000	0.912	0.703							
Dasst	0.06	-0.04	-0.01	0.03	-0.04	-0.01	1.00					
Sign level	0.170	0.060	0.242	0.000	0.001	0.242						
Migrt	-0.08	-0.09	0.14	0.11	0.08	0.15	-0.04	1.00				
sig level	0.000	0.000	0.000	0.000	0.000	0.000	0.060					
Hlthst	-0.12	-0.12	0.01	-0.03	-0.02	0.17	-0.09	0.10	1.00			
sig level	0.000	0.000	0.244	0.006	0.194	0.000	0.000	0.000				
Schlng	-0.02	-0.03	-0.02	0.00	0.02	0.20	-0.12	0.07	-0.07	1.00		
sig level	0.228	0.039	0.073	0.919	0.174	0.000	0.000	0.000	0.000			
Dnor	0.03	0.02	-0.04	-0.01	0.01	0.16	-0.03	0.06	-0.04	-0.01	1.00	
sig level	0.019	0.103	0.001	0.504	0.380	0.000	0.039	0.000	0.001	0.242		
Dcen	0.00	0.00	-0.02	-0.01	0.00	0.03	0.02	0.02	-0.01	0.00	0.00	1.00
sig level	0.026	0.032	0.001	0.000	0.001	0.000	0.060	0.000	0.005	0.437	0.448	0.000

Table 10: Pairwise Correlation t-test Matrix for explanatory variables (Hours equation)

	Age	agesq	rwage	rwagesq	Rwagehus	Nly	HLthst	Durb	schlng
Age	1.00								
sig level									
Agesq	0.98	1.00							
sig level	0.000								
Rwage	-0.04	-0.05	1.00						
sig level	0.000	0.000							
Rwagesq	0.00	-0.01	0.21	1.00					
Sig level	0.780	0.592	0.000						
Rwagehus	0.20	-0.04	-0.04	0.05	1.00				
Sign level	0.000	0.00	0.00	0.000					
Nly	-0.12	-0.12	-0.04	-0.01	0.43	1.00			
sig level	0.000	0.000	0.000	0.269	0.40				
HLthst	0.07	0.01	0.02	0.00	-0.06	0.04	1.00		
sig level	0.000	0.284	0.016	0.929	0.000	0.000			
Durb	-0.10	-0.11	0.20	0.05	-0.24	0.09	0.00	1.00	
sig level	0.000	0.000	0.000	0.000	0.000	0.000	0.703		
Schlng	-0.33	-0.32	0.24	0.05	-0.31	0.09	-0.01	0.30	1.00
sig level	0.000	0.000	0.000	0.000	0.000	0.000	0.271	0.000	

Table 11: Hausman Exogeneity Test of Agricultural Labour Supply

Var	Coefficients			
	(b)	(B)	(b-B)	sgrt(Diag)
AGE	0.008	0.006	0.002	0.013
AGESQ	0.000	0.000	0.000	0.000
RWAGE	15.828	15.82	0.004	1.125
RWAGESQ	-12.75	-12.71	-0.036	0.900
RWAGEHUS	0.033	0.023	0.011	
NLY	0.000	0.000	0.000	
HLTHST	0.721	0.730	-0.010	0.134
DURB	-0.785	-0.580	-0.205	
CONST	21.760	21.856	-0.096	

Test: H_0 : Residuals are not endogenous H_a : Residuals are endogenous with regressors (schlng, kds))

$\text{Chi2}(7) = (b-B)'[(V_b - V_B)^{-1}](b-B) = 1.96$

$\text{Prob} > \text{chi2} = 0.9237$ ($V_b - V_B$ is not positive definite)

Table 12: Maximum Likelihood Results for Agric. Labour Supply (Alternative Model)

Number of obs	3,290	Censored obs	1,061
		Uncensored obs	2,229
Probit Regression		Heckman Selection Model	
Wald chi2(12) = 581.62	Prob > chi2=0.000	LR chi2(8)	29.32
Log Likelihood	-1777	Prob > chi2	0.0003
Pseudo R2	0.143	Log likelihood	-2967.41

