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HOUSEHOLD RESOURCE ALLOCATION: IMPLICATIONS FOR POVERTY ALLEVIATION AND HOUSEHOLD WELFARE DURING LAND REDISTRIBUTION

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Abstract

This paper assesses the role played by access to assets in explaining rural household allocation of labour and sources of incomes using a multinomial logit model. To confirm the results we measure the effects of redistribution of assets to assess gains and simulate general equilibrium effects using de Janvry and Sadoulet's computable non-separable household economic model. We find that land redistribution remains a critical instrument in an asset driven approach to poverty alleviation, but that there might be conflicts between social efficiency and equity in redistributing assets because there are economies of scale in human capital assets and social capital for migration.

INTRODUCTION

Categorising households by type of labour market integration as applied by Eswaran and Kotwal (1985) recognises that rural households are endowed with different levels of assets and that they maximize utility in an environment characterised by access to working capital constrained by collateral ownership. Insufficient access to these assets is the main determinant of poverty. Given the type and level of asset entitlements, rational choice of rural agricultural households lead them to choose differential labour strategies and thus to belong to different labour regimes. Rational choice also explains performance, such as the land/labour ratio and factor productivity (Lipton (1985). Entitlement failures in some of these assets leads to certain poverty.

The paper presents preliminary results from a multinomial logit model used to explain how household labour time is allocated to three groups of activities based on the factors identified by the analytical framework. The results obtained here may be of some interest, apart from the prediction of how labour would be allocated, because they can also be interpreted as a measure of the extent to which household labour can be harnessed (exploited) as a way of boosting the levels of income (and thus alleviating poverty) in rural areas. This is in cognisance of three key characteristics of the Zimbabwean rural economy:

- First, labour input accounts for more than 70% of agricultural output and about half of non-agricultural output produced in the small-scale rural sector in most of the Sub-Saharan region (Tshibaka, 1986). Therefore, the need to increase the utilisation of labour allocated to productive activities is central from both growth and equity standpoints. In addition if household labour time allocation patterns can be shown to mirror the relative importance of the sources of income in response to asset ownership, it would be possible to construct a model that predicts how households adjust their labour allocation patterns as their levels of asset ownership changes.
- Secondly, the maintenance and continuous adaptation of a highly diverse portfolio of activities in order to ensure survival is a distinguishing feature of rural livelihood strategies in third world countries (von Braun and Pandya-Lorch, 1991; Sahn, 1994; Reardon et. al., 1998). This household level diversification has implications for rural poverty reduction policies since it means that conventional approaches aimed at increasing employment, incomes, and productivity in single occupations, like farming may be missing their targets.

- Lastly, these household assume differential asset positions , which influence their family labour supply (depending on the extent to which they are endowed with different labour skills) and farm labour demand (depending on their land and fixed capital endowment). This, among other things (e.g. transaction costs) leads to farm households being differentially integrated into labour markets.

Differential market integration has two crucial consequences for the analysis of labour decisions. The first is the way in which household decision making is modelled. In households that work off their farms for a wage or hired in labour, and household labour can be perfectly substituted for hired labour in production, the opportunity cost of household labour is the effective wage received if labour is hired and paid if the household is a hirer. Production decisions can be taken independently of consumption decisions, with the production decision being taken before the consumption decision and the two are linked through the income level achieved in production. In households that are self sufficient in labour, production and consumption are linked through the time constraint and the two decision problems must be solved simultaneously. The second is that membership to different labour groups as hirers, employees or self-sufficient, implies differential response to policy intervention. Thus differentiating rural household by type enables the analysis of the differential impact of policy interventions across household and to design differentiated interventions for particular types of households. This second aspect is, however, not pursued in this study.

The empirical aim of this study is therefore to explain labour time allocation to three labour activities: on-farm work, off-farm work and leisure. By examining the coefficients of the factors, we make inferences about the possible impacts of reallocation of resources. First, the effects of both exogenous and endogenous variables are considered. Skill is measured by the number of years spent in school and leisure includes home time or time spent in the preparation of food, child rearing, gathering of firewood and other household chores. The first model under consideration comprises three equations, representing the three main activities to which labour can be allocated. All of the data are taken from the household economic survey carried out during the 1996/97 agricultural season and conducted by the Ford Foundation sponsored *Economic Reforms and Meso-scale Rural Market Changes in Zimbabwe* (FFMPC) project. Using a similar analytical framework (de Janvry and Sadoulet, 1995) we differentiate households according to their asset position and simulate models to anticipate household general equilibrium effects of the transfer of resources to different groups. This second part of the study is used to not only confirm the validity of the results we get in the first part, but also to extend them.

2. A MODEL OF HOUSEHOLD BEHAVIOR

In this study we use an agricultural household economic modelling framework to analyse how labour is allocated in the rural household sector and, by examining the magnitudes of the coefficients of the factors, make inferences about the possible impacts of reallocation of these resources.

