THE DETERMINANTS OF POVERTY IN MALAWI, 1998

An analysis of the Malawi Integrated Household Survey, 1997-98

by

The National Economic Council, Lilongwe, Malawi

The National Statistical Office, Zomba, Malawi

The International Food Policy Research Institute, Washington, DC, USA

June 2001

Table of Contents

1. Introduction 3
2. Modeling the determinants of poverty 5
    2.1 The exogeneity of explanatory variables 5
    2.2 Poverty line areas 7
    2.3 Agro eco-zones 8
3. Sources of data 9
    3.1 Household survey 9
    3.2 Community survey 11
4. Estimation issues 11
5. Model variables 14
    5.1 Dependent variable 14
    5.2 Independent variables 15
        5.2.1 Demographic 16
        5.2.2 Education 16
        5.2.3 Employment and occupation 16
        5.2.4 Agriculture 17
        5.2.5 Access to services and utilities at the household level 18
        5.2.6 Community characteristics and access to services at the community level 18
        5.2.7 Agro-eco zone fixed effects variables 19
6. The Malawi determinants of poverty model 19
    6.1 Demographic variables 20
    6.2 Education variables 22
    6.3 Employment and occupation variables 24
    6.4 Agriculture variables 26
    6.5 Access to services at the household level 27
    6.6 Community characteristics 27
    6.7 Agro-eco zone fixed effects variables 28
7. Poverty simulations 29
    7.1 The methodology 29
    7.2 The simulations 30
        7.2.1 Household size and composition simulations 32
        7.2.2 Education simulations 33
        7.2.3 Employment and occupation simulations 35
        7.2.4 Agriculture simulations 36
        7.2.5 Improvements in access to services and infrastructure simulation 38
        7.2.6 Community level simulations 38
8. Conclusions 39
9. References 41
10. Tables and Figures 42
11. Annexes 54
    11.1 Abbreviations 54
    11.2 Glossary 55

11.3 Poverty line derivation 57
11.4 Calculating welfare on a per capita versus an adult equivalent basis 60

Table of Tables & Figures

Table 1: Agro-ecological and economic zones 42
Table 2: 1997-98 Malawi Integrated Household Survey questionnaire table of contents 43
Table 3: Distribution of the 1997-98 Integrated Household Survey sample and the 10,698 household and 6,586 household analytical data sets 44
Table 4: Descriptive statistics of variables used in the determinants of poverty model 45
Table 5: Model of the determinants of poverty in Malawi 47
Table 6: Comparison of actual measures of welfare with base simulation 49
Table 7: Simulation results - percent change in consumption and poverty indices 50
Figure 1: Agro-eco zones used in the determinants of poverty analysis 53
Table 8: Poverty, food poverty, and non-food poverty lines and spatial price indices at April 1998 prices, by poverty line area 59

1. INTRODUCTION

With the inauguration of the Poverty Alleviation Program in August 1994, the Government of Malawi committed itself to reorienting economic and social policies towards developing human and economic resources for reducing poverty in the country. Shortly thereafter a Poverty Monitoring System (PMS) was implemented to support Government's effort in this area, enabling it to closely monitor the economic and social situation of the population and to analyze the impact, effectiveness, and efficiency of poverty-oriented policies, programs, and projects.[1, 2]

The 1997-98 Malawi Integrated Household Survey (IHS) was a comprehensive socio-economic survey of the living standards of households in all districts of Malawi. The IHS was carried out by the National Statistical Office (NSO) under the auspices of the PMS. Its principal purpose was to allow a quantitative poverty analysis to be conducted and a poverty profile to be developed for the nation. The IHS was to provide key benchmarks to allow assessments to be made in the future on trends in poverty in Malawi. The survey was designed so that the information gathered could be used to gauge the incidence of poverty in the population at the district level and above.

The poverty profile based on the IHS was completed in late-2000 (NEC 2000). The poverty profile is a descriptive tool that provides key information on the *correlates* of poverty. Typically a poverty profile is a bi-variate analysis which compares the poverty status of households or individuals to each of a range of selected characteristics of the households or individuals. Although the poverty profile is insightful, such a bi-variate exercise is limited in its usefulness because it shows how poverty levels are correlated one characteristic at a time. In doing so it does tend to simplify complex relationships. Nevertheless, the completion of the poverty profile provides an appropriate starting point for a determinants of poverty analysis.