Variable	Coef	Bootstr. std err.	Z	p>z
HOURS1				
AGEHH	0.01	0.10	0.08	0.940
AGESQ	0.00	0.00	-0.13	0.895
RWAGE	15.84*	3.68	4.30	0.000
REALWSQ	-12.76*	4.74	-2.69	0.007
RWAGEHUS	0.02	0.58	0.03	0.973
NLY	-0.00	0.00	-0.95	0.343
HLTHST	0.72	0.64	1.14	0.256
DURB	0.78*	0.34	2.29	0.021
SCHLNG	0.01	0.08	0.08	0.936
CONS	21.76	2.12	10.29	0.000
LPD				
AGEHH	0.03	0.01	3.48	0.000
AGESQ	0.00	0.00	-2.86	0.004
MSTATUS	0.31	0.08	4.07	0.000
HSIZE	0.01	0.02	0.52	0.603
KDS	-0.01	0.02	-0.37	0.714
DURB	-1.47	0.07	-20.4	0.000
HLTHST	-0.05	0.06	-0.81	0.417
MIGRT	-0.29	0.06	-4.61	0.000
SCHLNG	0.02	0.00	4.16	0.000
DNOR	0.14	0.06	2.26	0.024
DCEN	-0.02	0.05	-0.31	0.760
CONS	-0.10	0.18	-0.54	0.591
/athrho	-0.22	0.04	-4.98	0.000
/lnsigma	2.60	0.02	136.63	0.000
Rho	-0.21	0.04		-0.294
Sigma	13.40	0.25		12.913
Lambda	-2.87	0.57		-3.997
LR test of indep eqns.(rho=0)			chi2(1)=4.14	P=0.042

Table 13a: Heckit Estimation for Non agricultural Labour Supply

Number of obs		1044		
Regression with sample selection		Censored obs	759	
		Uncensored obs	285	
Probit Regression		Heckman selection model		
LR chi2(11)	55.49	Wald chi2(13)	83.00	
Prob > chi2	0.000	Prob > chi2	0.000	
Pseudo R2	0.0453			
Variable	Coef	Bootstr. std err.	z	p>z
HOURS2				
AGEHH	0.57	0.50	1.12	0.261
AGESQ	-0.01	0.01	-1.22	0.223
REALW	16.59	12.26	1.35	0.176
REALWSQ	-13.67**	7.08	-1.93	0.054
REALWHUS	5.83	7.91	0.74	0.461
NLY	0.00	0.00	0.84	0.399
HLTHST	-4.35	2.72	-1.60	0.109
DURB	21.32*	4.55	4.69	0.000
SCHLNG	0.54***	0.33	1.65	0.098
CONS	14.97	11.98	1.25	0.212
LPD				
AGE	0.03	0.02	1.59	0.112
AGESQ	-0.00**	0.00	-2.34	0.019
MSTATUS	-0.63*	0.11	-5.59	0.000
HSIZE	0.05**	0.03	1.76	0.078
KDS	0.01	0.04	0.23	0.818
DURB	-0.26**	0.10	-2.55	0.011
HLTHST	0.01	0.09	0.11	0.916
MIGRT	-0.05	0.10	-0.55	0.582
SCHLNG	0.01	0.01	1.28	0.201
DNOR	0.11	0.12	0.87	0.384
DCEN	-0.12	0.10	-1.16	0.247
CONS	-0.51	0.33	-1.55	0.121
Lambda	-21.62*	8.42	-2.57	0.010
Rho	-0.77			
Sigma	28.08			

NOTE * significant at 1%, **significant at 5%, *** significant at 10%
All coefficients are computed based on robust standard errors

Table 13b: Non Agricultural Labour Supply - OLS Regression (Bias Corrected)