Most rural families have multiple sources of income. These include off-farm wage work in agriculture, wage work in non-farm activities, rural non-farm self-employment and remittances (or external transfers). Several studies have shown that in Sub-Saharan Africa 30 to 50 % of household income is from non-farm sources (Reardon et. al., 1998), although in some cases this figure can be as high as 80/90% (May, 1996). Studies have also shown that the limitations of the agricultural sector in employing the rural labour force fully and achieving comparable incomes (with urban areas) can be overcome if the importance of all the productive activities of rural households are taken into consideration. Policy intervention can then be tailored to take cognisance of the non-conventional nature of this economy (Tomich et al., 1995; Fuller 1990; Gasson, 1986; and Oshima 1986). This approach effectively recognizes that the ability of household members to participate fully in the labour market is largely dependent on the level of human capital.

The theoretical household economic model that is based on household welfare maximisation is employed. Each household is considered to possess a stock of only 2 categories of labour, skilled labour (L^s) with opportunity cost w^s and unskilled (L^u) labour with opportunity cost w^u. The level of education (i.e. the number of years of schooling individuals received) is used to categorise the types of labour[1]. That is, the household maximises a utility function in home time (of the different household members) and family income given certain household characteristics, θ:

$$1) \qquad \max u(l_e^u, l_e^s, Y; \theta)$$

where l_e^u is leisure for unskilled labour and l_e^s is leisure for skilled labour, Y is household income. The household produces a single output, Q, using a fixed amount of farm productive assets, A, and labour[2]. Household welfare is maximised subject to the following constraints:

i. $\quad L^u = l_e^u + l_i^u + l_o^u \quad$ and $l_e^u \geq 0$,

[1] Those who have received less than 14 years of education are considered unskilled whilst those with more than 14 years as skilled.

[2] Arable land is not included because it is assumed that there is no land market, which is the case in Zimbabwean rural areas. Therefore for given fixed assets, any adjustments are made on the labour market.

ii. $L^s = l_e^s + l_i^s + l_o^s$ and $l_e^s \geq 0$, and

iii. $Q = f(A, l_i^u, l_i^s, l_h; \theta)$

where farm household income consists of farm net revenue, off-farm earnings and other exogenous incomes or remittances (R). That is

2) $Y = pQ(A, l_i^u, l_i^s, l_h; \theta) + R - w^h l_h + w_o^u l_o^u + w_o^s l_o^s$,

where unskilled labour allocated to on-farm activity is denoted by l_i^u and unskilled labour allocated to off-farm activity by l_o^u. l_i^s is skilled labour allocated to on-farm activity and l_o^s is skilled family labour time allocated to non-farm activity, l_h is hired labour and p is output price. All the categories of labour are considered to be non-negative. Off-farm earnings of the farm household are given by the product of the off-farm wage rate and hours worked off the farm.

The production function, Q, and the utility function u are assumed to be increasing, strictly concave, and continuously differentiable in their arguments. These assumptions ensure that the problem admits only one solution given by the following Kuhn-Tucker conditions:

- $\frac{\partial L}{\partial l_i^s} = -\frac{\partial u}{\partial l_e^s} + \frac{\partial u}{\partial Y} p \frac{\partial Q}{\partial l_i^s} - \lambda_2 \leq 0,\ l_i^s \geq 0$, and $l_i^s \frac{\partial L}{\partial l_i^s} = 0$
- $\frac{\partial L}{\partial l_i^u} = -\frac{\partial u}{\partial l_e^u} + \frac{\partial u}{\partial Y} p \frac{\partial Q}{\partial l_i^u} - \lambda_1 \leq 0,\ l_i^u \geq 0$, and $l_i^u \frac{\partial L}{\partial l_i^u} = 0$
- $\frac{\partial L}{\partial l_o^s} = -\frac{\partial u}{\partial l_e^s} + \frac{\partial u}{\partial Y} w_o^s - \lambda_2 \leq 0,\ l_o^s \geq 0$, and $l_o^s \frac{\partial L}{\partial l_o^s} = 0$
- $\frac{\partial L}{\partial l_o^u} = -\frac{\partial u}{\partial l_e^u} + \frac{\partial u}{\partial Y} w_o^u - \lambda_1 \leq 0,\ l_o^u \geq 0$, and $l_o^u \frac{\partial L}{\partial l_o^u} = 0$
- $\frac{\partial L}{\partial l_h} = \frac{\partial u}{\partial Y}\left[p \frac{\partial Q}{\partial l_h} - w^h \right] \leq 0,\ l_h \geq 0$, and $l_h \frac{\partial L}{\partial l_h} = 0$
- $\frac{\partial L}{\partial \lambda_1} = L^u - l_i^u - l_o^u - l_e^u = 0$
- $\frac{\partial L}{\partial \lambda_2} = L^s - l_i^s - l_0^s - l_e^s = 0$

where λ_1 and λ_2 are Lagrange multipliers associated with the non-negativity constraints.

If we consider the effect of the magnitudes of the different categories of household labour for example, it is clear that the solution is similar to the standard result[3]. Consider two cases where:

(a) $l_0^s > 0$ and $l_i^s > 0$ (skilled labour is allocated to both on-farm and off-farm activity). This means that

$$\frac{\partial u}{\partial Y} w_o^s = \frac{\partial u}{\partial Y} p \frac{\partial Q}{\partial l_i^s} = \frac{\partial u}{\partial l_e^s} + \lambda_2 \text{ , then}$$

$$p \frac{\partial Q}{\partial l_i^s} = w_o^s$$

This result states that the household equates the value of the marginal product of labour on-farm to the off-farm wage.

