Economic Policy Reforms and Meso-Scale Rural Market Changes in Zimbabwe

The Case of Shamva District

Edited by
LOUIS MASUKO

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CONTENTS

Chapter 2

LABOUR ALLOCATION IN SMALLHOLDER AGRICULTURE IN THE SHAMVA DISTRICT: A HOUSEHOLD ECONOMIC APPROACH

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INTRODUCTION

Studies on agrarian transformation under the impact of wider economic force in small economies have tended towards one of two interpretations. The first is that agricultural mechanisation and commercialisation lead to economic differentiation within the rural population creating two classes: a small land owning class and an increasingly marginalised one. In addition to this process rural populations find themselves being rapidly displaced as many individuals are forced to look for work outside agriculture. The second view emphasises the importance of understanding persisting forms of organisation such as the family farm, which uses non-wage household and extra-household labour (Chayanov, 1966; Servolin, 1972).[1]

Whereas the first view regards off-farm employment as the critical factor for the transformation of the small-scale economy the second approach concerns itself more with the land issue and emphasises the key role that agricultural production plays. Non-agricultural work is thus considered as supplementing the farm income and so is ancillary to agricultural production around which the life experiences and social commitments of the members of the production unit are, for the most part formed (Galeski 1971, p.68). Thus regardless of which view is considered and in order to understand the way in which economies which are predominated by such forms work, a much closer scrutiny of the relationship to land, and to the relative weight which non-agricultural activities including home production have within various types of households in the rural population, is needed. Such an analysis would require a close examination of the following:

- the cropping systems,
- the degree of intensification of agriculture,
- availability of different types of labour,
- possibilities of getting income from the sale of agricultural produce and
- the possibilities and potential of getting remittance income.

It would also be important to consider the relationship that small-scale agriculture has with large-scale, commercial agriculture as well as its participation in systems of marketing, credit and technical inputs (Davis, 1980).

At the same time however, land utilisation is influenced by the existence of other sources of income and employment open to the family and by the social and professional aspirations of its members. Therefore an analysis of the internal characteristics of the household and the way its individual members respond to external factors would be of crucial importance if a link needs to be established between both policy variables and individual welfare and between different policy levels. However, despite the fact that it has been widely accepted that individual welfare is to a large extent based on a complex set of economic and socio-cultural interactions, most development policies do not take these into consideration. These inter-relationships are affected by and indeed do affect the creation, functioning and dissolution of institutions within which the individual is situated. The institutions can either be households (families), businesses, associations, clubs, or co-operatives. This study aims to dwell on the first of these, recognising that the ways in which resources are allocated within and around them are guided by internal and external dynamics of the rest of the economy.

Any analysis of agrarian-based economies needs to take cognisance of the fact that labour is the single most abundant resource in the smallholder agricultural sector and it accounts for more than 70% of agricultural output in the Sub-Saharan region. Therefore the need to economically employ this input is central to both growth and equity in this sector. Surprisingly, however, very few studies have attempted to determine the factors that affect how this input is allocated. Studies on small-scale farm labour allocation under the conditions, which are faced by Zimbabwean households have not been prominent in the study of African workers and there has been a reluctance to analyse circumstances where categorisation of the different non-conventional phenomena is difficult. Most agricultural labour studies conducted in Sub-Saharan Africa have tended to concentrate mostly on describing the division of labour (Spencer, 1976; Shapiro, 1978; Matlon *et al*, 1979; Cleave 1974; Niang, 1980; Lele, 1981), estimating the amount of labour allocated to agriculture and household activities (Cleave, 1974; Ruthernberg, 1980; Tshibaka, 1989) and estimating the contribution of this input to farm productivity (Mellor, D. *et al.*, 1987; Eicher and Staaz, 1990). Few have dealt on the economic determinants of the allocation of this input. Generally studies have not tried to address the economic factors that determine labour use, nor have they tried to evaluate the impact these factors might have on rural activity diversification. In the Zimbabwean rural economy productive endeavour is centred mainly around agricultural production. Most of this production is carried out by smallholder producers whose objectives tend to be quite different from those normally assumed for neo-classical producers. Agricultural produce is first and foremost intended for on-farm consumption and secondly for sale and exchange and because of systems and mechanisms of obligations and other social relationships,

household economic models have been used to analyse household resource allocation behaviour. The attraction of these models has always been that they provide a framework for understanding the considerations behind the allocation of family resources and leisure and household participation in markets, both as hirers and as sources of labour.

Since the work of Becker (1965) the decision on the labour time allocation of household members in least developed countries has been studied for three main reasons:

- It sheds light on how the development process affects the organisation of production, and how this, in turn, is related to the reproductive behaviour of the population and hence provides an analytical platform for the organisation of the rural economy.
- It provides an instrument for policy analysis by pinpointing the reasons why some groups in society are bypassed in the development process and formulating appropriate policies for increasing the participation of these groups.
- It explains the nature of rural economic institutions, which has a direct bearing on the economics of the rural agricultural household since it is concerned with how these institutions affect the allocation and distribution of resources, how they have evolved and how they will adapt to changing economic circumstances.

Neo-classical agricultural household models are based on the conception that a household is both a consumption and producing entity operating in a market environment and follows the conventional objective of optimising through the use of marginal principles (Becker, 1965).

Thus the models are driven by prices and the assumption of some household equilibrium. So, in conditions where markets are imperfect and/or for some goods are missing and/or where the household is not a single homogeneous entity, these studies do not accurately reflect the conditions that smallholder producers face. Therefore in order to be able to accurately characterise the agricultural household this study begins by describing the main features of the households and some conditions that directly affect their productive activities, then a brief description and analysis of some theoretical models that have been used in previous studies of the household follows. A theoretical model of the household that takes into account some of the conclusions from the review given the data available is then put forward and the resultant econometric model estimated.

1.2 OBJECTIVES OF THE STUDY

First, the study aims to contribute towards improving our knowledge of the economic behaviour of Zimbabwean farm households and the economic conditions under which they produce. The understanding being that since the

neo-classical agricultural household model has been used to predict the effects of changes in conditions that can be manipulated by policy makers on decision making and economic outcomes in the agricultural household, it is important that the conditions and characteristics used in the model are accurate so as to avoid erroneous and misguided adjustments by policy makers. This is done by undertaking an analysis of labour use in the smallholder agricultural household sector of the Shamva district as a way of determining the main factors that affect the labour time allocation among different activities. The idea is that once the main determinants of labour time allocation are determined then it would be easier to design policies or structure already existing ones in order to influence the development of particular activities. In order to do this, however, there is a need to be absolutely convinced in the methodological framework that one adopts. Thus a very brief review of the relevant methodologies is carried out with the hope of identifying the most appropriate modelling framework. This section not only outlines the framework of the agricultural household model that was chosen for the analysis, but also critiques its use and identifies possible implications of policy recommendations based on it, so that policy recommendations from this piece of work could also be interpreted accordingly.

In particular the study documents and discusses the impact of the factors that affect labour time allocation and to suggest likely policy impacts of policies that are based on a naive understanding of the processes and functioning of the rural household economy. This exposes the likely institutions that can inform and more appropriately direct policy intended to direct the development process.

1.3 DATA SOURCES

Household resource allocation studies almost always face data problems. Household surveys rarely cover most of the informational needs of such a study. Recent studies of this kind have relied on panel data from, for example, the International Crop Research Institute for Semi-Arid Tropics (ICRISAT)'s village level studies for India[2] and cross-section studies in West Africa and Mexico. In Zimbabwe no such panel data that constitutes a realiable series has been collected, but it could be possible to use data from some of the household economic surveys that are periodically conducted by the Department of Research and Specialist Services.

The two main sources of data used in this study are the two surveys carried out by the research group. The first data set is derived from the main survey carried out in January 1996 and the second is derived from the household survey carried out in the 1996/1997 crop year as a follow up to the first one. The sample was deliberately chosen to be representative of the conditions under which smallholders produce and/or earn income.[3] The sample covered 468 households in seven wards spread across the whole of the Shamva district. In the first survey households were interviewed over a period of five weeks during which information on their assets, cropping, marketing and labour activities was

collected. This survey also included many questions on opinion-based reactions to different aspects of the policies that were currently in place and those that are under discussion. Data on asset holding was based on both the farmers' responses and the enumerators' observation. The problem that plagued the valuation of the farmers' assets concerned the fact that market valuation of these assets can be misleading because of the age of some of the assets. If true market valuation is used some assets have a negative value, which does not make sense and complicates the analysis. Therefore the measure of depreciation used was calculated as a proportion of the relative weight (to total output) of the crops that use a particular tool/asset. This was a far from satisfactory method, but one that took into consideration the intensity with which the particular tool/asset was used in the production process. Another potential source of error is the amount of land area that households have at their disposal. This was not accurately measured by the enumerators, but was observed and cross-checked against the farmers' response.

The second survey carried out with the generous help of researchers from the SWA Institute, was concerned mostly with the amounts of labour allocated to different activities and the expenditure of the households. This second data set was collected for each of the households surveyed in the main survey the year before. Each household was surveyed every other week to shorten the recall period and in order to save on travel time. The five enumerators were asked to, wherever possible, spend at least one full working day with one household at least twice during the survey period. Although this was mostly a requirement for the parallel research that was being conducted by the SWA Institute research assistants, it was ideal because for at least two days during the 34 weeks the data collected was actually observed. The rest of the time, however, labour time allocated was the farmer's estimation. The survey area covered the wards indicated in Table 2.1 and can be easily identified on the district map.

Table 2.1: Location and Number of Respondent Households

Ward	Number of households surveyed	Number used in the analysis
1	55	10
2	35	26
3	62	54
7	78	40
9	60	59
11	80	20
14	42	10
16	39	40
—	17	—
Total	468	259

Source: Economic Policy Reforms and Meso-scale Rural Market Changes in Zimbabwe — The Household Study Data Set, 1997

of time allocated to non-income generating activities was also very difficult to establish because some of the activities are carried out together with supervision and education of younger members of the household, making classification difficult. Secondly, the upward price movements during the season tend to skew the prices of commodities towards those that are traded for cash as opposed to those that are traded for other commodities. This shortcoming is totally ignored in the analysis that follows. The other shortcoming was that of output data, since the survey did not cover the whole harvest time. Estimates based on the observed area planted and estimated productivity of the farmer and reconciled using regional averages, were used.

Data on prices was made available from the Grain Marketing Board (for most cereals) and from wholesale and retail outlets in and around the area under study, although an effort was made to collect more direct data from middlemen and rural buying centres. The idea here was to be able to compare these prices and be able to make a rational conversion of the non-cash payments. Wage levels were standardised by using market prices of commodities to convert labour paid in non-cash terms and those who worked on other farms who did not report the level of their wages. The same was done for general workers. Input prices were collected by asking each household to supply the cost to themselves of the input either in cash or in commodity form. For those who gave it in commodity form, the price was established using market prices reported at the time. Other background information and weather trends were obtained from secondary sources, mostly from quarterly publications of the Central Statistical Office, MALRR and the Meteorological Office.

Section II

THE RURAL HOUSEHOLD ECONOMY IN SHAMVA

The rural economy is dominated by two major sectors: the smallholder farm and the non-farm sectors. The main determinant of output outside land in the smallholder agricultural sector is family labour, so households rely predominantly on their own labour for their subsistence and existence. Capital input besides draught power is limited with some 6% of the households not possessing any production capital.

2.1 CROPPING SYSTEMS

Among smallholders agricultural production is based on a mixed system in which livestock provide tillage, transport, manure, milk, meat, some cash income and a store of wealth, while cropping provides most of the household food plus some cash income.[4] Almost all plots are prepared for planting with an ox-drawn

plough, some are weeded with an ox-drawn cultivator, and transportation is often carried out by an ox-drawn cart. Seeding, most weeding, harvesting and threshing are typically done by hand. These operations are on average carried out along gender lines, with women doing most of the seeding, hand weeding and processing and man most of the harvesting.[5] A very small proportion of CA (communal area) and RS (resettlement area) farmers, own or can hire tractors and other mechanical equipment. Donor-funded tractor-hire schemes are in operation, but because of long distances between fields, small field sizes, and high capital and maintenance costs typically make tractor ploughing more expensive than ox-drawn ploughing; the use of tractors is therefore limited.[6]

The farming system is dominated by maize as is the case at national level. Of the 468 households surveyed in the district 444 (or 96%) grow maize and some of them also grow cotton. Thus among smallholders, maize and cotton are the dominant cash crops, although the area planted to the small grains (millets and sorghum) and oilseeds (groundnuts and sunflowers) is also high.