Hours worked in non agricultural sector conditional on the employed				
	Obs	124	R-squared	0.149
	F(10,113)	2.63	Adj R-squared	0.074
	Prob > F	0.01		
Variable	Coef	Bootstr. std err.	z	p>z
HOURS2				
AGEHH	0.482*	0.143	3.36	0.001
AGESQ	-0.006*	0.001	-3.86	0.000
RWAGE	2.362	3.845	0.61	0.539
RWAGESQ	-4.074	2.742	-1.49	0.138
NLY	6.0e-06	0.000	0.48	0.630
HLTHST	-1.65***	0.931	-1.77	0.078
DURB	2.37***	1.406	-1.69	0.092
SCHLNG	0.043**	2.54	2.01	0.045
INVMRATIO_NAG	-15.743*	3.323	-4.74	0.000
CONST	23.58*	5.94	3.97	0.000

NOTE: * significant at 1%, **significant at 5%, *** significant at 10%
All coefficients are computed based on robust standard errors

Table 14: Sensitivity Analysis of Labour Supply

	HECKIT MODEL	OLS (bias corrected) REGRESSION Conditional on workers	TOBIT MODEL
	(coeff) (std error)	(coeff) (std error)	(coeff) (std error)
AGEHH	0.002 (0.001)	0.00 (0.00)	0.42 (0.12)
AGESQ	-0.145 (0.123)	-0.17 (0.13)	-0.00* (0.00)
RWAGE	15.77*(3.32)	15.78* (2.95)	15.11*(3.92)
RWAGEHUS	-12.78*(3.98)	-12.79* (3.25)	-15.71 (4.41)
RWAGESQ	0.03 (0.226)	0.04 (0.71)	0.55*** (0.32)
NLY	-0.00 (0.00)	-0.00 (0.00)	-0.00* (0.00)
HLTHST	0.971(0.687)	1.00** (0.53)	-0.20 (0.76)
DURB	7.93**(3.81)	9.13* (3.84)	-25.67*(1.41)
SCHLNG	0.101 (0.089)	0.10 (0.08)	0.26* (0.08)
INVMRATIO	-	-13.59*(3.91)	-
CONS	28.45* (3.47)	29.35* (3.35)	5.81* (2.51)

NOTE: * significant at 1%, **significant at 5%, *** significant at 10%
All coefficients are computed based on robust standard errors

Appendix 3

Table 15: Sample Data (Agricultural Labour Supply with 60 observations out of 3,290)

lpd	age	agesq	mstatus	hsize	hours1	schlng	dnor	dcen	dsou	migr	dasst	durb	kds	nly	realw	realwsq	hlthst	realwhus
1	40	1600	1	7	20	8	1	0	0	1	0	0	3	0	0.00	0.00	0	0
1	32	1024	1	6	18	8	1	0	0	1	0	0	4	0	0.00	0.00	0	0
1	18	324	1	3	12	6	1	0	0	1	0	0	1	0	0.27	0.07	0	0
1	17	289	1	2	16	11	1	0	0	1	0	0	1	0	0.19	0.04	0	0
1	48	2304	1	7	20	3	1	0	0	0	0	0	5	0	0.00	0.00	0	0
1	65	4225	1	3	30	0	1	0	0	1	0	0	2	0	0.00	0.00	0	0
1	31	961	1	8	18	9	1	0	0	1	0	0	3	0	0.00	0.00	0	0
1	36	1296	1	8	20	8	1	0	0	1	0	0	5	0	0.00	0.00	1	0.1814
1	58	3364	1	3	42	0	1	0	0	0	0	0	1	60	0.20	0.04	0	0
1	25	625	1	2	12	12	1	0	0	1	0	0	1	0	0.17	0.03	0	0
1	33	1089	1	10	30	10	1	0	0	0	0	0	6	0	0.25	0.06	0	0.2268
1	40	1600	1	7	36	8	1	0	0	0	0	0	4	58	0.00	0.00	0	0
1	31	961	1	8	36	4	1	0	0	1	0	0	3	33	0.27	0.07	0	0
1	47	2209	1	5	30	0	1	0	0	0	0	0	1	100	0.00	0.00	0	0
1	29	841	1	2	24	6	1	0	0	1	0	0	1	0	0.45	0.21	0	0
1	27	729	1	6	24	7	1	0	0	1	0	0	3	0	0.00	0.00	0	0
1	38	1444	0	4	30	0	1	0	0	0	0	0	1	0	0.19	0.04	1	0.1361
1	21	441	1	3	20	12	1	0	0	1	0	0	1	0	0.14	0.02	0	0
1	22	484	1	6	30	9	1	0	0	1	0	0	2	0	0.14	0.02	0	0
1	62	3844	1	5	12	0	1	0	0	1	0	0	2	0	0.45	0.21	1	0
1	23	529	1	4	18	10	1	0	0	1	0	0	3	21	0.18	0.03	0	0
1	20	400	1	3	10	8	1	0	0	1	0	0	2	0	0.00	0.00	1	0
1	45	2025	0	7	36	0	1	0	0	1	0	0	5	0	0.00	0.00	0	0.4399
1	62	3844	1	9	18	3	1	0	0	1	0	0	4	0	0.00	0.00	0	0
1	41	1681	1	8	30	0	1	0	0	1	0	0	5	0	0.00	0.00	0	0
1	68	4624	0	2	10	0	1	0	0	1	0	0	2	0	0.00	0.00	0	0
1	21	441	1	3	10	9	1	0	0	1	0	0	2	0	0.11	0.01	0	0
1	20	400	1	3	18	9	1	0	0	1	0	0	2	0	0.39	0.15	0	0