(b) $l_0^s = 0$; $l_i^s > 0$ (all skilled labour is allocated to on-farm activity).

$$\frac{\partial u}{\partial Y} w_o^s - \lambda_2 - \frac{\partial u}{\partial l_e^s} \leq 0$$

$$\text{i.e. } \frac{\partial u}{\partial Y} w_o^s \leq \frac{\partial u}{\partial l_e^s} + \lambda_2$$

$$\frac{\partial u}{\partial Y} p \frac{\partial Q}{\partial l_i^s} = \frac{\partial u}{\partial l_e^s} + \lambda_2 .$$

$$\text{This implies } p \frac{\partial Q}{\partial l_i^s} \geq w_o^s .$$

3.1 Variables

The economic model suggests that the amount of labour allocated to different activities in a typical household is a function of the level of asset holding of the household (as part, of farm charateristics), the price of labour allocated to the different activities, the skills base of the household and the characteristics of the household. However, exactly what farm characteristics should be included is subject to debate (see Huffman, 1991; Lass and Gampesaw, 1992; and Kimhi, 1994). In this study the variables we use include land area, capital, remittance income, dependency ratio and family size (as household characteristics). Unskilled family labour L^u is dissaggregated into male and female unskilled labour. L^s is the number of skilled family members. A considerable proportion (59.8%) of family income of sample households is from

[3] See appendix for the other scenarios.

non-farm activities. The sources of non-farm income are principally labour income and remittances from migration.

Agricultural productive assets are characterised by the value of productive capital in farm machinery and equipment, breeding stock, and farm buildings. These are expected to positively affect the amount of labour allocated to both agricultural and non-agricultural activity because of the hypothesised low asset base of most households in the rural areas[1]. The magnitude and significance of assets would be expected to depend on the characteristics of the household and whether or not any of its members are in permanent or full time employment. Land area, which is both irrigated and rainfed, is expected to positively affect the labour time allocation to farming. The hypothesis being that, one of the main constraints to the allocation of labour to farming is the amount of land accessible to the household.

Remittance income is expected to negatively affect the time spent on farming since this income would then be used to purchase some of the required food consumption and therefore reduce the amount of effort that would be devoted to this activity. The time allocated to off-farm work, likewise could be expected to fall as remittance income rises. This belief is based on results from other studies which found that leisure is a normal good (Gould and Saupe, 1989 and Tokle and Huffman, 1991).

Off-farm wage is expected to negatively affect the time spent on farming. However, it is also possible that the effect of this variable might be totally insignificant because of the relative scarcity of regular employment opportunities in the study area, in which case the wage would not reflect the true opportunity cost of this labour..

Of the household characteristics only two are used: dependency ratio and household size. The dependency ratio, which is the ratio of the number of consuming units to the number of working units, is expected to have a positive effect on the amount of labour set allocated to farming. This is based on the observation that farming is the main source of food for the household. The size of the household is expected to have a positive effect on both skilled and unskilled labour allocation in both on-farm and off-farm activity.

Table 6 below presents statistics describing the explanatory variables outlined above. In the case of skilled labour a new variable is included to capture the relative employability of skilled labour. In Zimbabwe, as in many other developing countries, suitability of an individual for a job, particularly for a regular off-farm job is assessed largely using educational attainment levels (see Benjamin and Guyomard, 1994). Therefore, education level can be considered to be a proxy for human capital.

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[1] See Tshibaka (1989)

Table 3. Description of Variables

Variable*	Sample Mean	Standard Deviation
Area (acres)	6.2	4.6424
Assets (Z$)	1881.65	3698.56
Dependency ratio	2.1041	1.58400
Remittances (Z$)	1941.87	979.51
Wage (Z$)	85.62	22.77
Household Size	4.5	1.71
Education	4.1610	8.1024

* n = 109 households except for the education variable of skilled labour where n = 57.
Source: Economic Policy Reforms and Meso-scale Rural Market Changes in Zimbabwe - The Household Study Data Set 1997.

4. ESTIMATION AND RESULTS

4.1 The Model

Since the analysis aims to explain an allocation problem where total available time is fixed, a number of different allocation models could be used. However, most are not exactly suited for the study. The model we use ensures that the average shares of time allocated to different activities are non-negative and that the average shares sum to unity[5]. Such a model, similar to Theil's (1969) multinomial extension of the linear logit model as put forward by Bewley and Young (1987) whose notation we use here, is chosen. The modified basic structure of the model is as follows:

$$(1) \qquad w_i = \frac{\exp[g(x,\beta_i) + u_i]}{\sum_{j=1}^{n} \exp[g(x,\beta_j) + u_i]}$$

$$i = 1, \ldots\ldots, n^6.$$

where w_i is the average share of the ith activity, x is a vector of total household time, β_i (i =

[5] This is in recognition of the results from other studies, notably Kimhi (1994), which show that non-negativity constraints are very important for on-farm work for farm households.
[6] In the present model $n = 3$.