The *determinants* of poverty analysis is a multi-variate analysis that extends the analysis of the poverty profile by attempting to infer the *causality* of specific household characteristics on household welfare. It attempts to answer the question of how a

[1] Although the Technical Working Committee of the PMS includes a wide range of stakeholders, three core institutions undertake most of the data collection and analytical functions for the PMS: the National Statistical Office (NSO), the Center for Social Research (CSR) of the University of Malawi, and the National Economic Council (NEC). These institutions receive technical assistance from the International Food Policy Research Institute (IFPRI)

[2] The first section of the Annex provides a list of the abbreviations used in this paper, whereas the second section of the Annex provides a glossary of many of the technical terms used.

particular variable affects poverty *conditional* on the level of other potential determinants of poverty. It goes beyond the poverty profile of assessing mere correlation of the characteristics of a household with its poverty status to consider the causes of poverty at the household level. The results of this determinants of poverty analysis exercise should be of particular interest to policy makers since it provides a means to assess the likely impact on the incidence of poverty in Malawi of a range of specific government policies aimed at improving the welfare of the population.[3]

Before we proceed to a discussion of the determinants model, we should first note the difference between *correlates* and *determinants*. Correlates refer to sets of two variables, for example, X_1 and X_2, that may or may not be associated in any causal way. The correlation model simply seeks to answer the question: "Are these two variables linearly related?". The correlation model seeks to identify the degree of *gross* association between the values of any two variables. No functional relationship between X_1 and X_2 is assumed or required for the use of the correlation model. Moreover, the existence of mutual variation between two variables does not imply that the variation in one variable, say X_1, is "caused by" variation in X_2 (Johnson, *et al.* 1987, p. 86). Furthermore, the relationship between two variables can vary from one set of data to the next. Thus, co-variation does not imply causality. Consequently, the correlation model used to derive a poverty profile for Malawi requires fewer assumptions than does the regression model used in the determinants of poverty analysis.

The regression model used in assessing the determinants of poverty in Malawi, in contrast, permits inferences to be made as to the direction and strength of causality between an independent and a dependent variable. This is achieved by controlling for the effect on the dependent variable of the other relevant independent variables in the equation. That is, one holds the values of other independent variables constant while isolating the effect of one independent (explanatory) variable on the dependent variable.

---

[3] The only previous attempt to model the determinants of household welfare in Malawi was done by modeling the determinants of smallholder incomes in rural Malawi using the 1992-93 National Sample Survey of Agriculture data (World Bank 1995, pp. 48-49). In contrast to the model described in this paper, it is important to highlight that this earlier model was limited to rural smallholder households and considered income levels, rather than the consumption-based household welfare indicator used here.
In this earlier study, eight household variables, plus Agricultural Development Division fixed-effect variables, make up the final model. The most important determinants of smallholder incomes were found to be the amount of cultivated land (positive), household size in adult equivalents (negative), and gender of household head (negative, if female).

Thus, the explanatory variables in our regression model are called determinants, because the dependent variable is a *function* of the explanatory variables and, therefore, is determined by them.

In contrast, the correlation model is computed without controlling for the effect of the other variables on the dependent variable: One cannot infer whether the variation in household welfare, Y, is due to the variation in household characteristic X_1 or due to the variation in X_2 or due to the variation in any other characteristics of the household.

2. MODELING THE DETERMINANTS OF POVERTY

Our approach to assessing the determinants of poverty in Malawi is based on modeling the natural logarithm of total daily per capita consumption of survey households, our household welfare indicator. This is our dependent variable. The model can be specified as follows:

$$\ln c_j = \beta x_j + \eta_j$$

where c_j is total daily per capita consumption of household j in Malawi Kwacha (MK); x_j is a set of exogenous household characteristics or other determinants, and η_j is a random error term.

In our model, the value of nominal consumption is normalized in order to obtain consumption in real terms. Temporal normalization to an April 1998 base, the middle month of the IHS survey period, was done using separate monthly Consumer Price Indices (CPI) for the three rural regions and four urban centers of Malawi.[4] These CPIs were calculated by the NSO. Spatial normalization was based upon the poverty lines calculated using the IHS data. As each poverty line represents the cost of a comparable basket of basic goods in a poverty line area, a set of spatial price normalization indices for the four poverty line areas was calculated by dividing the weighted mean poverty line for all IHS sample households by each of the poverty lines. (Refer to the third section of the Annex for details on the derivation of the poverty lines.)

2.1 The exogeneity of explanatory variables

The set of independent variables that are hypothesized to be determinants of consumption includes household and community characteristics. The key selection

[4] In April 1998, US $1.00 = MK 25.40.

criteria for these variables is *exogeneity*. As the goal of the model is to infer *causality*, variables which might be affected by current consumption in a household – endogenous variables – are excluded from the model. Our selection of potential determinants is guided by the results of the poverty profile of the IHS, as well as by those variables known to be of considerable interest to Malawian policy makers.

Endogenous, or jointly determined variables, have values which are determined through the joint interaction of other variables within the specified system (Judge, *et al*. 1988, p. 601). In contrast, exogenous variables are variables that affect the levels of the endogenous variables, but whose own levels will be determined outside the system. Exogenous variables are assumed to influence the values for the endogenous variables, but are not influenced by those variables in return because no feedback relation between the endogenous and exogenous variables is assumed.

For instance, one might examine several variables which seem to be related to the welfare of a household. These might include, for example, the educational level of the head of household and the quality of roof under which the household sleeps:

- The educational level of the head of household is an *exogenous* variable when examining household welfare, since it is determined by actions that are unrelated to the welfare level of the current household of which he or she is the head. The education level of the household head is likely to be an outcome of the past welfare status of his or her parent's household rather than of the current welfare status of the household.
- In contrast, that a household sleeps under a roof of iron sheeting is an *endogenous* variable when examining household welfare. It is only households with higher welfare levels that one would expect to have metal roofs. That a household has a metal roof is directly a function of its *current* welfare status, i.e., roof type depends on the level of household welfare.