Crops are normally grown without fixed rotation and the mix normally reflects ease of cultivation and the importance of crops as food. Profitability considerations come in way behind these two considerations and probably reflect the fact that these producers are highly risk averse. Small households also grow green vegetables, tomatoes and other horticultural crops in small plots and gardens. These are very commonly irrigated. In general within the CAs, at least each household owns a vegetable garden although total area given for each household in the rest of this report does not include these gardens so does not appear in the total. Water is drawn from surface streams, wells, and occasionally from government-drilled boreholes and is usually applied by hand with buckets. Garden produce is often a major element of the diet and also a major source of cash for day to day purchases. Gardening is mostly done in the drier season and therefore was not accurately captured in the survey. A comparison of area sizes with the number of crops grown reveals a significant positive correlation (0.43). As more land is accessible for cultivation the smallholders tend to diversify into the production of other crops. However, the correlation is not conclusive since it is low and therefore cautions against any generalization (See Table 2.2, where AREA is the arable land area accessible to the household, ASSHOD is asset holding of the household, COTTARE6 is area under cotton, MAIZE6 is area under maize and NUMCROP is number of crops planted). Area under non-food crops is significantly correlated to area accessible, with cotton having a correlation coeficient of .52

Farmers also typically raise livestock which are fed on open communal pasture. An average farmer raises cattle, small ruminants and chicken. Livestock herding constitutes the single most important production activity in livestock production. The nuances surrounding livestock are ignored in this study, although the time allocated by most males and some children includes this activity. Cattle are

Table 2.2: Correlation Coefficients

	AREA	ASSHOD	COOTARE6	MAIZARE6	NUMCROP
AREA	1.0000	.9778**	.5152**	.5943**	.4267**
ASSHOD		1.0000	.1362	.0083	.1969*
COTTARE6			1.0000	.4046**	-.0667
MAIZARE6				1.0000	.1548
NUMCROP					1.0000

* — Signif. LE .05 ** - Signif. LE .01 (2-tailed)
Source: Economic Policy Reforms and Meso-scale Rural Market Changes in Zimbabwe — The Household Economy Study Data Set, 1997.

mostly raised for draught power with a negligible 0.9% of household reporting any substantial milk sales or production. Therefore cattle are treated as production assets and together with other livestock as a store of wealth.

2.3 PURCHASED INPUT USE

Although the most widely used type of fertilizer remains livestock manure and anthill soil, purchased fertilizer use among small-scale producers is common. Fertilizer use patterns are very different within and lower in smallholder sectors than in large scale commercial farming sectors. This is mostly because it is less profitable (due to higher transport and credit costs in obtaining fertilizer, and lower fertilizer productivity). Fertilizer purchases at the national level show a general increase from the crop year 1980/81 although they normally drop off following a severe drought (for example in the 1994/1995 season). This is confirmed by data from Shamva which shows evidence of increased fertilizer purchases in 1995/1996 as compared to 1996/1997. The recovery of purchases and use after that season was boosted by the Government's production pack distribution programme instituted to boost the recovery of the sector from the deleterious effects of the drought. It remains, however, the case that fertilizer use is closely positively correlated to the level of income and/or cattle ownership. Higher income households, which are normally those who own some cattle, tend to use more fertilizer than poorer households (see also evidence from Amin and Chipika, 1993). During the survey period 264 households reported (and were observed) buying an average of 4.67 bags of urea based fertilizer at an average cost of Z$99.13 and of these 242 bought an average of 5.57 bags of ammonium fertilizer at a cost of Z$112.01.[7] There is about 12% variation in the prices of fertilizer, but at face value these can be attributed to locational differences (see Table 2.3).

Table 2.3: Variation of the Cost of the Main Fertilisers

	Urea-based fertiliser		Ammonium nitrate fertiliser	
	Mean	STD Dev	Mean	Std Dev
For Entire Population	**97.8319**	**12.0133**	**112.7758**	**13.7037**
Ward 1.0	101.0000	12.0093	115.7700	17.1845
Ward 2.0	99.6667	10.0333	102.7500	13.7204
Ward 3.0	102.0250	19.3879	111.4375	14.9557
Ward 7.0	96.0000	8.5147	109.0000	10.7171
Ward 9.0	94.7500	7.3046	103.7778	9.4310
Ward 11.0	93.8133	10.7468	115.7778	13.8814
Ward 14.0	95.0000	8.3187	114.3750	15.1180
Ward 16.0	103.8571	16.0876	122.0000	7.1492

Missing Cases = 40.0 %

Source: Economic Policy Reforms and Meso-scale Rural Market Changes in Zimbabwe — The Household Economy Study Data Set, 1997.

Seed for maize, sunflower, tobacco and cotton is typically purchased, whilst for other crops it is normally retained from the previous season's production. Purchases range from households who spend about Z$20 to those who spend well over Z$1000. Some neighbour to neighbour sales are observed, but most farmers keep their own crop output. Some insecticides and pesticides use is observed in the case of non-food crops like cotton.

2.4 INCOMES

Diverse sources of income other than crops and livestock are found, including artisan work, crafts, some works, mining and different forms of trading activities. Moreover, many households receive remittances from family members working in the large cities such as Harare and Bulawayo. Together-farm income accounts for 45% of total estimated income, excluding transfers such as remittances and pensions. Much of the rural non-farm income is from self-employment (including mining), unskilled labour or small business activities such as production of inputs or processing of agricultural produce, which is largely a natural outgrowth of crop and livestock production.[8]

Because the study avoids the use of direct income for obvious reasons, no data on income was collected directly, although it was observed that the implicit value of livestock herd appreciation represented a substantial part of the incomes of these households. Off-farm incomes are also quite high (as a percentage of the total potential income) amongst poorer households than amongst better-off households and is a source of funds for the purchase of inputs and fall back position in times of drought. However, the determinants of off-farm work participation remains a potential research question.

...al expenditure inequality (taken as a measure of income inequality) is also quite high within the rural areas. An overall Gini coefficient of .4 is calculated for these populations, compared to .71 when land ownership is used as a measure of wealth. Other studies have noted that of the five sources of rural income (agriculture, livestock, non-farm, rental, and transfers) agricultural income accounts for the largest share of overall income inequality (Muchena, 1993). But income from livestock and other non-crop sources helps decrease this inequality. From a close scrutiny of the total expenditure figures this seems to be the case in the survey area as well. These findings indicate that policies that seek to promote livestock development and to attract non-farm investments in rural areas are likely to promote better distribution of income, but unlike in studies elsewhere in Africa there is no evidence to suggest that this kind of income or any other is not pooled according to local norms of obligation and kinship.[9]

2.5 SOCIAL CHARACTERISTICS

Small-scale farm households in Zimbabwe are mainly composed of the head of the family, the spouse (or spouses), children and dependent relatives. Generally, the head of the household, who is normally the father, makes most of the decisions based on experience and, more importantly, based on advice from the spouse (or spouses).[10] The household was in many cases more difficult to delineate than is generally acknowledged and in most cases a distinct and restrictive definition was for convenience (see comment Matlon, 1988). For example, in most households with more than one wife or in households which have a strongly integrated extended family, household boundaries tend to be arbitrary and do not accurately reflect the way in which decisions are formulated and production activities undertaken.[11]

Men have ultimate control over land and women tend to gain access to land through marriage. In resettlement areas permits could, until recently, only be passed from father to son.[12] All production decisions, including the production structures and timing are done by men where possible and there is an informal division of labour among different types of activities. Women tend to do the more tedious and time-consuming duties, while men normally do the heavier and less tedious ones. Women tend to assume responsibility for particular crops (see Table 2.4 below).[13] Amin and Chipika (1993) find that this distinct division is characteristic of households that are male headed in Mashonaland West (Chirau and Magondi), with females taking responsibility for most food production.[14] From the table it is clear that the trend in the Shamva district is closely similar. The only discernible difference being that females tend to take responsibility of a slightly more broader array of crops than in Mashonaland West. The reason for this is not very obvious.

Table 2.4: Main Responsibility over Crops by Gender

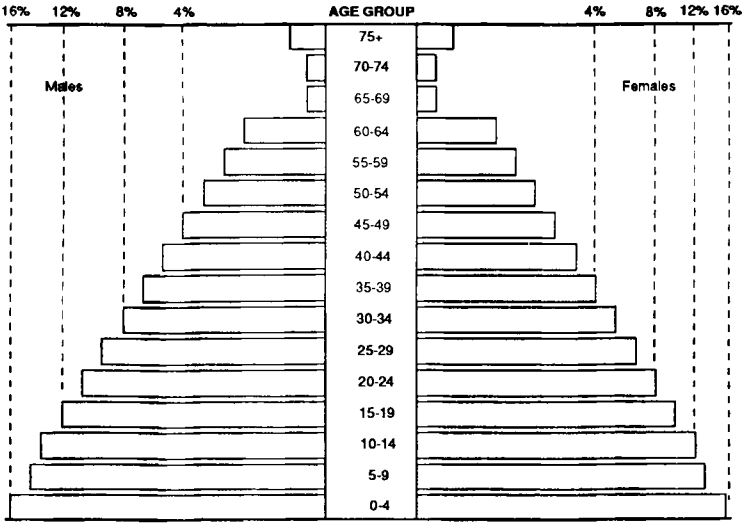
Crop	Average Percentage of Females Taking Responsibility		Average Percentage of Males Taking Responsibility	
	Shamva	Mash.[1] West*	Shamva	Mash.[1] West*
Maize	51.3	50.4	48.7	49.6
Cotton	46.0	41.3	54.0	58.7
Sorghum	47.5	48.5	52.5	51.5
Sunflower	45.9	38.8	54.1	61.2
Millet	56.2	65.6	43.8	34.4
Groundnuts	84.4	86.9	15.6	13.1
Bambara nuts	86.7	77.5	13.3	22.5
Pumpkins	—	96.1	—	3.9
Green vegetables	83.2	89.6	16.8	10.4
Tomatoes	89.5	91.3	10.5	8.7
Beans	87.2	82.1	12.8	17.9
Sweet potatoes	99.3	100	0.7	—

[1] Mashonaland *Calculated from Chipika and Amin (1993)

2.6 DEMOGRAPHIC FEATURES

Figures from the 1992 Census (CSO, 1992) show that there are on average five persons per family. This closely approximates the sample family average of 6.5. The range varies between one and twenty members. Within the average household there are slightly more women than men. Figure 2.1 shows the age-sex distribution of the whole Mashonaland Central province.

Fig. 2.1 Population Pyramid (percent), Mashonaland Central, Zimbabwe



Source: CSO, 199

These data show that the children age group (5-9 year age group) is typically the largest, while the 65-69 year age group had the least proportion (1.1%) (CSO, 1993). These figures are fairly reflective of the structure of households in Zimbabwe. This means that the dependence ratio is quite high in this economy, meaning that the dual effect on the two sexes' time allocation deserves closer attention. In an economy which also has farming as its major source of food the dependence ratio would be expected to positively influence the amount of labour time allocated to agriculture. On the other hand the higher dependence ratio puts a lot of pressure on the amount of time female members of the household can allocate to income generating productive activities. The demographic composition of households is thus a very important aspect of these households because their survival strategies seem to be based on it. This would therefore be reflected in their resource allocation decisions. For example, the presence of children is an important factor affecting the labour supply decision of the female at certain stages of life (see Blundell and Walker, 1983, 1986; Deaton, 1985; and Heckman and MaCurdy, 1980 for studies related to this issue).

2.7 FAMILY LABOUR FORCE PARTICIPATION

Agricultural production in Zimbabwe is mostly seasonal. During the peak season labour bottlenecks are quite common and so is food availability. The bulk of the labour required comes from household labour. In 1995/96 not less than 84% of the required labour was furnished by the household family members. The rest which accounted for about 16% was obtained through exchange arrangements. These can either be informal group arrangements (nhimbe) or loose and variable exchanges of labour for land or for other factors of production. Demand for farm labour exhibits seasonal variations which closely follow the pattern of rainfall and other environmental conditions. The result of this seasonal variation is that the average length of the working day also varies but in general is a lot higher in the survey period than in most parts of Africa. For example, in their study of smallholders Mansell and Johnson (1968) found that farmers worked from between 4.5 to seven hours per day but Lindsey (1989) found that the length of the labour day is on average between 6.5 and nine hours a day. This is generally in line with the findings in this study, which shows that on average the labour day is above 7.5 hours. This figure should be treated with caution because the survey period does not include the agricultural off-peak winter months.