1, . . . , n) is a set of parameters and u_i (i = 1, . . . , n) are the disturbance terms. From this equation it is clear that $0 < w_i < 1$ and $\sum w_i = 1$.

The expression above is linearised by Theil (1969) for estimation purposes. This is done by taking the log of the ratio of the ith equation to the nth equation. However, the interpretations of the size and sign of individual parameter estimates are not immediately obvious. Bewley (1982) argues that since taking the log of the ratio of the ith equation to the geometric mean of all of the equations is exactly equivalent in its properties, it is a more useful representation. Further, he developed the model into one that closely resembles the Rotterdam and AIDS models (Bewley, 1986) commonly used in analysing food expenditure shares. A convenient specification of $g(x, \beta)$ is:

$$g(x, \beta_i) = \alpha_i + \beta_{iy} \ln(y) + \sum_{j=1}^{n} \beta_{ij} \ln(x_j), \tag{2}$$

where y is total household time and x_j is the jth explanatory variable; the elasticities of these variables are

$$\in_{ij} = \beta_{ij} - \sum_{k=1}^{n} w_k \beta_{kj} \tag{3}$$

$$i, j = 1, \ldots, n,$$

and the elastisities of the shares in response to the total time available (the scale variable) are

$$\eta_i = 1 + \beta_{iy} - \sum_{k=1}^{n} w_k \beta_{ky} \tag{4}$$

$$i = 1, \ldots, n.$$

In this study, we develop the system at a single point, the mean, as has been assumed by others with the double log system (see Byron, 1968; Court and Kakwani, 1970). The allocation shares at this chosen point are denoted by $\bar{w}_1, \ldots, \bar{w}_n$[7]. On substituting (2) into (1) and taking logs, a weighted average of the transformed equation is found, which when subtracted from the log of equation (1) yields a linear version:

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[7] These need not be the means, but merely a data point where $\sum \bar{w}_i = 1$ and $\bar{w}_i > 0$.

(5) $$\ln(w_i/w^*) = a_i^* + b_{iy} \ln(y) + \sum_{j=1}^{n} b_{ij} \ln(p_j) + v_i^* ,$$

where $\ln(w^*) = \sum_{i=1}^{n} \bar{w}_i \ln w_i$ and

(6) $$b_{ij} = \beta_{ij} - \sum_{k=1}^{n} \bar{w}_k \beta_{kj}$$

$i = 1, \ldots, n; j = 0, \ldots, n$

(7) $$a_i^* = \alpha_i - \sum_{j=1}^{n} \bar{w}_j \alpha_j ,$$

$i = 1, \ldots, n$, and

(8) $$v_i^* = u_i - \sum_{j=1}^{n} \bar{w}_j u_j$$

$i = 1, \ldots, n.$

Therefore, the parameter estimates are exactly equivalent to the elasticities of the variables in question, except the estimate for the scale variable.

4.2 Results

Unskilled Labour

The above model was then fitted to the household data from 109 households for *unskilled labour* using the Time Series Programming package and the results obtained were tabulated as shown on table 7 below.

As expected, with respect to labour time allocated to on-farm activity, the coefficients of the land area accessible to the household variable(AREA), the value of assets(ASSH), the amount of remittance income(REMIT), off-farm wage rate(WAGE) and dependency ratio(DEPRATIO) are mostly significantly different from zero, implying that these variables are important determinants of the share of labour allocated to on-farm activity. The dependency ratio included on the assumption that high dependency would generate pressure to allocate more labour to on-farm activity in order to increase food output, is the most significant. Family size(SIZE) and off-farm wage rate, are not significantly different from zero. However, both display the expected signs.

Table 4 FIML Estimates for Unskilled Labour

Equation / Variables	Share of On-farm Labour Time	Share of off-farm Labour Time	Share of Leisure Time
Constant	0.5087	-20.119	0.6691
	(0.6122)*	(-0.2655)	(2.4559)
AREA	0.73289	0.09629	-0.40364
	(5.6055)	(0.36444)	(-5.4869)
ASSH	-0.2459	0.53315	0.2266
	(1.9921)	(1.3453)	(2.0554)
DEPRATIO	0.1920	-0.89402	0.1455
	(4.9101)	(-2.9953)	(1.9526)
REMIT	-0.18955	-0.06095	0.1182
	(-2.0319)	(-0.2901)	(2.0980)
WAGE	-0.32337	4.3023	-0.50850
	(-0.96482)	(7.4047)	(-2.4255)
SIZE	-0.24262	-1.2743	0.34415
	(-1.3006)	(-3.5934)	(3.2091)
AVAIL	0.0002	-0.0012	0.0003
	(0.5619)	(-2.9216)	(1.9907)
$\bar{R}^2$	0.6912	0.6912	0.6912

*Figures in parentheses are t-statistics

Elasticity estimates for labour can be interpreted as implying that a one percent increase in the area accessible to the household would be associated with a 0.73 percent increase in the share of labour allocated to on-farm work, an insignificant increase in the share of time allocated to off-farm and a 0.4% fall in leisure time. A one percent increase in the level of assets would lead to 0.25% fall in the share of labour allocated to farming activity and 0.23 % increase in leisure. A one percent increase in the dependancy ratio is associated with a 0.19% rise in the share of labour allocated to farm work, a 0.89% fall in non-farm work and a negligible rise in leisure time.