lpd	age	agesq	mstatus	hsize	hours1	schlng	dnor	dcen	dsou	migr	dasst	durb	kds	nly	realw	realwsq	hlthst	realwhus
1	51	2601	0	5	48	0	1	0	0	1	0	0	2	0	0.00	0.00	0	0.2177
0	68	4624	1	2	0	0	1	0	0	1	0	0	1	0	0.00	0.00	1	0
1	18	324	1	4	18	8	1	0	0	1	0	0	3	0	0.00	0.00	1	0
1	31	961	1	8	36	0	1	0	0	1	0	0	3	0	0.11	0.01	0	0.2404
1	44	1936	1	7	10	0	1	0	0	1	0	0	5	0	0.00	0.00	0	0
0	46	2116	1	6	0	0	1	0	0	1	0	0	7	0	0.45	0.21	1	0
1	45	2025	1	9	30	8	1	0	0	1	0	0	4	133	0.00	0.00	0	0
1	34	1156	1	7	30	0	1	0	0	1	0	0	2	750	0.23	0.05	0	0
1	56	3136	0	9	30	0	1	0	0	0	0	0	5	200	0.18	0.03	0	0
0	18	324	1	3	0	8	1	0	0	1	0	0	1	417	0.36	0.13	0	0.4082
1	30	900	1	6	30	7	1	0	0	0	0	0	2	0	0.00	0.00	0	0
0	41	1681	1	7	0	4	1	0	0	1	0	0	4	0	0.00	0.00	0	0
1	55	3025	1	4	24	0	1	0	0	1	0	0	2	100	0.00	0.00	1	0
1	24	576	1	3	24	13	1	0	0	1	0	0	2	0	0.00	0.00	0	0
1	49	2401	0	3	36	9	1	0	0	0	0	0	2	0	0.14	0.02	0	0
1	24	576	1	4	36	7	1	0	0	1	0	0	2	0	0.00	0.00	0	0
1	33	1089	1	9	36	3	1	0	0	0	0	0	7	108	0.00	0.00	1	0
1	23	529	1	3	30	13	1	0	0	1	0	0	2	0	0.00	0.00	1	0.2177
1	30	900	1	6	28	8	1	0	0	1	0	0	2	45	0.00	0.00	1	0
1	52	2704	0	4	36	14	1	0	0	0	0	0	3	33	0.00	0.00	0	0.2268
1	72	5184	0	2	36	4	1	0	0	0	0	0	2	0	0.07	0.00	0	0
1	40	1600	1	11	34	8	1	0	0	0	0	0	4	0	0.00	0.00	0	0.2268
1	57	3249	1	3	30	4	1	0	0	0	0	0	1	42	0.00	0.00	0	0
1	58	3364	0	8	24	0	1	0	0	0	0	0	5	33	0.20	0.04	0	0
1	20	400	1	3	30	10	1	0	0	1	0	0	1	67	0.23	0.05	0	0
1	19	361	1	3	30	8	1	0	0	1	0	0	2	0	0.17	0.03	0	0
1	50	2500	1	7	36	0	1	0	0	1	0	0	2	0	0.05	0.00	0	0
1	20	400	1	3	28	11	1	0	0	1	0	0	2	0	0.17	0.03	0	0
1	68	4624	1	5	18	0	1	0	0	0	0	0	3	54	0.00	0.00	1	0.2268
0	52	2704	1	3	0	5	1	0	0	0	0	0	1	75	0.27	0.07	0	0
1	62	3844	1	3	18	5	1	0	0	0	0	0	2	27	0.23	0.05	0	0