As expected, maize and cotton as the leading crops in the rural areas absorb most of the total available household labour. Groundnuts and bambara nuts are relatively more labour intensive, but as they are normally produced for household consumption they do not represent a proportionally large share of total male labour allocation. The per unit labour requirements of the different crops varies widely from ward to ward, from village to village and from

household to household. But because of the seasonal nature of the agricultural production process the productivity of labour and other inputs for that matter depend not only on the total amount used but also on the timing of application. This is because both the amount and timing is an important determinant of yields (Antle, 1983).

Table 2.5: Crop Specific Demand for Labour by Type of Operation (for Maize, Cotton and Groundnuts)

Crop	Operation	Period	Hrs/Working Unit
Maize	Manure application	Sept	36
	Ploughing	Oct/Nov	54
	Harrowing	Oct-Dec	22
	Seeding/Planting	Nov/Dec	72
	Weeding/Cultivating	Dec-March	184
	Fertiliser application	—	49
	Harvesting: stacking	April/May	96
Cotton	Ploughing	Oct/Nov	134
	Seeding	Nov/Dec	101
	Weeding/Cultivating	Dec-March	96
	Supervision	—	34
	Filtering/Spraying	Jan-March	131
	Picking	May	238
	Other	—	34
Groundnuts	Manure application	Sept	56
	Ploughing/Planting	Oct/Nov	245
	Weeding/Cultivating	Dec-Feb	239
	Harvesting: Stacking	April/May	123
	Other	May	96

Source: Economic Policy Reforms and Meso-Scale Rural Market Changes in Zimbabwe — The Household Economy Study Data Set, 1997.

Labour time allocation to different activities also differs widely (Rorhbach 1990). This is probably because of the considerable differences in the time allocated to weeding/cultivation operations and these depend on the relative productivity of the different regions.[15]

Table 2.6: Crop Specific Demand by Source (Maize, Cotton and Groundnuts)

Crop	Male Labour	Female Labour	Exchange
Maize	450.34	64	—
Cotton	336.71	353.95	77.34
Groundnuts	134	467.74	157.26

Source: Economic Policy Reform and Meso-Scale Economic Changes in Zimbabwe — The Household Economy Study Data Set, 1997.

household production takes on a very significant part of both male and female labour time and allocation is not rigid. Women undertake most tasks related to the children's welfare and are responsible for all cooking, most fuelwood gathering, all water collection, washing and ironing for the family. Men are responsible for housing and providing most of the cash income needed in the family mostly through off-farm seasonal work, mining and labour exchanges. Child labour is also divided along gender lines. Girls help out in the collection of water and fuelwood and in all the house chores whilst their male counterparts herd cattle and other livestock.

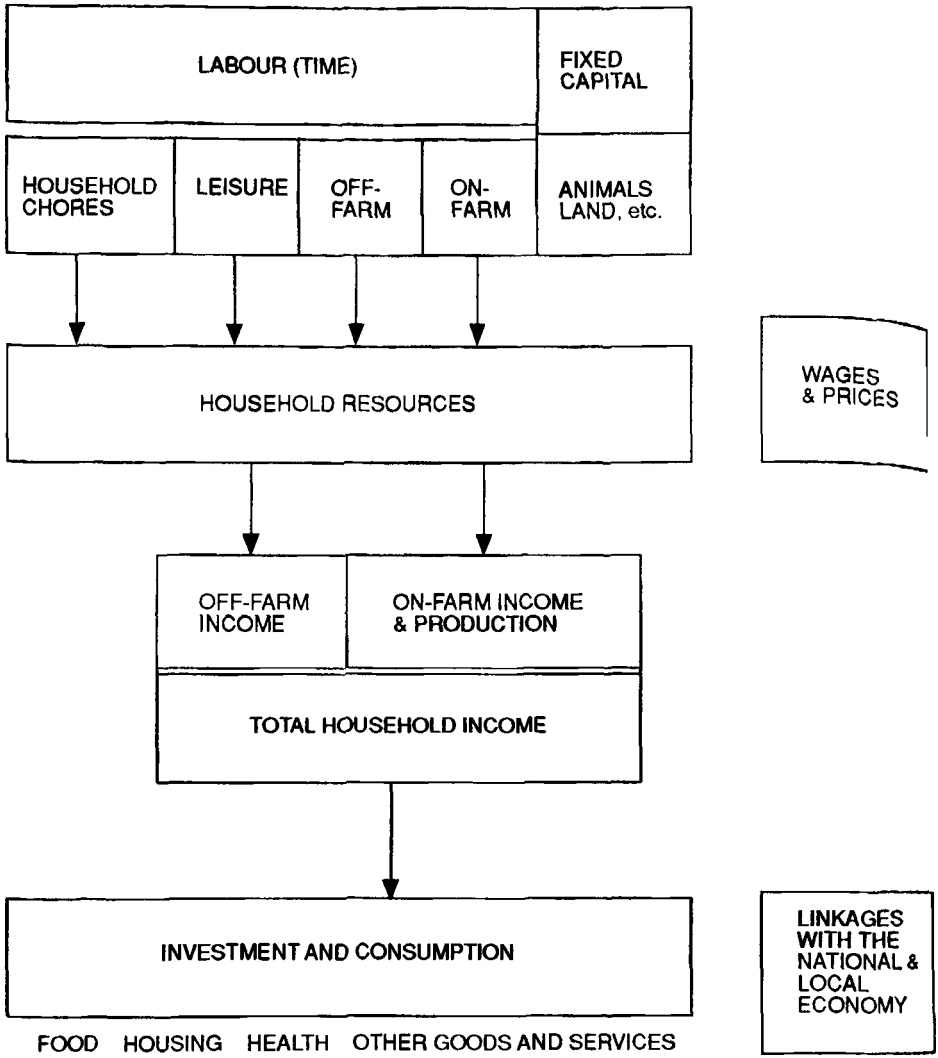
2.8 OTHER CHARACTERISTICS

In this study household is treated as a distinct economic unit because it engages in both consumption (and leisure) and production. Thus it could be modelled in a neo-classical economics sense as a combination of both the standard consumer on one side and a producing firm on the other. In any one period the family must make decisions on the level of output and labour input, the level of family labour supply and the level of consumption. The iterations between these decisions in the face of imperfect and incomplete markets is the basis upon which the farm household is acknowledged to possess sufficiently distinctive behavioural characteristics that sets it apart from other economic units (This idea is explored further in the next section). In the above characterisation small-scale farm households are understood to be defined by the extent to which the family contributes to the farm in terms of labour, capital, and the inheritance rights of the individual members to the family household land and other assets. Whether these decisions are made sequentially or simultaneously and whether the single entity household is appropriate or not is the subject of Section 3.3 below.

2.9 RELATIONSHIP WITH THE WIDER ECONOMY

From the above outlined characteristics of the rural household economy it can be said that resource allocation decisions of the household tend to be overridden first and foremost by considerations for subsistence and decisions about off-farm work. Migration tends to depend on who the family can "afford" to do without at particular points in time. The household head, whether resident or not, tends to take most of the decisions regarding timing and crop mixes, with actual day-to-day managing of the farm left to the subordinate partner. The interactions with other parts of the economy can therefore be illustrated as shown in Figure 2.2 below.

Fig. 2.2: The Household in the Wider Economy



2.10 THE IMPORTANCE OF AGRICULTURAL HOUSEHOLDS IN ZIMBABWE

Regardless of the fact that small-scale households account for a majority of the population of most African countries, little is known about the internal and external economic factors that they face. With over 70% of the national population living in rural areas, agriculture is by far the largest sector in the Zimbabwean

economy. Farming employs over two thirds of the national workforce and not only accounts for over 40% of Zimbabwean national exports but also contributes well over 20% of GDP (in 1994 figures).[16]

In the 1994/95 season smallholders produced 51.9% of marketed maize, 88,9% of sorghum, 98% of groundnuts and 98.1% of sunflower seed. Yet incomes are low (under a sixth of average national income) for the majority of farmers who live in relatively dry, low productivity areas. These impoverished families depend on fragile agricultural systems for their subsistence and a large portion of their cash earnings. It is precisely because of this fragility of these productive systems and their specific internal characteristics and structures that household resource allocation takes on a very important role in rural economic policy formulation. Identification of economic and non-economic variables to adjust and how (in which direction) to adjust would thus be of primary concern.

Observation

This section has explored the main factors that affect the decision-making process of the household. Smallholders face unique conditions, both internal and external that make their behaviour different from that of other economic agents. This should shape the way in which they would react to internal and external changes to their conditions because, as Gradstein and Nitzan (1988) suggested, the way in which an organisation behaves depends upon the structure of decision making *within* the organisation.

Given the characterisation and the conditions described above, models of the household economy can then be assessed according to how accurately they reflect the socio-economic conditions faced by households in Shamva. This is the subject of the next section.

Section III

ALLOCATION OF HOUSEHOLD LABOUR TIME TO DIFFERENT ACTIVITIES

As pointed out above most activities are divided along both gender and age lines and the amount of labour time allocated to an activity is closely related to which member of the household undertakes it.

The time allocated to different activities was collected for the 34 weeks (15 September 1996 through 31 May 1997) in the 1996/97 crop year as a follow-up to the data collected on the same households the crop year before this.[17] Although all reasonable attempts were made to cover all activities, there is likely to be an over-representation of activities that are carried out during the day as opposed to those that are carried out at night.[18] This is because most of the data was

collected during the day. So, it is fair to expect selectivity biases in the data with concomitant empirical and methodological implications. Labour time allocation structure and distribution among family members tends to follow the pattern outlined in Table 2.7 below.

Table 2.7: Time Allocation Structure of Household Activities Sept. 96/May 97

Activities	Males Hours per working unit*	Females Hours per working unit
Income-generating	1 927.8 (57.8)	1 637.5 (49.1)
Farming	1 105.6 (33.2)	1 199.4 (36.0)
Non-farming	822.2 (24.6)	438.1 (13.1)
Non-income generating	1 404.2 (42.2)	1 694.5 (50.9)
Household	343.5 (10.3)	976.9 (29.3)
Social**	1 060.7 (31.8)	717.6 (21.5)
Total	3 332	3 332

* A working unit is defined as an adult-equivalent.
** For purposes of the residual time allocated to social activities and leisure daytime (daylight) is assumed to be a period of time between 6:00 a.m. and 6:00 p.m. However, daytime (daylight) to these households is usually a lot longer.
Figures in parentheses are percentages of hours
Source: Economic Policy Reforms and Meso-scale Rural Market Changes in Zimbabwe — The Household Study Data Set, 1997

During the survey period male household members spent more time on income-generating activities than their female counterparts (Table 2.7). 57.8 percent of the male working time was allocated to income generating activities, but females devoted 49.1 percent of their working time to these activities. Non-income generating activities were allocated 45.3 percent of total labour time, of which 21.3 percent was devoted to domestic activities and 24 percent to other non-income generating activities. About 42.2 percent of male working time was allocated to non-income generating activities, of which 10.3 percent was spent on household production activities and the remaining 31.8 percent was devoted to other non-income generating activities.

If we consider the contribution of each member to the household's total work load over the study period, the analysis indicates that an average male member of the household contributed about 17.7 percent more labour than his female counterpart to income-generating activities. However, a different picture emerges if labour time allocated to agriculture and non-agriculture is considered. Males are observed to devote .5 percent less time to farming and 64 percent more time to non-farm income-generating activities than their female counterparts. But for non-income generating activities, the data shows that an average female

ated 20 percent more labour than an average male to this group of activities. ther breaking down of these activities into domestic and other activities eals that an average female spent about 184.4 percent more labour time than male counterpart on domestic activities, while an average male allocated 8 percent more time than his female counterpart to other non-income-nerating activities during the study period.

Comparison with other studies carried out for the sub-region shows that the findings generally are in line, although in this study most of the results are much closer. Men spend relatively more time on income generating activities than their female counterparts. The study also reveals that on average in the Shamva district, women do spend significantly more time on farming than men. This is in direct conflict with earlier studies in the Sub-Saharan region (Luning 1967; Spencer 1976; and Matlon *et al.* 1979), which found that there is no significant difference between the time spent by men on farming as opposed to that spent by females. This might just be because these studies are slightly dated or because of the high potential of the district compared to average localities in the region.

In sum, this analysis finds that both male and female members of the household allocate about half of their labour time to income-generating (farming and non-farming) activities and that farming receives about 36% of household labour time allocated to income-generating activities. Therefore, an assessment of the key determinants of labour time allocation between income-generating and non-income-generating activities is called for to help in policy making.