The analysis reveals that with respect to off -farm work activities all variables except for remittances and land area accessible to the household have a significant effect on the share of labour time allocated to off-farm work. The coefficients of these variables are all statistically different from zero, and they display the expected signs. Remittance income has no effect on off-farm labour[8], but negatively affects on-farm labour use. An increase in this income, however is associated with an increase in the time for leisure.

[8] This might be cause by the fact that some types of off-farm labour time allocation is lumpy.

Wage rates have a significant effect on only off-farm work and leisure. As the size of the household increases, the share of time allocated to off-farm activity falls and leisure time rises. The scale variable shows that as available labour increases, labour on-farm, off-farm labour decreases, and time spent on leisure increases.

Skilled Labour

Since the empirical model makes use of the log form, the model for skilled labour is fitted to data from only 57 households that reported skilled labour which participated in both on-farm and off-farm work during the survey period. Here we include an education variable since it is expected that a higher educational and skills level is associated with off-farm work.

Table 5 FIML Estimates for Skilled Labour Time

Equation / Variable	Share of On-farm Labour Time	Share of off-farm Labour Time	Share of Leisure Time
Constant	-2.0102	0.2298	0.3493
	(-0.9287)*	(0.1561)	(0.2248)
AREA	0.3027	-0.0341	-0.5301
	(3.9879)	(-1.9739)	(-3.3997)
ASSH	0.3570	-0.2302	-0.3098
	(2.9965)	(-2.7593)	(-1.9693)
DEPRATIO	0.6174	-0.2645	0.0700
	(.8047)	(-1.9364)	(0.2911)
REMIT	-0.1796	-0.0823	0.2529
	(-2.6658)	(-2.4853)	(1.8654)
WAGE	-.4477	0.1312	0.1126
	(-0.4760)	(2.0287)	(2.425)
SIZE	0.1653	0.4639	0.3574
	(0.34302)	(0.3172)	(2.2269)
EDUCATION	-0.0962	0.2459	0.1234
	(-2.0355)	(2.1645)	(3.0257).
AVAIL	0.4209	0.2145	-0.6693
	(1.0934)	(2.4027)	(-1.8972)
R_L^2	0.5625	0.5625	0.5625

*Figures in parentheses are t-statistics.

Characteristics of the farm affect the share of labour spent on farming. The elasticity estimates show that both area and capital have a positive impact on the share of labour time of skilled family members spent on farming, but have an opposite effect on the share allocated to off-farming and leisure. These are consistent with the assumption that assetsincrease the productivity of the household's on-farm work activity, which raises the opportunity cost to off-

farm work. The elasticity estimate for the share of on-farm labour time with respect to area displays a slightly smaller effect than that with respect to assets, but influences the outcomes in a similar way.

With the exception of the share of leisure time in the case of household size, both size of the household and Dependency ratio are found to be mostly insignificant in the allocation of labour time by skilled workers. Remittance income on the other hand has a negative effect on the share of labour set aside for both farming and non-farm activity[9], but its effect on leisure is statistically insignificant.

The off-farm wage rate has a positive and statistically significant effect on the share of household labour allocated to off-farm work. All things being equal, at the sample mean, a 1% increase in the household's weekly wage is accompanied by an increase in the share of labour time allocated to off-farm work of 0.13%. Hence, off-farm work time allocation is influenced by the financial attractiveness of off-farm wage. The share of on-farm labour time is not significantly affected by the wage rate.

Our results also show that human capital as defined by the skills element, is also important[10]. Education has a positive effect on the share of off-farm work and a negative effect on the share of on-farm work. The implication is that additional schooling increases household wage by more than it increases their reservation wage for both on-farm work and leisure. The net effect is increased household income diversification. This result is similar to other studies carried out in both similar and different conditions (Robinson, McMahon and Quiggin, 1982). Education has a positive effect on the share of labour allocated to off-farming through efficiency effects. Education helps increase labour productivity, and this has a positive effect on the demand for an individual's labour as well as on the probability of obtaining off-farm employment.

4.4 *Goodness of Fit.*

Our analysis uses a system of equations. This makes the use of a single equation measure of goodness of it problematic[11]. Instead we use an alternative measure, which takes the following form:

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[9] This is exactly the same effect remittance income has on unskilled labour.

[10] No information of cognitive achievements, job skills or work experience was collected therefore the level of education as measured by the number os years of schooling members of the household received was used.

[11] Bewley (1985, 1986) has demonstrated this measure tends to be biased towards unity when the degrees of freedom are few.

$$R_L^2 = 1 - \frac{1}{1 + LR / [T(n-1)]}$$

where T is the number of observations, n is the number of equations in the system and the log likelihood ratio, LR, is double the difference between the log likelihood of the model and the log likelihood of the same dependent variables on a constant term only, (i.e. with all the βs equated to zero).

For unskilled labour, the fit is fair ($R_L^2 = 0.69$), but for skilled labour the relatively lower lower goodness of fit measure (0.59) suggests that other explanatory variables should be considered. However, given that the data used in this study is cross-sectional the level of these measures are quite good.