Table 16: Sample Data (Non agricultural Labour Supply data with 60 observations out of 1,045)

lpd	age	agesq	mstatus	durb	hsize	hours2	schlng	dnor	dcen	dsou	migr	hlthst	dasst	durb	kds	durb	realw	realwsq	realwhus
1	68	4624	1	0	2	10	0	1	0	0	1	1	0	0	1	0	0.00	0.00	0
0	46	2116	1	0	6	0	0	1	0	0	1	1	0	0	7	0	0.45	0.21	0
1	18	324	1	0	3	18	8	1	0	0	1	0	0	0	1	0	0.36	0.13	0.40816
0	41	1681	1	0	7	0	4	1	0	0	1	0	0	0	4	0	0.00	0.00	0
1	52	2704	1	0	3	15	5	1	0	0	0	0	0	0	1	0	0.27	0.07	0
0	51	2601	1	0	5	0	8	1	0	0	1	0	0	0	2	0	0.00	0.00	0
0	20	400	1	0	4	0	10	1	0	0	1	0	0	0	1	0	0.63	0.40	0
0	62	3844	1	0	3	0	6	1	0	0	0	1	0	0	2	0	0.00	0.00	0
0	21	441	1	0	3	0	10	1	0	0	1	1	0	0	1	0	0.41	0.17	0.18141
1	34	1156	1	0	5	30	4	1	0	0	1	1	1	0	1	0	0.00	0.00	0
1	43	1849	0	0	1	20	7	1	0	0	0	0	0	0	1	0	0.00	0.00	0
1	40	1600	1	0	3	42	8	1	0	0	1	0	0	0	2	0	0.00	0.00	0.45351
1	36	1296	1	0	6	36	8	1	0	0	1	0	0	0	4	0	0.00	0.00	0
1	28	784	1	0	6	24	9	1	0	0	1	0	0	0	3	0	0.00	0.00	0
0	40	1600	1	0	9	0	10	1	0	0	1	0	0	0	5	0	0.00	0.00	0
1	76	5776	0	0	3	20	0	1	0	0	0	0	0	0	1	0	0.24	0.06	0
0	63	3969	1	0	5	0	0	1	0	0	0	0	0	0	2	0	0.34	0.12	0.58957
1	30	900	1	0	7	38	6	1	0	0	1	0	0	0	5	0	0.00	0.00	0
0	17	289	0	0	2	0	11	1	0	0	1	0	0	0	3	0	0.00	0.00	0
0	33	1089	1	0	8	0	11	1	0	0	1	0	1	0	3	0	0.00	0.00	0
0	26	676	1	0	6	0	14	1	0	0	1	1	0	0	4	0	0.32	0.10	0
0	27	729	1	0	3	0	13	1	0	0	1	1	0	0	2	0	0.26	0.07	0
1	26	676	1	0	3	30	8	1	0	0	1	0	0	0	3	0	0.00	0.00	0
1	55	3025	0	0	4	12	0	1	0	0	1	1	0	0	3	0	0.23	0.05	0
1	23	529	1	0	3	18	10	1	0	0	0	0	0	0	1	0	0.27	0.07	0
0	30	900	1	0	7	0	7	1	0	0	0	1	0	0	2	0	0.14	0.02	0
1	24	576	1	0	4	8	10	1	0	0	1	0	0	0	4	0	0.18	0.03	0.13605
0	58	3364	0	0	4	0	0	1	0	0	1	0	0	0	5	0	0.32	0.10	0
1	27	729	1	0	5	6	11	1	0	0	1	0	0	0	3	0	0.00	0.00	0