3.1 SEASONALITY

Since agriculture in the district is mostly rainfed, rural household activities generally exhibit a certain degree of seasonality that reflects changes in the rainfall distribution pattern and other environmental conditions. These changes determine all agricultural production activities and those activities that are closely related to the rainy season like gathering and also those activities that can only be done during the drier seasons like hunting, fishing, and even mining. This imposes a seasonal pattern of labour time allocation on the rural households to both income-generating and non-income generating activities. Thus it is important to examine this seasonality of labour use and allocation in order to determine when labour shortages can occur and whether this seasonality is different between gender, as is the case with total labour time allocation and whether labour shortages are particularly critical for agricultural operations such as ploughing, planting, weeding, fertilisation and harvesting. This will help in establishing whether or not some policy recommendations on labour use should be gender specific.

In order to further consider these issues labour time allocation is broken down into two: first we consider time allocated by males and females to income and

non-income generating activities and second we analyse month-to-month allocation of labour to agricultural and non-agricultural activities. Figures 2.3 and 2.4 show the first case.

Fig. 2.3: Month-to-Month Male Labour Time Allocation to Income and Non-Income Generating Activities

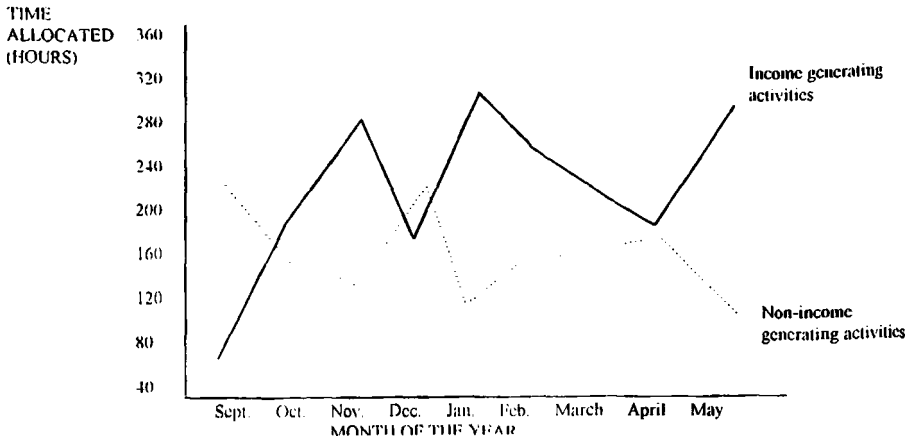
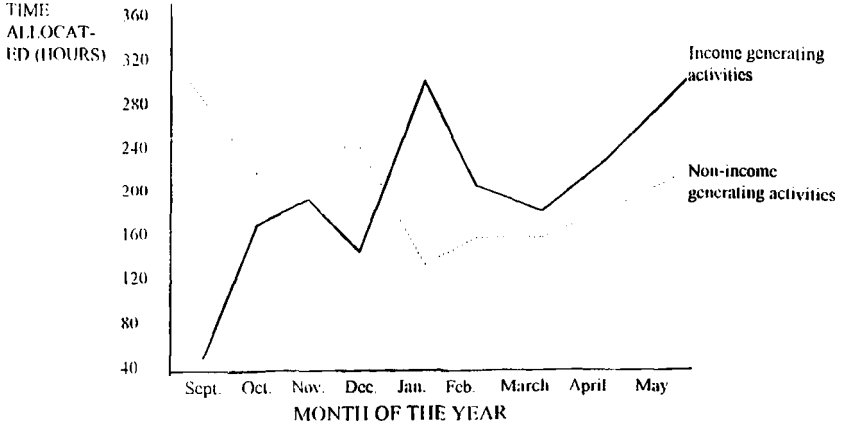


Fig. 2.4: Month-to-Month Female Labour Time Allocation to Income and Non-Income Generating Activities



Male labour time allocation to income generating activities shows a rise from mid-September to November. In the month of December it falls, reaches its lowest point of the season towards the beginning of January before rising and reaching its highest point in early February. From February to April there is a gradual fall, but then it rises again in May as the harvest period picks up. Meanwhile male labour allocated to non-income generating activity shows a completely different trend, which in some ways complements the time allocated to income generating activity.

Mid-September to December male labour allocation falls, then it rises dramatically and peaks in during the latter part of December. It then falls and reaches its lowest point in January before rising again until the month of April, after which it falls.

In the second case, that of female labour allocation shows a different trend as shown in Figure 2.4. Month-to-month female labour time allocation to income generating activities shows a rising trend between September and November then there is a slight decline in December before rising in January and February. In March and April it falls and reaches its lowest before rising again in May. The time allocated to non-income generating activities shows the reverse between September and February. From mid-February there is an upward trend up until the end of the dry season. So, the labour time devoted to theses activities exhibit different patterns for men and for women.

As is evident from the data in Table 2.7 the data also shows that both male or female household members spend slightly more than 50 percent of their available monthly labour time on income-generating activities during the entire period. Thus the observed pattern of labour use and allocation does suggest some potential seasonal labour shortages in the study area. So labour allocation should be considered in terms of total labour. In any case, given the extent to which non-farm work absorbs family labour, it is plausible to suggest that the amount of labour allocated to farming during the survey year can hardly be attributed only to seasonal climatic fluctuations. Therefore although rainfall can and normally is a limiting factor to the amount of labour time allocated to agricultural production, the assumption in this study is that the climatic conditions are given and not variable over the study area/period. Thus it is other factors that are of concern to this study.

3.3 THEORETICAL CONSIDERATIONS IN HOUSEHOLD MODELLING

The choice of methodology for the empirical part of this work is based on the basic characteristics of the household economy and the need to select the most appropriate methodological framework. Therefore it seems proper to outline briefly the theoretical framework upon which the *neo-classical* agricultural household models are based and to briefly review the alternative studies and methodologies used in household economies.

3.3.1 The Agricultural Household Economic Model

This section draws heavily on agricultural household models as outlined in Singh, Squire and Strauss's 1986 book. As a distinct economic unit the household decides on the choice of input mix, technology and resource uses, provides the required level of labour for production activities and based on the outcome of these production and labour supply decisions, it defines its choices of consumption bundles and hence determines the supply of marketable output. It therefore unifies and co-ordinates the economic functions of production, resource supply and consumption.

Following Becker's (1965) analysis of the household, agricultural models specify that household time is generally allocated to the production of goods and services for home consumption, to the production of goods and services for sale on the market, to work outside the household and leisure. Hence the household seeks to maximise a joint utility function. The realisation of this idea of joint decisions can be traced back to the early work of Chayanov (1966) and later Nakajima (1969) and Krishna (1969).

$$U = f(X_a, X_m, X_l) \qquad (1)$$

where (X_a) are agricultural products consumed on the farm, (X_m) are goods and services purchased by the household from product markets and X_l is leisure. This utility function is maximised subject to

(i) a production function

$$X_f = f(A, L, \gamma) \qquad (2)$$

where (Xf) is the agricultural commodity produced on the household farm, (A) is the fixed land available to the household, (L) is the sum of household and hired labour applied in production and γ are environmental variables. The price of labour is assumed to reflect productivity, so household labour is valued according to its opportunity cost. This is the wage it commands in the market or if no competitive markets exist or are imperfect, according to an implicit farm wage (endogenous to the household) that is derived when the household's farm labour supply is equated to its demand. This wage is referred to in the literature as a *"virtual wage"* (Singh *et al.*, 1986).

(ii) a time constraint

$$T = X_l + T_f + T_w \qquad (3)$$

where (T_f) is the family labour input and T is the total amount of labour that is at the disposal of the household. T_w is the time spent by household members in the market. T_w can be positive or negative depending on whether the family is, in net terms, hiring in or hiring out labour.

(iii) a budget constraint

$$p_m X_m = p_a (X_t - X_a) - w(T - T_f) \qquad (4)$$

where (p_m) and (p_a) are the prices of the commodity that the household purchases from the market and agricultural product, respectively, (X_t) is the amount of the agricultural produce not consumed, (w) is the market wage, and ($T - T_f$) can either be positive or negative depending on the sum of labour hired-in and labour hired out. The time constraint and the budget constraint can be reduced into a full income constraint

$$p_m X_m + p_a X_a + wX_l = wT + p + R \qquad (5)$$

where (p) is a measure of farm profits with all labour valued at the market wage and (R) is non-household production income such as remittances.

The main assumptions are that: the farm household takes part in both product and resource markets and that these markets are competitive; each participating individual faces a given price vector and that the household utility function is a well behaved quasi-concave function that is constant over time, continuous and twice continuously differentiable. The household, it is further assumed, aims to maximise this joint utility function, such that household members are assumed to have identical preferences.

Three main issues arise from the above characterisation: the first is that if we consider labour input, the first-order condition is

$$p_a \partial X_t / \partial L = w. \qquad (6)$$

That is, the household equates the value of the marginal product of labour in farm production with the market wage. This equation can be solved for L as a function of prices (p_a) and (w), the fixed land area and production technological parameters. So, production decisions can be made independently of consumption and labour-supply. In addition to this, labour is assumed to be perfectly substitutable, therefore the labour input is not differentiated. The second is that if a solution to (6) above is substituted into the income constraint and first order conditions, the solution to these would give standard neo-classical demand curves of the form

$$X_n = X_n(p_m, p_a, w, Y^*), \; n = m, a, l. \qquad (7)$$

where Y* is full income. But here the level of income is determined mainly by agricultural production, therefore changes in factors that influence production will cause changes in income which will in turn change consumption behaviour. So, consumption is dependent on production, meaning that despite decisions being taken simultaneously in time, household choices can be modelled as recursive (Jorgenson and Lau, 1969; Nakajima, 1969).

The third issue is directly related to the second and is that of the profit effect, which is basically the one-way relationship between production on one hand and labour supply and consumption on the other. This relationship can be illustrated by considering what happens when there is an increase in the price

of the agricultural product and establishing what the impact on consumption would be. From equation (7) above

$$dX_a/dp_a = \partial X_a/\partial p_a + (\partial X_a/\partial Y^{**}\partial Y^*/\partial p_a) \qquad (8)$$

where the term in parentheses captures the profit effect. This means that an increase in the price of the staple would increase farm profits. For a normal good the term $\partial X_a/\partial p_a$ is negative (This is the standard result of neo-classical demand theory) and $\partial X_a/\partial Y^*$ is positive. Therefore for a normal good an increase in the price of the agricultural product would increase farm profits, which in turn increases full income (Y^*). So, an increase in profits reduces the negative impact of $\partial X_a/\partial p_a$. Thus depending on the magnitude of this change the negative impact might be outweighed by the profit effect.

Thus, the pattern of and level of production, resource supply and consumption are governed by the existence of and participation in the market economy. Where the labour market plays an active role the whole process can be visualised as a recursive block process. The household first makes a decision on the level of production and input uses. If it can hire in labour, the firm's decision with regard to use of labour is independent of the preference of the family for the consumption of leisure time. The family's decision with regard to the supply of labour would be made strictly in reference to the market determined wage rate. Once the level of income is determined from these production and labour supply decisions, the family decides on the consumption of bundles that maximises its welfare function. Such a sequential and recursive process allows the concentration on income as the only link in the joint production-consumption decisions. It also permits the use of relatively manageable estimation procedure in the empirical model.

The empirical results of this type of model are quite robust, but mostly because of the appropriateness of the characterisation of the households studied (Tshibaka, 1986).[19] Other empirical studies that use the recursive neo-classical formulation include Lau, Lin and Yotopoulos (1978); Barnum and Squire (1979); Sicular (1986) and Strauss (1982).

In the absence of an active and relatively perfect labour market, the decision process may not necessarily be recursive. The demand for farm labour has to be matched with the supply of family labour. But the total working time, and hence available for farm production, is influenced by the family's decision for consumption of leisure. The availability of farm labour time becomes conditional on the demand for consumption of leisure.

3.3.2 Alternative Theoretical Models of Household Behaviour

Most of the work that has been done on household resource allocation has tried to improve the realism of agricultural household models by reconsidering conceptual understandings of the household and the assumptions and

constraints that are imposed in modelling household behaviour. The most widely available consider separability, labour substitutability, risk and risk aversion, missing or imperfect labour markets and the use of a unitary utility function.

3.3.2.1 *Accounting for Labour Substitutability*

Empirical work in developing countries has highlighted the fact that household labour is not, and therefore cannot be taken to be, substitutable (Carney, 1989; Crehan and Guyer, 1984; Jones, 1986; Roberts, 1988). In Southern Africa labour is, in most cases, not just a factor of production which can be allocated on the basis of comparative advantage because it can be differentiated on the basis of gender, age and sometimes even social status (Evans, 1991). Since the demands placed upon the time of women are different from those placed upon that of men and because social norms and tradition also affect the way in which women's labour is allocated, its mobilisation and allocation may be based on more complicated mechanisms of obligation between household members (Scott, 1988; Agarwal, 1994).[20] In any case, output produced by differentiated household labour might not be the same (Koopman, 1996).