5. IMPLICATIONS

On-farm and off-farm hours.

The theoretical expectations of the model are in general confirmed by the results. Land and productive assets are the main determinants of variations in the share of labour time spent on both on-farm and off-farm productive activities at the expense of leisure. This is more clearly defined in the case of skilled workers. Depending on the relative importance of the three activities, in terms of income generation, these results can be used to identify ways of enabling the increase not only of the productivity, but also the levels of income of the lesser endowed section of the rural populace. This would have an effect of reducing the number of household living in poverty and the level of poverty. Because households with access to relatively larger pieces of land (8+ acres) and with a relatively large asset base (Z$5000+) tend to hire labour at some point during the agriculture production season, the key instrument to help households become successful small scale enterpreneurs who start hiring in labour, would be to either increase or facilitate the increase in the asset endowment of households.

The study also shows that regardless of the comparatively high labour use among Zimbabwean rural households, there is some scope for significant increases in labour time use that could help improve the income earning capacities of rural households. Zimbabwean agricultural households face similar problems to those faced by households elsewhere in developing economies: a widening gap between rural and urban income; the inability of non-farm employment to absorb the relatively unproductive agricultural labour; and a relatively unstable household food security system. So, it is necessary for poor rural household to farm;

but if poverty is to be alleviated, it is essential that such households, because of the limitations brought about by the fixed factors, should do more than just farm. There is, therefore, a need to strengthen the economic linkages between the farm and non-farm sectors. This can be done by enabling the development of a range of rural industries, financial and other socio-cultural institutions.

*Land/*Asset *Redistribution*

Results show that distributing land and assets to rural households could significantly significantly increase their labour time use. Since the overwhelming majority of these households have access to but small pieces of land it could be concluded that in fact these two variables could be useful to policy making for welfare improvement in this part of the national economy. The importance of these variables does not overshadow the fact that because of the nature of the household production unit, internal characteristics affect the response of these households to changes in their entitlement levels. It means then that any policy which does not take into consideration the heterogeneity of households and the likely differences in their response to policy cannot acheive its stated goals.

Our empirical results show that household leisure time is a normal good regardless of the existence of off-farm work, a result which is consistent with empirical evidence from other parts of Sub-Saharan Africa. This result coupled with the fact that taking up off-farm work by some household members is one method of reducing the quantity of unemployed labour in agriculture and means that activity diversification and therefore policy encouraging it, could be a possible way to raise productivity in the rural areas.

Empirical results from this study shows that labour time allocation, which can be shown to parallel sources of income, is closely related to asset ownership and the characteristics of the analytical unit (the household).

5. DIRECT AND INDIRECT EFFECTS

In this part we try to show that the effect of asset redistribution goes beyond just the direct effects and that asset entitlement is important in any poverty alleviation strategy for these households (ie. The section confirms results from the modelling effort above). In this section a methodology first used by de Janvry et. al. (1992) is used and employed later for the study of Mexican households. We begin by constructing an asset based typology of rural households.

As we have shown in section 2 households are engaged in both crop and livestock production, wage labour, self-employment in micro-enteprises and migrate to urban areas. In

this typology it is hypothesised that the main determinants of household time allocation strategies and level of income are the different type of assets that the household control. It is important to note that this hypothesis does not imply that ownership of these assets represents actual income strategies but that ownership of these assets represents the potential which households have in designing income earning strategies that capitalize on these assets. Similarly, ownership of these assets also represents the potential which households have in reaching higher income levels as asset ownership increases, not the actual income levels achieved.

Table 9. An Asset based Differentiation

Production Assets Labour assets Migration Assets	Low* Low Low	High Low None	Low High None	Low Low Possess	High High None	Low High Possess	High Low Possess	High High High
Observations	39	26	116	91	51	46	62	37
Percentage of households	8.3	5	24.8	619.5	10.9	9.8	13.2	7.9
Production Assets								
Crop land**	3.1	12	4.5	4.2	13.7	4.0	15.3	20.5
Livestock	2.2	7.3	3.1	2.9	11.6	6.8	10.4	15.5
Labour Assets								
Household Size	4.5	4.5	7.8	5.2	8.5	8.1	4.7	9.1
Education	2.7	3.3	6.8	3.9	7.6	7.0	3.9	7.6
Small Enterprises	3.2	3.5	6.9	3.4	10.1	4.2	3.2	3.0
Migration				0.99		2.1	2.7	0.8

* Endowment below threshold for all three asset groups

Categorising households according to asset holding has predictive power, if these potentials are translated into differential income generating strategies that are specifically related to asset ownership. As de Janvry et al. (op. cit) point out, the income level of these household should rise 'as asset endowments place households above the threshold in a large number of asset categories' (pg. 3). Table 9 shows a categorisation of these households by their endowment of assets. Assets are separated into: agricultural land assets, labour assets which are composed of household unskilled labour units, and migration assets which are made up of the number of permanent migrants and members of the household who are currently engaged in migration minus one (since this is the migration capital for one migrant in the household). The threshold of agricultural production assets is 6.3 acres, that for labour assets is 4 adult equivalents and that for assets greater than zero.