lpd	age	agesq	mstatus	durb	hsize	hours2	schlng	dnor	dcen	dsou	migr	hlthst	dasst	durb	kds	durb	realw	realwsq	realwhus
0	28	784	0	0	6	0	1	1	0	0	1	0	0	0	2	0	0.27	0.07	0
0	73	5329	0	0	4	0	0	1	0	0	0	0	0	0	3	0	0.00	0.00	0
0	20	400	1	0	7	0	9	1	0	0	1	1	0	0	4	0	0.23	0.05	0
1	27	729	1	0	4	30	12	1	0	0	1	0	0	0	3	0	0.00	0.00	0
1	20	400	1	0	4	0	8	1	0	0	1	0	0	0	2	0	0.00	0.00	0
0	45	2025	1	0	7	0	0	1	0	0	1	1	0	0	2	0	0.00	0.00	0
1	21	441	1	0	2	0	10	1	0	0	0	1	0	0	1	0	0.00	0.00	0.24943
1	34	1156	0	0	5	13	6	1	0	0	1	1	0	0	4	0	0.27	0.07	0.20408
1	20	400	1	0	3	0	8	1	0	0	1	1	0	0	1	0	0.00	0.00	0
1	41	1681	1	0	3	0	11	1	0	0	1	0	0	0	2	0	0.00	0.00	0
1	50	2500	0	0	5	40	0	1	0	0	1	0	0	0	2	0	0.00	0.00	0
0	67	4489	0	0	5	0	0	1	0	0	0	1	0	0	2	0	0.00	0.00	0
0	32	1024	1	0	6	0	3	1	0	0	1	0	0	0	3	0	0.00	0.00	0
0	28	784	1	0	5	0	8	1	0	0	0	1	0	0	2	0	0.00	0.00	0
1	59	3481	1	0	5	10	8	1	0	0	0	0	0	0	2	0	0.00	0.00	0
0	32	1024	1	0	5	0	7	1	0	0	1	0	0	0	3	0	0.27	0.07	0
0	29	841	1	0	5	0	10	1	0	0	1	0	0	0	2	0	0.00	0.00	0
1	28	784	1	0	7	0	8	1	0	0	1	0	0	0	2	0	0.00	0.00	0
0	72	5184	0	0	2	0	0	1	0	0	0	0	0	0	1	0	0.00	0.00	0
0	24	576	1	0	6	0	7	1	0	0	1	0	0	0	3	0	0.00	0.00	0
0	44	1936	1	0	2	0	8	1	0	0	1	0	0	0	1	0	0.32	0.10	0
1	20	400	1	0	3	0	12	1	0	0	1	0	0	0	2	0	0.25	0.06	0
0	24	576	1	0	3	0	11	1	0	0	0	0	0	0	1	0	0.27	0.07	0
0	56	3136	1	0	6	0	10	1	0	0	0	1	0	0	2	0	0.00	0.00	0
1	34	1156	0	0	3	84	13	1	0	0	0	0	0	0	2	0	0.25	0.06	0
0	22	484	1	0	7	0	9	1	0	0	1	0	0	0	2	0	0.20	0.04	0
0	41	1681	1	0	3	0	8	1	0	0	0	0	0	0	2	0	0.29	0.09	0
1	25	625	1	0	5	10	12	1	0	0	1	0	0	0	4	0	0.00	0.00	0
1	30	900	1	0	5	10	19	1	0	0	1	1	0	0	2	0	0.00	0.00	0
0	26	676	1	0	4	0	11	1	0	0	1	0	0	0	1	0	0.68	0.46	0