In the model outlined in Section 3.3.1 in order to solve the household demand function, first the household production function has to be estimated. Within the production function though the labour input is not differentiated suggesting that both males and females face the same production possibilities. In reality this is not the case. The household thus should have more than just one production function (Evans, 1991). Apps and Rees (1996) model the household by taking this into consideration and most game theoretic models also tend to consider the differences in labour. These are discussed in Section 3.3.2.3.

In a farm household model which analyses labour supply decisions of subsistence rural households in Malawi, Becker (1988) uses a labour component differentiated along gender lines. He uses a linear programming framework where male and female labour are completely dichotomised and where household behaviour is given by a monetary safety-first rule. This treatment of the farm household is based on the geometric solution proposed by Low (1986). The survival level is defined in terms of the maize stock, since it is the staple and its level determines whether the farm household would survive or not. The only risk considered is production risk (or the farmer's understanding of production risk). Male and female labour in the linear programme are entered with different coefficients and non-purchased inputs (like livestock manure) are quite meticulously recorded and included. The determinants of labour allocation include risk perceptions towards different technologies, which directly indicates the importance of accurately describing the production process by differentiating labour input. The results show that there are different opportunities for male and for female labour and that weak adoption of yield-increasing technologies is explained by different opportunity costs of time of family members and by the risky nature of income generated.

On-farm and off-farm labour on the other hand might not be substitutable. I small-scale agriculture there are instances where factor and product market are not well developed and in particular these markets might be imperfect. Thi severely constrains the substitutability of factors.[21] Using Canadian cross sectional data Lopez (1986) demonstrates that because of differences i preferences between on-farm and off-farm work, production, consumption an labour-supply decisions are interdependent. The *"main source of th interdependence is the existence of endogenous shadow prices that would become a basi linkage between the production and consumption sectors of the model"* (in Singh et a p. 307). He models farm households where there is interdependent utility an profit maximising decisions by considering two situations. The first is whe preferences for on-farm and off-farm work differ because commuting time fo off-farm work is considered. Secondly, he considers a situation where labour i differentiated because *". . . time allocations between on-farm and off-farm work ha different utility connotations . . .."* (p. 307).

Since profit is a function of time allocated by household members and o farm and off-farm time allocation affects their preferences differently then famil farm utility and profit maximisation cannot be separated. Lopez points out th this is in line with findings from other studies which have suggested th *'disutility associated with diverse working conditions is different'* (Diewert, 197 Fieldings and Hoseck, 1973). He then tests whether or not the non-recursiv model is *"preferred to the recursive one"* and finds that it is. In this study Lope (1984, 1986) presents one of the earliest explicit tests of separability. He al considers that on-farm and off-farm labour are imperfect substitutes in th production function. So, farmers face some kind of *"virtual"* farm wage differe from the market wage.[22] Other studies that deal with labour substitutabilit typically deal with it as a problem of separability (Lopez, 1986; Arayama, 198 Savane, 1988) or just consider it through demographic variables without havi an effect on the production function or the recursiveness of the model (Tshibak 1992; Barichello, 1979; Barnum and Squire, 1979).

Importance of Substitutability (or lack of it)

Substitutability allows a single production function to be specified. The fact that substitutability is not always possible means that separate functions need to be used or the formulation of the problem needs to be changed. Lack of substitutability (i.e. gender and age differentiation) invalidates the use of comparative advantage as an analytical tool to comprehend or determine how family labour is mobilised and allocated.[23] So, market policy adjustments to change supply response, for example, may not have the expected impact when substitutability is ignored. This is because, as Scott (1988) and Akram-Lodhi (1992, p. 34) conclude in part, *"the gender and social characteristics between different types of family labour have an effect on the opportunity costs and relative productivity of household members. These social characteristics of the household tend to differentiate*

...r input so that attempts to change supply response by, say, changing market ...tives may not have the expected outcome."

3.2.2 Non-Separability

...haps the most noted drawback of the neo-classical model has been the ...mption that *"production conditions (i. e. input prices, output prices and ...ology) affect consumption and labour supply decisions exclusively via income levels ...that production decisions are entirely independent of consumption and labour supply ...isions"* (Lopez, 1985 p. 6). This assumption has been found to be untenable ...several reasons from lack of substitutability of labour inputs and imperfect/ ...complete markets to the mechanisms of social obligation and tradition. So, ...hen markets are intermittent and sometimes imperfect, decisions on production ...d consumption cannot be made independently of each other and so in such ...ases any analysis requires a model that solves the demand functions ...multaneously with the production function (World Bank, 1990). In fact the ...orld Bank concedes that in certain areas it would be instructive to use both ...odels alongside each other in order to avoid conclusions which are themselves ...*products of the analysis"* (World Bank 1990, p. 60). Unfortunately, because of ...e difficulty in making such a model tractable and easily estimatable, most ...pirical studies have used recursive formulations. Singh *et al.* (1986) suggest ...at constructing both models and solving them concurrently might be helpful ...determining the impact of using one or the other formulation, although they ...o not cite any results from studies that have used both formulations.

Benjamin (1991), basing his approach on Pitt and Rosenweig (1985), sets out to test for separation based on the observation of a correlation between demographic composition and farm employment. He considers three models: the first is where there is a binding constraint on off-farm employment as the maximum amount of hours a household can work off its farm; second, is where constraints are imposed on the hiring in of labour; and the third, which is not outlined here, is where there are differing returns to on-farm and off-farm employment akin to the restriction imposed by Lopez (1986). These three models are based on a more stylised model, which is composed of two parts. The first is a quasi-concave utility function defined over consumption, c and leisure, l: $U = U(c, l; a)$, where (a) parameterizes the utility function and summarises the household's characteristics. The second is a convex production function: $q = f(L; A)$, where L is the total family and hired labour and A is land.

In the first model some kind of rationing represented by the maximum time a household can work off its farm (H) is postulated. The supply of household labour (L^s) is given as

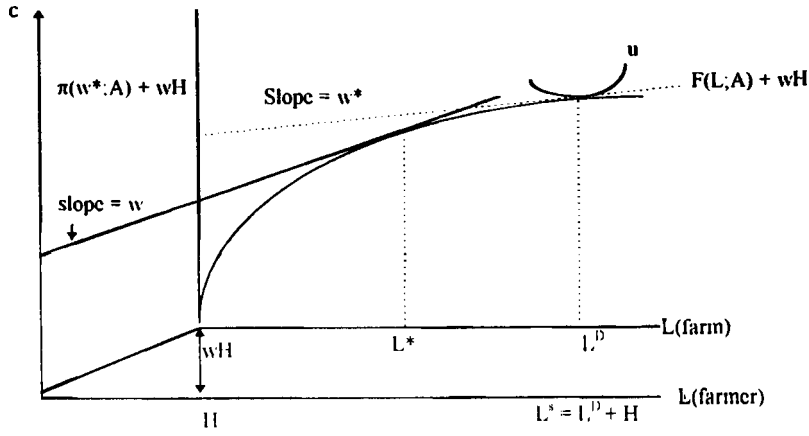
$$L^s(w, M; a) = T(a)\, l(w, y + \pi + wT(a); a), \qquad (9)$$

where (w) is the wage rate, π is profit, (T) is the household's time endowment, (M) is full income, L^s is labour supply and y is exogenous income. The constraint is binding when

$$L^s(w, M; a) > L^*(w; A) + H \qquad (10)$$

where L^* is the optimal amount of farm labour. When desired labour supply exceeds available off-farm labour opportunities the amount of labour used depends on the preferences of the household and technology and the household can now allocate additional labour to its own farm until the equilibrium is reached as illustrated in Figure 2.5.

Fig. 2.5: Binding Constraint on Off-farm Employment



Source: Benjamin (1991)

From this representation and the analysis of the shadow wage, the effects of the demographic variables on the equilibrium choice of labour is determined. In the second model the demand side is formalised by considering the peak agricultural season when farmers face labour shortages, so

$$L^*(w; A) > L^c + L^s(w, M, a) \qquad (11)$$

where L^c is hired labour, such that

$$L^D = L^*(w^*; A) = L^s(w^*, M^*, a) + L^c \qquad (12)$$

That is, since the market wage is exceeded by the marginal product of labour, the optimal strategy of the farm household would be to apply labour on the farm until the shadow wage rate is achieved.[24] Separation is tested for and is rejected, in part, implying that farm labour supply and demand cannot be analysed independently of family composition, although in this case evidence

is found that suggests that farmers might be constrained on the demand side. However, when a number of qualifications are made the study finds that farm employment is uncorrelated to household composition.[25]

A much earlier study (Hymer and Resnick, 1969), perhaps anticipating the reduced set of independent decisions in the absence of a labour market, extends the reasoning behind this type of model to include non-traded non-agricultural activities (Z-goods).

The problem with this study is that the assumption of negative income elasticity of Z-goods and the redundancy of Z-goods (Barnum and Squire, 1979) that they find suggest that Z-goods have no theoretical significance. This causes problems in cases where it has been established that they are in fact quite important.[26] In any case they (the Z-goods) have formed the basis of various theoretical models. Excluding them would not advance the analysis of the household's economic behaviour.

Effects of not Accounting for Separation

In terms of empirical analysis, if the model is erroneously taken to be separable, elasticity estimates would be inaccurate since the virtual wage is taken to be a constant. This would lead to market policy packages that are inappropriate in that the desired outcome would never be attained and there would be continuous misallocation of resources. Basically, the danger is that of fitting a model on inappropriate data and then making assumptions for the model not to be rejected.

3.3.2.3 Bargaining[27]

In most studies, the agricultural household is modelled as an individual economic agent (that is, it is assumed that the household's objective is to maximise some unitary utility) and therefore maximises a joint utility function. The use of a single welfare function leads to aggregation problems because although the choices of each individual member of the household may be consistent with preference theory for a single consumer, their aggregate choices might not be consistent. This inconsistency could be illustrated in Figure 2.6 below. However, it should be noted that aggregation would not be a problem if individuals have identical preferences or where a single individual makes all the decisions for the good of the whole family. When prices and endowments are such that the a budget constraint is given by $X_{f1} - X_{m1}$, bundle f1 would be picked. When prices are changed so that the new budget constraint becomes $X_{f2} - X_{m2}$, sensible choices cannot be points to the left of f1, since a preference for f1 over these bundles has already been revealed. So the only consistent points are those to the right of and including f1.

Fig. 2.6: Revealed Preference of a Single Individual

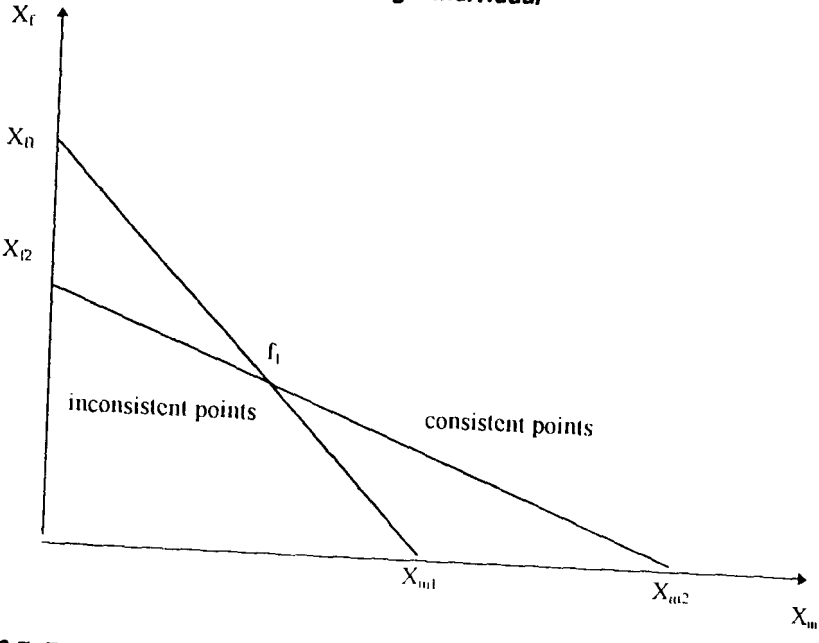
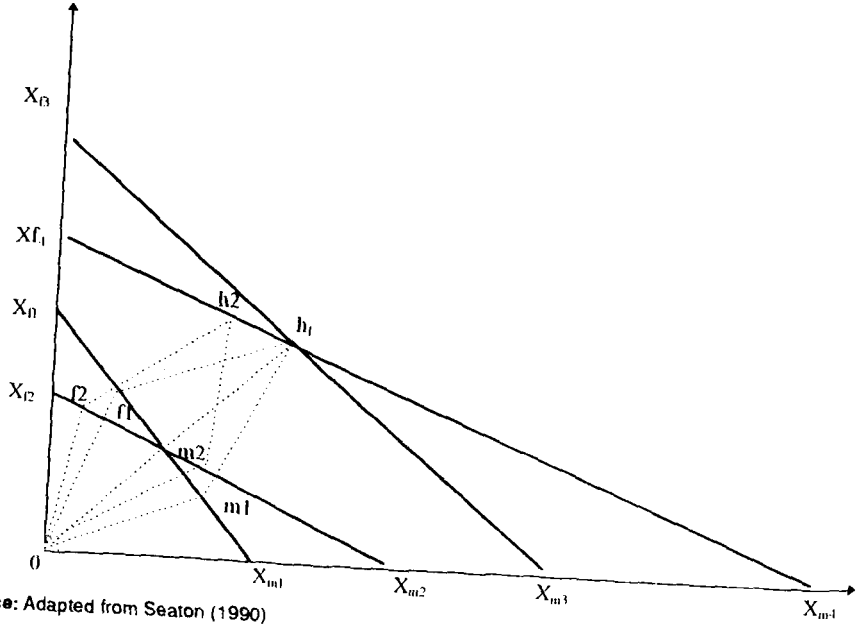