As expected income data from the different groups of households indicates that income levels are highly positively correlated with income levels achieved. The degree of correlation however, is strongly dependent on the types of assets which individual households possess. For example, households without any assets have total income which is equal to 20% of the income of those which possess the three types of assets. The same applies to the poverty head count ratio, which falls as the number of as the number of asset owned increases. Therefore, the predictive power of assets on income is found to be very strong as de Janvry et. al., whose methodology we use here, have found for Mexican households.

Table 10. Household Assets and Sources of Income

Production Assets	Low	High	Low	Low	Low	High	High	High
Labour assets	Low	Low	High	Low	High	Low	High	High
Migration Assets	Low	None	None	Possess	Possess	Possess	None	High
Percentage of households	18.3	24.8	5.0	10.1	10.9	9.8	13.2	7.9
Sources of Income								
Crops	11.6	50.2	6.9	20.8	3.3	43.4	30.8	14.0
Livestock	10.8	12.3	10.4	0.9	5.1	16	9.9	8.7
Self-employment	9.4	4.7	2.6	6.6	13.4	3.8	2.6	10.7
Wage Labour	38.9	15.8	63.7	17.9	19.7	7.6	37.7	34.3
Remittances	18.7	10.1	15.1	49.4	53.5	24.9	2.1	31.7
Other sources	10.6	6.9	1.3	4.4	5.0	0.3	16.9	11.6
Total Income ($)	3906	7565	6407	8389	8875	10135	10825	16471
per head ($)	1085	2308	1290	1745	2617	5120	4598	3852
Poverty headcount ratio (in %)	77.3	54.1	49.4	42.6	30.2	39.5	21.6	19.1

The predictive power of assets on income strategy is also strong. Households with only agricultural assets derive 63% of their income from crops and livestock and those with only labour market assets derive 39% of their total income trom wage labour. Those who possess only migration assets derive 49% of their income from remittances, whilst households with agricultural and migration assets derive 84% of their income from crops livestock and remittances. Those with agricultural and labour market assets derive 78% of their income from crops livestock and wage earnings and those with labour market and migration assets derive 73% of their income from wage earnings and reinittances. Finally households with the three types of assets derive 89% of their income from crops livestock wage earnings and remittances.

As expected household labour allocation closely follows the relative importance of the various sources of income in response to asset ownership. Table 11 shows the correlation of

asset holding and labour time allocation which enables the construction of a household model that serves to predict how households adjust their labor allocation strategies to changing levels of asset ownership.

Table 10. Household Assets and Labor Allocation

Production Assets Labour assets Migration Assets	Low*	One Asset High Low None		Low Low Possess	Two Assets High High None		Low High Possess	High
Percentage of households	8.3	5.0	24.8	619.5	10.9	9.8	13.2	7.9
Labour Allocation								
On-farm	1.10	2.22	1.86	1.16	2.31	1.79	1.94	1.90
Off-farm	0.10	0.89	0.21	0.22	0.30	0.10	0.63	0.68
Self-employment	0.12	0.30	0.15	0.27	0.18	0.03	1.30	0.18
Migration	0.27	0.17	0..05	0.85	0.89	0.69	0.05	0.91

This in tum allows the prediction of what the poverty reduction value and the social efficiency gain or cost of policies that target asset transfers to specific classes of households is.

5.1 THE MODEL

A model also based on asset entitlement, similar to de Janvry et al (1992), is used[12]. Here again the household is assumed to allocate its time to on-farm work, off-farm work and leisure. The problem of the household, if that household participates in the market is:

$$\text{Max } u(c, z_h),$$

where c is a vector of household consumption goods[13], subject to:

i) agricultural production technology, with imperfect substitution between family and hired labor:

$$g(\{q_j\}, l_a, Z_n) = 0, \text{ where}$$

$q_j > 0$ for agricultural commodities produced,

$q_j < 0$ for purchased variable inputs, including hired labor.

ii) labor-based microenterprise production, labor market employment, and migration:

$$q_i = q_i(l_i, z_i), \quad i = na, z_a, dm.$$

[12] The details of this modelling framework are not explained here since there can easily be obtained from de Janvry et. al. (1992).

iii) Cash constraint

$$\sum_{i \in T} p_i(q_i + E_i - c_i) + S = 0$$

where E_i is change in stocks and S are cash remittances.

iv) Prices used are prices in food markets and shadow prices for nontradables. That is:

a) prices are the market prices for tradables. These prices are used for the prices for food bought and sold by the household and hired labour in agriculture, labour sold on the labour market, migration wages, and purchased inputs. So

$$p_k = p_k^*,$$

where p_k is the market prices for tradeables.

b) prices are equal to shadow prices for non-tradables. This pricing is used for food, if the household is self-sufficient in food. Such that

$$q_f = c_f.$$

This pricing is also used for family labor allocated across activities under the time constraint such that,

$$\sum_i l_i + c_i = E_i,$$

which determines the shadow wage w*. The shadow wage is measured as the effective family labour cost in agriculture. Family labour is thus homogenous and measured in the number of adults, with an opportunity cost equal to the shadow wage.