Fig. 2.7: Revealed Preference for a Group



urce: Adapted from Seaton (1990)

That this is what happens for a single individual is agreed, the problem is whether this also applies for a group like the household. In Figure 2.7, identical for each individual budget constraints shift from $X_{f1} - X_{m1}$ to $X_{f2} - X_{m2}$. Household agents m, f would make *"consistent choices m1, m2 and f1, f2 respectively, and aggregation of them yields inconsistent household choices h1 = m1 + f1 and h2 = m2 + f2.*

Seaton notes that this should not take place if there is one individual who makes all decisions or if individuals have the same preferences including situations with positive assertive mating.

In response to this deficiency of not taking into account a household with diverse tastes and preferences, two branches have emerged in the literature. The first, consists of bargaining models (Mansur and Brown, 1980; McElroy and Horney, 1981).[28] Bargaining can be either co-operative or non-co-operative (Jonathan, 1991; Chiapori, 1988). The second comprises models based on exchange within the household and some kind of a Walrasian equilibrium in household market contracts (Apps and Rees, 1988). In both cases it is assumed that the allocation of resources is Pareto efficient.

(a) Non-Cooperative Bargaining (Pareto Inefficient)

This sub-section borrows heavily from Seaton (1990). Generally, most non-cooperative bargaining models assume that in a two individual set-up the consumption needs of the spouse are 'respected', and that there is no household production. Non-market income is received by both individuals i = 1, 2. Thus altruistic functions[29]

$$U_i = U_i(L_1, L_2, Y) \qquad (13)$$

and a pooled budget constraint for individual members are suggested

$$W_1T + W_2T + N_2 + N_1 \geq W_1L_1 + W_2L_2 + Y \qquad (14)$$

where leisure is L_i, (Y) is a household composite commodity produced at wages (W_i), and the price of Y (p) = 1. N_1 is non-market income for individual 1, N_2 is that for individual 2 and T is household time allocated to work and leisure. Given the restriction that all income is spent, Y can be written as

$$Y = W_1T + W_2T + N_2 + N_1 - W_1L_1 - W_2L_2 \qquad (15)$$

Altruistic indifference curves for individuals 1, 2 in L_1, L_2 space could then be derived by substituting (25) into (23). However, both members can choose their own leisure levels conditional on the choices made by their spouse since they have access to the pooled income. This behavioural model defines the point of bliss/dictatorship (movement away from which utility levels fall) by determining a set of points analogous to reaction functions in contemporary duopoly theory for non-cooperative behaviour.[30]

When hours of work decisions are mutually consistent a Cournot solution to this model originally formulated by Leuthold (1968) can be determined by solving for individual 1's problem

$$\text{max.: } U_1 = U_1(L_1, L_2, Y) \qquad (16)$$

given that individual 2 chooses L_2 and a household budget constraint

$$W_1T + W_2T + N_1 + N_2 \geq W_1L_1 + W_2L_2 + pY \qquad (17).$$

Individual 2's problem is analogous to that of individual 1's.

Bjorn and Vuong (1984) on the other hand discuss the role of logical consistency conditions on a model which considers a Nash-cooperative simultaneous equation model, with both males and females participating. Participation of individual i = 1, 2 in the labour market was denoted by $I_{pi} = 1$ or 0, such that

$$I_{pi} = 1 \text{ if } L_i > 0 \text{ otherwise } I_{pi} = 0.$$

Individual 1's problem becomes:

$$\text{Given } U_1 = U_1(I_{p1}, I_{p2}), \text{ choose } I_{p1} = 1 \text{ or } I_{p1} = 0.$$

Individual 2's problem

$$\text{Given } U_2 = U_2(I_{p1}, I_{p2}), \text{ choose } I_{p2} = 1 \text{ or } I_{p2} = 0$$

The study finds that the decision to work depended on the participation decision of the spouse.

Another way of looking at the problem of household resource allocation is suggested by Ulph (1987, 1988). The suggestion is that individuals maximise utility from the sum of shares from joint consumption. So individual 1's problem is to

$$\text{max. } U_1 = U_1(L^1_1 + L^2_1, L^1_2 + L^2_2, Y^1 + Y^2) \qquad (18)$$

given L^2_1, L^2_2, Y^2 chosen by individuals 1 and 2's own budget constraint

$$W_1T + N_1 \geq W_1L^1_1 + W_2L^1_2 + pY^1 \qquad (19)$$

where L^i_1 is the individual i's purchase of individual 1 leisure, L^i_2 is i's purchase of individual 2's leisure and Y^i is the household good. Individual 2's problem would thus be the same as 1's but subject to L^1_1, L^1_2, Y^1 chosen by 1 and 2's own budget constraint

$$W_2T + N_2 \geq W_2L^2_1 + W_2L^2_2 + pY^2 \qquad (20)$$

Lump sum transfers of income between member 1 and 2 were found to have an effect on the resource distribution if individuals have only their private goods. When there is joint consumption of private goods the distribution of income does not matter.

(b) Cooperative Bargaining (Pareto Efficient)

Only the neo-classical and the Kalai-Smorodinsky models are discussed here. Co-operative bargaining models of household behaviour are an attempt to identify where households make a Pareto efficient choice between points that correspond to different utility levels ('dictatorial point or point of bliss'). All these models define some form of welfare function. Essentially the neo-classical model fixes this point in an undefined manner whilst the other models suggest that household dominance, power or prices define the solution.

Although the neo-classical model can be derived as the fixed weighted sum of the utility functions of individual members:

$$U_h = aU_1(L_1, L_2, Y) + (1 - a)U_2(L_1, L_2, Y), 0 \leq a \leq 1, \quad (21)$$

it is normally formulated without the aggregate parameter 'a' , that it is formulated as

$$\text{Max. } U_i = U_i(L_1, L_2, Y), i = 1,2 \quad (22)$$

subject to a pooled budget constraint

$$N_1 + W_1T + N_2 + W_2T \leq W_1L_1 + W_2L_2 + pY \quad (23)$$

in which case the 'a' is fixed and so is difficult to identify. On the other hand the Kalai-Smorodinsky solution is a proportional solution, which defines the two highest utility levels U_1, U_2 achievable by individual 1 and individual 2 respectively at the *'dictatorial points'* (Kalai-Smorodinsky, 1975). The problem is expressed as

$$\text{max.: } U_1 = U_1(L_{a1}, L_2, Y) - Q_1 \quad (24)$$

with respect to the budget constraint

$$W_1T + w_aft + N_1 + N_2 \geq W_1L_1 + W_2L_2 + PY((U_1 - Q_1) / (U_2 - Q_2)) - ((U_1(D_1) - Q_1) / (U(D_2) - Q_2)) = 0 \quad (25)$$

where D_1 and D_2 are the dictatorial points for 1 and 2 respectively and Q_1 and Q_2 are 'threat points' (or points where individuals would quit or leave the household unit). It was found that the neo-classical form is rejected by the data. Unlike in this test where restrictions were placed on the labour supply function, Chiapori (1988) imposes some functional restrictions on the demand functions, which are thought to be representative of the Pareto efficient behaviour but the result is the same. Curiously, their conclusions are dependent on the form of the welfare function. This leads to some doubt as to the desirability of such models.

These bargaining models omit home production. But since the work of Becker (1965) it has been recognised that a sizeable proportion of household time not allocated to market labour supply is set aside for the production of home goods and services within the household. Besides, the assumption of comparative

advantage (in neo-classical agricultural household models) and co-operative bargaining (in game theoretic models) is that household resource allocation is Pareto efficient. From a model which suggests that agricultural production is simultaneously carried out on many plots controlled by different members of the household, Udry (1996) finds that even this assumption is not substantiated. Using data from Burkina Faso and basing his assumption on the fact that men and women control different pieces of land the main finding is that factors are not efficiently allocated. About 6% of output is lost because factors are not efficiently allocated within the household since plots controlled by women tend to be less intensively cultivated. Thus household labour supply, fertility, taxation, production and general inequality should of necessity include household production of home goods and services. This concern has prompted household economic studies which attempt to account for home work. This was done in a study by Apps and Rees (1996).

3.3.2.4 Exchange in the Household

Apps and Rees (1996) propose that individuals maximise individual utilities

$$U^i(X_i, Y_i, Z_i)\ i = 1, 2 \qquad (26)$$

where X is a composite market good whose price equal unity; Y is a home-produced good, the price of which is determined within the household, and *pure* leisure (Z_i), whose price is determined in the market. The individual utilities, which are strictly increasing, strictly quasi-concave and twice differentiable, are maximised, subject to

$$U^2 \geq U^2_0 \qquad (27)$$

where U^2_0 is *'the constraint utility level'*, which lies in some interval (U_2, V_2) where V_2 is the maximum utility that individual 2 can achieve.

$$\Sigma X_i \leq \Sigma(w_i l_i + m_i) \qquad (28)$$

$$\Sigma Y_i = Y \leq h(t_1, t_2) \qquad (29)$$

$$l_i + t_i + Z_i = T,\ i = 1, 2, \qquad (30)$$

$$l_i \geq 0;\ t_i \geq 0;\ z_i \geq 0;\ i = 1, 2, \qquad (31)$$

where l_i is time spent supplying labour on the market; t_i is time spent in domestic production, $h(t_1, t_2)$ is the household production function, w_i are exogenously determined wage rates and m_i are non-wage incomes.

The idea is that an individual has a certain level of reservation utility which when *". . . not weakly exceeded . . ."* the individual would leave the family unit since they are not able to exchange their "domestic" product for a market good within the market for household contracts in order to attain this level of utility.

By assuming an interior solution the first order conditions, where *"p* is the imputed price of the domestic good at the household equilibrium"*, were written as

$$U^i_Y/U^i_x = p^*, i = 1,2, \quad (32)$$

$$U^i_z/U^i_x = w_i, i = 1.2 \quad (33)$$

$$w_i/h_i = p^*, i = 1, 2, \quad (34)^{31}$$

The equations (32) and (34) correspond to Pareto efficiency in consumption allocation. Using a duality formulation and including some demographic variables on Australian data they show that *". . . it is of central importance to incorporate the analysis of domestic production in individualistic models of household supply in order to avoid both misleading theoretical results and empirical mispecification"* Apps and Rees (1996, p. 216).

This model effectively shows that it is not enough just to estimate these models based on conventional productive labour, but that given the importance (and amount) of time these households (particularly women members) spend on home production the empirical results cannot be accurate and therefore policy prescriptions based on them would be flawed.

3.3.2.5 Risk and Risk Aversion

As stated in Section 2 small-scale household producers are risk averse (Binswanger, (1979). However, most studies on labour demand in least developed countries use models that do not account for this. Mostly they are static and assume perfect information. As a result these models are recursive, so production decisions are estimated without reference to consumption choices (Strauss, 1986). However, because of seasonal modulations in the agricultural cycle and other economic variables, risk and risk aversion come into play and input demand decisions are dependent on the consumption and labour supply choices of the household (Fabella, 1980; Roe and Graham-Tomasi, 1986).

Roe and Graham-Tomasi suggest that household utility is derived from a sequence of consumptions of goods and leisure over its time horizon and from a bequest. That is

$$U(X_t, X_{lt}, b_t) = \sum_{t=1}^{T} \alpha^t u(X_t, X_{lt}) + \alpha^{T+1}\delta(b_{T+1}) \quad (35)$$

where X_{qt} is an agricultural staple and X_{mt} is a market purchased good, t = 1,2 . . . ,T is the time horizon, b_t is a financial asset and $\alpha = (1+ e)^{-1}$ is the discount factor. A stochastic production function is specified as:

$$Q_{t+1} = Q(L_t, A_t; \varepsilon_{t+1}) \quad (36)$$

where L and A are labour and land inputs and ε is a random variable. The model is dynamic and the household *"possesses a single financial asset"*. The other constraints can be summarised as

$$b_{t+1} = a_t\underline{A} + w_t\underline{L} + p_t - C_t + (1 + r)b_t \qquad (37)$$

where a_t is the rental rate of land and w_t is the wage, A and L are land an labour endowments, π_t is profit in period t, C_t is expenditure on goods and leisu in period t and the planned activity at time t is given by

$$Z_t = (X_{qt}, X_{mt}, A_t, L_t) \qquad (38)$$

The idea here is that the financial asset smoothes the fluctuation in household consumption by linking household marginal utility of income. A dynamic programming framework is used. The model is non-separable. *"The risk preferences for solving the problem of maximising the expected utility of profit must be derived from three household preferences for income risk and ultimately from their preferences concerning consumption variability."* The modelling framework although simple provides an insight, as with the Becker study, on the empirical biases that can arise if risk on household consumption choices is not properly considered.

Effects of not Accounting for risk

In a model like the one by Roe and Graham-Tomasi above the empirical effect would be to overestimate the quantity of output and the amount of resource allocated to production. On the other hand resources allocated to off-farm activities would be underestimated. The problem is that without accounting for risk in a situation where the producers are risk averse, the model is too rigid to be informative or predictive. However, little work has been done on such multi-periodic studies.

3.3.2.6 Pooling

The neo-classical model has come under increasing criticism not least because its use is based on the underlying assumption that household resources are pooled and then reallocated such that individual members' welfare is equated. That way then household resource allocation behaviour can be assumed to be Pareto efficient. This idea means that the household would allocate its time and resources according to comparative advantage. As mentioned above, several studies have suggested that this pooling assumption is at best questionable (Sen, 1984; Haddad and Kanbur, 1990; Haddad, Hadinott and Alderman, 1994). Instead it is suggested that the different genders and age groups have access to different resources and different types of income which leads to gender and age specific types of expenditure (Agwarl, 1994; Haddad *et al.*, 1994).

However, besides the game theoretic approaches, the pooling assumption persists in most household economic studies (Singh, *et. al.* and most of the references therein). Fortunately, this is not a problem for the Zimbabwean case where income and resource pooling is common across the rural economy[32] (see

chena, 1991; Mudimu, 1995; Collinson, 1986 and Muzari, 1993 for evidence he existence of resource pooling). It is still worth noting that the objections he income pooling assumption necessitates some kind of test before any clusions can be reached as to whether or not households in particular areas ally pool income.

DETERMINANT OF HOUSEHOLD LABOUR TIME

.1 The Model

ven the severe limitations in the data and the uniqueness of the conditions ative to other Sub-Saharan regions it is quite conceivable that despite the itations of the unitary (neo-classical) model, the only feasible model is a cursive one.[33] Estimations of the amount of household labour time (expressed dult-equivalent hours) allocated to different groups of household activities e given in the previous section. Next, the study attempts to identify key tors that determine the allocation of this labour time among these groups of ivities, that is, the factors that determine how this labour input is shared ong agricultural, non-agricultural, and other household (non-income-erating) activities. This assessment provides information on how to change e observed pattern of household labour allocation to enhance a specific group activities, for example, income-generating activities including farming.

Given the division of labour along gender lines and the high degree of erdependence between household members of both genders in this economy ere subsistence production is paramount, it is plausible to assume that the cision making unit is the household and not the individual. For example, the e of the cultivated area partly determines the amount of labour time female embers allocate to farming, which is primarily determined by the amount of bour the households devote to the operations carried out earlier in the season, hich tend to be male dominated in male headed households. Since subsequent rm operations (planting, weeding, harvesting, processing, and marketing) are imarily performed by females, one may assume that during the ploughing ason the household will take into account the available household female bour force. This is also based on the observation that the household head minates the household unit and that there is a lack of any kind of internal tonomy of the other members of the unit.

Income is pooled and although there is gender differentiation it is only confined responsibilities for the cultivation of different crops and participation in fferent activities.[34] Women tend to be responsible for food crop production ormally post ploughing activities only, in male headed households), but the tput is consumed and sometimes sold to generate income for the household a whole. Women and children cannot independently choose how that income spent. Therefore, labour should be differentiated along both gender lines and e but the household maximises joint utility. However, the lack of differential

wages in the data and in any case very few females ever work outside the household and even when they do, most of the remuneration is not in monetary terms, except when they market art and craft and their horticultural produce.

This raises the question of whether it is more accurate to use the co-operative bargaining approach, in particular the Kalai-Smorodinsky model, briefly presented above. The problem is that besides its obvious complexity, empirical implementation is difficult, mainly because utility parameters to be estimated would be twice as many as those in models based on the unitary household utility function. Since our data set are not so exhaustive as to contain sufficient information to identify all the parameters it is impossible to estimate, unless certain restrictive functional characteristics are imposed on the demand functions. These functional restrictions (characteristics) vary from dummy variables to interpretations of the nature of the bargaining process.[35] This is one of the major compromises that would have to be made in order that a fairly simple characterisation is possible. The justification of doing so is based on altruism.[36] According to Becker (1981, p. 191) an altruistic household "*... can be said to have a family utility function that is voluntarily maximised by all members regardless of the distribution of income*". Besides, because of certain conditions (like, for example, lack of inheritance rights of females in some circumstances) it is the case that the preferences of female members tend to be intertwined with those of their male counterparts. However, the use of the joint utility function has been criticised in recent literature (see discussion in Section 3.3.1), but these criticisms are ignored here, although it is noted that the use of bargaining models could resolve the issue because individual preferences would then be built into the model. The chosen theoretical model thus makes the following assumptions:

- Households maximise a joint utility function as in the neo-classical function in Section 3.3.1 above.
- Land is used mainly for agricultural purposes, but labour and capital is freely mobile between farming and non-farming.
- The production function is homogenous to degree one and exhibits constant returns to scale. That is, a Cobb-Douglas type production function is used despite the well known technological restrictions it implies.

So the theoretical model would be a slight variation of the one used by Bardhan (1984) where the household seeks to maximise the utility function

$$U = f(X_a, X_m, X_n, X_l, X_i)$$

where X_a is the agricultural product that the household consumes, X_m are goods purchased from the market for household consumption, X_n are non-agricultural goods consumed in the household , X_l is leisure and X_i is a set of non-income generating activities. It is clear that this model is just a detailed agricultural households economic model briefly outlined above. Therefore, from the first order conditions we can show that of all the endogenous variables only the

labour variables influence the choice of the household labour time to be allocated to agricultural and non-agricultural activities. This then enables us to solve for labour time allocation as a function of the prices (of agricultural output, the price of non-agricultural output, the price of labour, the land area and capital). That is labour allocated to agriculture $L_a = f(p_a, p_m, w, A, K)$ and labour time allocated to non-agricultural activities $L_n = f(p_a, p_m, w, A, K)$. If we ignore the source of labour that is used such that income generating labour is just split into two: agricultural and non-agricultural labour, then we could consider labour input in terms of shares of the stock of labour, where $A_s + S_n + S_i = 1$, in which A_s is the share of agricultural labour, S_n is the share of non-agricultural labour and S_i is the share of non-income generating labour.

3.4.2 Description of Variables and the Estimating Equations

The regression equations are based on the likely disparities between the economic and non-economic conditions faced by the household that have a bearing on the profitability of the activities that these households undertake. The first issue that is postulated to have such an impact are the different levels of transport costs for all the marketed commodities which on average range from Z$0.02 per kilogramme for maize to as much as Z$0.12 per kilogramme. This disparity is caused mainly by differences in the distance to marketing centres and to the availability of active marketing agencies within a given locality. The transportation costs and accessibility of some of the areas makes it difficult for producers in these areas to compete on the same footing with the producers in relatively easy access and closer to marketing centres. The fact that part of the assumption of the neo-classical formulation of the problem is that producers all face identical competitive economic conditions makes the inclusion of this aspect necessary. The effect of transportation differences is that they affect the prices of both agricultural and non-agricultural products and the level of prices of the inputs, which in turn affects the level of labour allocated to different activities if our formulation is correct. The transport variable was based on the level of the average transport price of three main crops: maize, cotton and ground nuts. This gives a balance between crops grown primarily for subsistence consumption represented here by ground nuts, a crop grown only for sale on to the market represented by cotton and a crop grown for both consumption and income generating purposes represented by maize. The households were thus divided into two groups: those with relatively high transport costs for commodities were given a dummy of one and those with a relatively lower one a zero value dummy.

The second issue is that of the wage (w). It is quite conceivable that in any one season there might not be any hiring-in of labour, in which case there would not be a need to include the wage rate in the regression equation. However, in the survey period some labour was definitely hired-in and hired-out. So, the problem becomes one of accurately accounting for this labour. For example, how does

one account for labour exchanges, or for labour time exchanged in kind or when obligations for labour use are not necessarily reciprocal. Do we use a market wage rate? What if the exchange labour is not based on seasonal obligations, but rather on a more long term basis?[37] Other studies on the households economy are ambiguous about how they treat these issues and so it is with grave reservations that we use the market wage rate.

When asked why they carry out some of the activities that they do most of these producers tend to give answers related to comparative prices of both farm and non-farm commodities. This suggests that relative prices are one of the major considerations outside subsistence for these households. Thus the third issue is the terms of trade between agriculture and non-agriculture. It has been implied above that there is a high correlation between prices and the transport variable, but in the case of terms of trade the relationship is quite different. It is expected that these would be neutral with respect to the transport variable and therefore would affect labour time allocation to farm and non-farm separately from the transport variable. Terms of trade (AN) were estimated from the three crops that have been used above for the transport variable. Taking the share of the crops output in total output as a weight, the previous harvest's weighted average prices of the three crops are used to represent the price of the agricultural products. The previous season's prices were computed from the average prices in the month of September 1996 (That is in the month the survey started, for convenience). To find the price of the non-agricultural commodities a weighted average of the returns to gold panning, beer brewing, and brickmaking was used.

Lastly, we consider demographic variables. Firstly, the gender aspects (G) of household decision making is taken into account by considering the gender composition of the household. This is based on the observation that the amounts of labour time allocated to both farm and non-farm activities is different for males and females. This variable is expressed as the share of females in family labour and is computed as a ratio of the number of household female working units over the total number of working units that the household has. It is expected that this variable will have a slightly positive effect on the labour time spent on farming and negatively on the time spent on non-agricultural activities although the exact positive effect would be expected if its effect on household production is considered. As regards the relative weight of the subsistence and income obligations of the family are concerned, the household dependency ratio (D) is used. It is defined as the ratio of the number of households consuming units to the number of working units that the household has. The idea is to be able to, with a bit of manipulation, calculate cost of supporting an adult-equivalent unit (this is useful eventually to be able to say how much, for example, the cost of supporting a child to the household would be).[38] Generally this variable is expected to positively affect the time allocated to agricultural production because of the semi-subsistence nature of production. Additionally, a variable for the capital base (C/W) of the household is also included to capture the asset base

ect on labour time allocation. Capital is defined as the capital in Z$ per adult ivalent unit and includes all household assets including cattle.[39]

The estimated equation for the share of labour allocated to agriculture was pressed as

$$A_s = f(T, w, AN, G, D, C/W, A, \varepsilon) \qquad (39)$$

here ε is the error term and that of non-farming as

$$S_n = f(T, w, AN, G, D, C/W, A, \varepsilon) \qquad (40)^{40}$$

Summary statistics of the variables postulated to have an effect on labour ime allocation are tabulated in Table 2.8 as follows:

Table 2.8: Summary Statistics of Variables

able	Mean	Standard Deviation	Coefficient of Variation
	0.085	0.153	78.564
	0.240	0.171	69.343
	0.017	0.04	24.001
	82.50	80.361	99.351
	1.433	1.037	19.035
	38.676	31.696	86.185
	8.916	34.185	112.321

urce: Economic Policy Reforms and Meso-scale Rural Market Changes in Zimbabwe — The Household dy Data Set.

4.3 Results

he results of ordinary least squares estimation on the data set gave the results iven in Table 2.9.