Solution for the first order conditions gives the reduced form:

$$q_i = f(\{p_j^*\}, w^*, Z_a)$$

$$l_a = f(\{p_j^*\}, w^*, Z_a)$$

On the demand side the choices are also based on w* and p*, the shadow prices and the system is of the form:

$$c = f(p^*, w^*, y^*, z_h)$$

The profit function for agriculture is specified as translog and the consumption system is also derived from a translog indirect utility function. But for off-farm activities a CES transformatiom function is used. Thus the model can be considered to be similar to a CGE

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[13] These goods include food consumed, purchased goods, and home time.

model for a small open economy with four sectors (agriculture, micro-enterprises,wage labour and migration), tradeables and non-tradeables[14].

5.2 RESULTS

The effect of asset transfer across households is measured in two ways. Firstly, percentage income gain or loss for every household category of resulting from a transfer of one unit of an asset is used. This tells us something about the value of the asset as a welfare improving measure for every household category. Secondly, we use absolute income effect from the transfer of a unit of a given asset.

The effect of asset transfer on the incomes of household is also measured in two ways. One, the productivity of the asset per household category is used. Asset productivity gives us the extent of the contribution to agricultural profit and to marginal asset transfer. This does not take into consideration resource reallocation across different activities and resource reallocation in consumption. Second, the change in income resulting from asset transfer that takes into consideration complete reallocation in production and consumption is used. Therefore this second measure is refered to as the full income effect and the extent to which it differs from marginal productivity would tell us something about the capacity adjust to changes to asset holding positions.

The simulated effects of transfers of fixed amounts of each transfer to differrent household categories is shown in table 12. These results are in line with findings from South America. A unit of asset transfer reuslts in a larger percentage gain in income for the poorer households than for richer households. Marginal productivity and total income effects shows that the total income effect is in general significantly inversely related to the level of household income.

For self-employment resource reallocation among those with higher levels of self employment assets creates strong economies of scale. Here distributing microenterprise assets toward those with low asset levels is progressive but not socially efficient. Agricultural assets display the expected inverse relation between total income and farm size. Therefore there are diseconomics of scale in farm size. Thus redistributing land from larger to smaller farms is progressive and socially efficient. This result as in the first model provokes many questions which are not dealt with in this study and therefore should not be taken out of context of this study.

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[14] See the CNH model in de Janvry and Sadoulet, 1994.

There are clear economies of scale in human capital assets for unskilled labour. This includes both family size and educational level. There are increasing returns to education up to 14 years of schooling. A larger family size generates a higher return as reallocation takes place. In this case educating those with low education is progressive but it is not socially efficient.

Table 12. Marginal Productivity and Simulated Effects of Asset Transfer

Production Assets Labour assets Migration Assets	Low* Low Low	High Low None	Low High None	Low Low Possess	High High None	Low High Possess	High Low Possess	High High High
Shadow wage of labour(Z$ per week)	35	67.1	10.2	47.8	43.0	15.6	56.3	71.9
Marginal Prodictivity of Assets (Z$)								
Agriculture	-20	477	-264	1900	660	-15	625	401
Non-farm labour	430	776	504	813	797	701	328	520
Migration				2116		2401	457	2184
Increase land by 1 acre								
Total income effect	393	548	943	1546	740	495	586	301
% of Income	10.1	7.2	14.7	18.4	6.8	5.6	5.8	1.8
Increase in labour assets by 1 unskilled labour unit								
Total income effect	389	747	631	744	605	404	777	713
Percentage of income	10	9.9	9.8	8.9	6.8	4.0	7.2	4.3
Increase in migration assets by 1 migrant								
Total income effect				1829		1389	1491	1988
percentage of income				21.8		13.7	13.7	12.1

The role of migration assets in migration observed in studies by Durand and Massey (1992) are also confirmed in this study. Migration in these family systems makes a marginal unit of this capital increasingly profitable. The marginal effect of migration capital although neutral to scale in first round effects, create increasing returns to scale in second round effects.

5.3 CONCLUSION

In the first modelling effort we have shown that labour time allocation is closely related to asset ownership and the characteristics of the household and hence income levels. Closely following de Janvry et. al we also show that asset redistribution toward the poor is progressive.

This is because it generates a larger percentage income gain for those with lower incomes. But absolute income gains are not largest among those with low assets levels when resource reallocation effects are taken into account. For land, there is generally an inverse relationship between the income effect of an additional unit of land and farm size. Thus for an asset based poverty alleviating strategy, redistributive land reform is a potentially crucial instrument. This is not the case for the other assets. In human capital there are economies of scale in human capital assets, self-employment and migration capital implying a tradeoff between equity and efficiency gains.

A larger family size allows greater flexibility in resource reallocation. Greater pauticipation to the labor market as employers also gives a flexibility advantage to the larger farms. Increasing flexibility in resource reallocation among the poor is thus fundamental in helping them derive full benefit from programs of assets transfers.

The second part of this study not only confirms the findings in the first part, but also extends these findings by providing insights into second round effects and the effects of other variables not included in the first. Insufficient access to assets is thus confirmed to be an important determinant of poverty and therefore an important instrument for poverty alleviating strategies.

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