Table 2.9: OLS Estimates

ependent Variables	Shares of Time Allocated to Agriculture (S_a)	Shares of Time Allocated to Non-Agriculture (S_n)
	1.675 (2.271)*	1.029 (0.744)
	0.267 (6.413)***	-0.655 (-12.204)***
N	1.735 (1.015)	0.164 (1.453)*
	-0.990 (-1.003)	-5.149 (-1.672)*
D	0.810 (1.100)	-1.902 (-0.736)
C/W	3.615 (7.034)***	0.064 (1.473)*
A	0.095 (5.809)	0.106 (1.847)
onstant	2.347 (0.548)	15.161 (2.731)**

R^2 = 0.285, F(agric.) = 18.31, ($F_{non\text{-}agric.}$) = 21,60 and n = 150
gures in parentheses are t-statistics and the variables are defined in Section 3.4.2 above.
ignificant at 10% level of significance
ignificant at 5% level of significance
ignificant at 1% level of significance

The estimated regressions for both the share of labou agricultural activities and that allocated to non-agricultural activities produc a reasonably fair fit with highly significant F-statistics at the 1 percentage lev In the case of the share of labour time allocated to farming activities the estimat coefficients for the terms of trade between agriculture and non-agriculture, t wage rate, capital per adult equivalent, the transport variable[41] and land ar accessible to the household are positive and significantly different from zer However, dependency ratio and gender composition show no obvious effect, but this should be treated with caution because of the ambiguity in the assumptions on which these variables were included. This confirms the point made in the discussion on the theoretical framework that intra-household resource allocation cannot be analysed satisfactorily by way of recursive modelling because of inherent inflexibility that is built into them. The implication for the rest of the variables is that they indeed impact on the share of household labour allocated to agriculture in the Shamva district.

Elasticity estimates show that the share of household labour time allocated to agriculture with respect to market wage rate is 0.11. This can be interpreted to mean that a percentage increase in the market wage is associated with an 11% increase in the time the household would allocate to agriculture. Secondly, the elasticity estimate of the share of household labour allocated to agriculture with respect to transportation variable is 0.15, with respect to the capital per adult equivalent unit is 0.27 and with respect to land and terms of trade between agriculture and non-agriculture is a whooping 0.31. As in the first case these figures imply that a 1 percentage increase in transport costs and proximity to marketing centres leads to a 15% rise in the labour time allocated to agriculture, a percentage increase in capital per working unit leads to a 27% increase and 1 percent increase in the terms of trade leads to 31% increase in the time allocated to agriculture. The same is the case for the land variable.

For labour time allocated to non-agriculture all variables are significant (and statistically different from zero). So, these variables can be considered to be important determinants of the share of labour time allocated to non-agriculture. These estimates indicate that a percentage increase in the wage rate would lead to a 12% fall in the labour time allocated to non-agriculture, a 1 percent increase in capital per working unit would lead to a rise of 10% in the share of household labour time allocated to non-agriculture.

CONCLUSIONS/COMMENTS

Firstly, it is clear that recommendations made from the review section of the study seem not to have been implemented in the choice of the model. The main consideration in any modelling exercise is to be able to come up with a framework that tells you something about the issue being addressed and given the limitations in data and the unobserved trends mentioned in the review

section,[42] the recursive model was found to be the best. In any case the applicability or otherwise of recent findings about applied agricultural household models to Zimbabwean households has hopefully been exposed, thus illustrating the problems that arise from generalisations in policy making and implementation. However, it remains the case that the best way of finding out whether the recursive agricultural household model is the most appropriate is to test for separation. The review serves to highlight the main issues that can affect modelling of agricultural households in a rural setting. This would, it is hoped, encourage research on the mathematical tractability of non-separable models.

One of the biggest obstacles for the integration of small-scale rural producers in the market system is their spacial location relative to major marketing centres and the persistence and relative advantages of non-monetary exchange of goods and services. The amount of produce that remains outside the market mechanisms makes it difficult to confirm subsistence levels of product use because most of the agricultural produce that is stored on the farm acts as a season-to-season buffer against the fluctuation of subsistent produce and complicates the analysis. The accurate measurement of the influences of these elements can only be by institutions more intimately related to the unit of analysis and which are more flexible in the way in which policy can be interpreted for purposes of implementation. Results suggest that transportation costs and/or distance to major marketing centres should be one of the target areas of policy. If the point is stretched a little we can say that proximity to and the development of a working relationship with the commercial farming sector could positively influence labour use for income generating purposes directly through the provision of off-farm employment and also through the provision of some technical know-how.

Land and terms of trade seem to dominate as explanatory variables for the share of labour time allocated to agriculture. This is entirely in line with expectations and the result from the opinion based responses. There is a great inequality in land accessible to the household and although other factors also influence the output level, land area exhibits strong influence on time allocated to agriculture. A whole different study would be necessary to determine what other variables affect rational labour choices between agriculture and non-agriculture. As for the terms of trade this might reflect the impact of the biases in the macro economy brought about by the discrimination against agriculture (see Masters, 1990 for evidence of these biases).[43]

The second major implication of these findings is that the improvement of rural markets (both product and capital) would positively affect the amount of rural household labour time allocation to both agriculture and non-agricultural income generating activities. Since most of the activities are off-shoots and extensions of agricultural production, attention should be focused at how the

asset base of the households can be improved in order that households could be provided by a solid foundation on which to accumulate capital which would then enable them to diversify their income generating activities portfolio.

Importantly, it has been shown that given the shortcomings of the neo-classical agricultural household model, policy recommendations resulting from its use should be considered carefully and with cognisance of the specific forms of relationships within a given area. The point being that the meso-level is appropriately placed to be able to capture these relationships enabling them to adjust or interpret policy accordingly for the benefit of these producers. The gendered nature of the macro-economy could therefore be appropriately addressed for the benefit of the economic unit most directly affected. Why the middle-level? Understanding and consideration of specific aspects of micro-level decision making particularly where socio-psychological and economic aspects of the analytical unit play a large role, can only be appreciated by those closest to it. The problem to be addressed being the nature and way policy is formulated. The study suggests that prescritively simplistic and management type of approaches to policy formulation cannot adequately address the economic problems of small-scale rural households. This is because policy makers might be misled by misrepresentations of the economic unit and by inherent biases within the macro-economy. Thus this study echos emerging concern by both academics and policy makers about the gendered nature of the macro-economy and suggests that addressing these problems involves a shift from conventional methods of policy formulation to a more complex and holistic approach.

Land is also central to the labour time allocation argument. What is quite clear is that management approaches to the land issues are not only inadequate, but that in the long term could compound the problem.[44] However, detailed consideration of the land question was deliberately omitted from this piece of work, although it was observed that there is general disillusionment with management style changes to land. Respondents made it clear that changes in the way land is being used or changes to who manages land resource utilization are either impractical given the survival constraint or unhelpful in terms of what changes these would bring on the use and value to them of the pieces of land available.

Because of the agricultural bias in the activity portfolio of these households, agricultural pricing policy intervention has historically been one of the main vehicles used to direct the developmental process and to try and alleviate any negative impacts of macro policy in the rural areas. The basic premise of this chapter is that this agricultural policy intervention cannot properly direct the developmental process since the general target for adjustment is normally the price levels because agricultural households typically do not produce solely for the market and their objectives are not similar to the ones normally assumed

for a neo-classical producer. Welfare analysis of most, if not all policy instruments normally used in the Third World have shown that these tend to result in large producer surplus gains and small to negligible consumer surplus improvements. This means that if a household cannot produce substantially over and above the subsistence level it foregoes the larger producer surplus. Thus is bypassed by policy. Hence, strategies for rural development should be based on an understanding of not just agricultural development *per se*, but the broadening of finance to non-farm enterprises, improvement of infrastructure, and broadening of rural education.

NOTES

1. See de Janvry and Garramon (1977), Mann and Dickinson (1978), Vergopoulos (1978) on the persistence of smallscale or simple commodity production.
2. See for example Saha (1993).
3. The sampling framework is available from the group report.
4. There are many detailed descriptions of CA farming systems. Two of the most useful published works are Cousins (1989), detailing livestock-crop interactions and the UZ/MSU Food Security Research Project (Rohrbach, 1989).
5. There is a fuziness about these divisions. Often the divisions vary from household to household and also according to whether or not the household has a resident male head.
6. See also comments by Rusike (1988).
7. A bag of fertilizer was considered to be the 50kg bag. The average prices were cleaned of outliers.
8. Mining here includes both small shaft drilling and panning.
9. Koopman (1991) reports this absence of income pooling in data collected from the south of Cameroon. The definition of pooling used is that given in part III.
10. It has been found that of the production decisions made in the survey area during the 1995/96 season 58,51% were indirectly made by the wife although only 20% of them were made directly (and then only because in 15% of the cases the husband was unavailable to make them).
11. See also comments by Ellis (1992).
12. The inheritability of these permits by spouses is one of the changes that has recently been given a lot of attention.
13. Responsibility means taking decisions about area, inputs, directing and managing family workers and general supervision.
14. Care must be taken to note that some crops such as maize are difficult to classify so are excluded from this statement.
15. Amin and Chipika (1992) provide an insightful breakdown of time allocated to different activities by different sexes and age groups in Mashonaland and Matabeleland.
16. Central Statistical Office (1995).
17. The implications of this for the empirical part of this study are discussed in the penultimate section of this chapter.

18. An example is the time allocated to activities like visits, some processsing (peanut butter making, *kutonongora*, etc.), rituals and some beer brewing.
19. Such studies use different estimating techniques and analyse different aspects of resource allocation, but are mostly for the supply side.
20. In any case it is crucial in any study of these households to consider the fact that the nature of household labour allocation is gender and age specific. Most heavy tasks are carried out by men whilst women do the weeding and unshelling (This is borne out by the survey data and Cleave (1974); Naing (1980). In fact where there are different responsibilities for different plots of land, women tend to be given sole responsibility of producing the staple with men concentrating on cash crops. This however, in no way means that the female actually controls food production *per se* but that accountability is spread across all the adult members of the family in contrast to studies which tend to assume that because there is a plot in a particular agricultural season that is said to be the spouse's, therefore of necessity the woman controls that plot (examples include Udry, 1996; Browning and Chiapori, 1994).
21. Ellis (1992) points out that at best smallholders are partially integrated in produc markets.
22. By equating the supply and demand of on-farm household labour the virtual farm wage can implicitly be derived.
23. This refers to comparative advantage based upon two economic agents producing two identical outputs from one input.
24. The comparative statistics are similar to those of the neo-classical model discussed in Singh *et al.* (1986, pp. 71-91).
25. It is important to note that the study itself comes to the conclusion that in the particular case considered the assumption of separation is not erroneous.
26. The importance of Z-goods has in fact been thoroughly documented (see Becker, 1965; Gronau, 1977; Michael and Becker, 1973).
27. Note that the notation used is maintained throughout the whole section, where there is a deviation the variable concerned is redefined.
28. The general formulation of these can be found in Chiappori (1988). A review of these models can be found in Strauss and Thomas (1995).
29. Altruism is defined according to Folbre (1986, p.304) as *"positive dependence of one person's utility function on the well-being of another"*.
30. See also Friedman (1977), Kooreman and Kapteyn (1989) as referenced in Seaton (1990).
31. Apps and Rees (1996), p. 218.
32. This issue has been the subject of a lot of recent work (see Udry, 1996; Koopman 1996, Akram-Lodhi, 1997), but their findings about pooling are not applicable here. Note should be made however, that even in these studies the basis on which income pooling is rejected is very suspect.
33. The lack of technological data for the different types of labour would make any other formulation impossible.
34. Zimbabwean society is strongly patriarchal.
35. See Kapteyn and Kooreman (1989).
36. Altruism is defined as the positive dependence of one person's utility function on the well being of another.

37. These are just a sample of the probems and questions that plague the use of the market wage. However, since the objective is to let the market conditions and the market price direct policy then it is only proper that a market wage should be used. How it should be calculated is another issue that is beyond the scope of this study.
38. See Hamdok, 1993.
39. Although the valuation of some of the assets, particularly the older ones, which in accounting terms might have a negative value, but in the real life experiences of these households have got a positive value, is subjective, care must be taken to value them in a consistent framework. Further, the understanding here is that cattle are mostly used for draught power purposes and as a store of wealth.
40. The derivation of the profit maximising conditions used in this study are available from the author.
41. The definition of this variable includes both transport cost and proximity to marketing centres.
42. Pooling was observed and the household dominates the household decision making process. Besides, no data was collected on the objectives, long-term or otherwise, of the different members of the household.
43. However, such a large figure is still surprising given the circumstances of this region. Another explanation might be embeded in the potential of the region in activities outside the ones considered here.
44. In a follow-up to this study the analysis of the intensity of agricultural labour use was found to be very high.

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