Other endogenous variables that are likely to be an outcome of *current* household living standards (as measured via consumption levels) are the possession of durable goods by household members, dwelling characteristics, current school attendance of children in the household, and so on.

Endogenous variables are *not* selected as regressors because they are determined by *current* household living standards. Our objective is to select regressors whose

values are determined outside the current economic system of the household, but which determine the level of household welfare – that is, exogenous variables.

One essential point to note is that we do not *determine* causality here through this analysis. Rather, we select variables that economic theory says are likely to be exogenous, and then we quantify and interpret the relationship as causal. Thus, our causality hypotheses are guided by economic theory. The most our empirical model can do is test this body of theory.

2.2 Poverty line areas

In the regression model we allow for regional heterogeneity. This means that we assume that there is variation in the determinants of poverty in Malawi between various rural and urban areas of Malawi. We use the four poverty line areas employed in the poverty analysis of the IHS as our analytical regions: Southern rural, Central rural, Northern rural, and Urban. Further, as described in the next section, we assume that there is additional variation within the rural areas which can be linked to general agro-ecological and economic conditions prevailing in several zones which sub-divide each rural poverty line area.

The implication of the heterogeneity hypothesis for the determinants of poverty model is that we assume many determinants are likely to have different coefficient values for each poverty line area. This variation between areas in the impact of these determinants on the welfare status of household will be masked if a single coefficient for the determinant was computed. Our assumption is that the value of the coefficient for a determinant will not be the same across all poverty line areas because the size of the effect of a determinant on household welfare will differ depending upon the location of the household. Thus, in constructing our model, for several key determinants we interact them with the poverty line area to generate different coefficients across these demarcations.[5]

For example, we would assume that the fact that a household grows tobacco may be a very important positive determinant of the welfare level of a household in Central

[5] Not all explanatory variables are interacted with the poverty line areas to generate poverty line area specific coefficients. As is shown in Table 5, the independent variables *facaccss*, *pubwk*, *aginput*, and *elec* have the same coefficients across all areas. These are the community level variables used in the model.

Moreover, one employment variable, *ysal_tb1*, is interacted with the Urban area and with the three rural areas *jointly*, resulting in only two coefficients for the variable.

rural, where tobacco markets are easily accessible. In contrast, we might expect that tobacco cultivation will not be so important in determining the level of household welfare in Northern rural because of marketing difficulties. In consequence, we would expect a positive and statistically significant coefficient for the explanatory variable on tobacco cultivation for Central rural households in our model and a statistically insignificant coefficient for Northern rural households. To capture these differences between areas in the level of the effect on household welfare of this determinant, in constructing the model we interact the variable on tobacco cultivation with the poverty line areas to produce poverty line area specific coefficients.

The hypotheses of heterogeneity between the three rural areas, in particular, can be assessed statistically by testing the equality of the coefficients for each determinant for the three rural poverty line areas. The test strongly rejects the null hypothesis that the coefficients for each determinant are not significantly different across the rural poverty line areas.[6] Consequently, in our model of the determinants of poverty in Malawi, separate coefficients for the four poverty line areas are generated for each determinant.

2.3 Agro eco-zones

In our model we also control for agro-ecological and economic fixed effects (agro-eco zones). These are the effects on household welfare which result from the location-specific endowment of an area in terms of, among others, soil fertility, climate, access to natural resources, and degree of market access.

Agro-ecological factors such as good soil fertility and benign climate determine the productivity of the land and, therefore, the level of living standards in rural areas. It is likely that household welfare will be affected positively if the household is situated in a locale that is favorably endowed agro-ecologically. Moreover, if an area enjoys good access to markets for the sale of household production, additional benefits should accrue to households in the area. Thus, it is the combination of agro-ecological endowments

[6] The results of the test to determine whether the model coefficients of Southern rural are the same as the model coefficients for Central rural were as follows: $F(17, 70) = 5.29$, $p < 0.001$.
Central rural vs. Northern rural: $F(17, 70) = 500.83$, $p < 0.001$.
Southern rural vs. Northern rural: $F(17, 70) = 5.70$, $p < 0.001$.
The F-statistics for the tests of the hypotheses are F (r, d-r+1) where r = number of restrictions tested and d = total number of sampled primary sampling units (PSU) minus the total number of strata. In our model, there are 104 PSUs and 18 strata. The regression and the tests are implemented using the *svyreg* and *svytest* commands of Stata® statistical software.

and economic features which provide a comparative advantage to the locale to produce and market a product competitively.

Nine agro-eco zones were delineated for use in deriving the determinants of poverty model. Each is wholly contained within one of the poverty line regions. Details on the agro-eco zones are provided in Table 1 and Figure 1.

We use the agro-eco zones in our model in two ways. First, in our analysis we include dummy variables to control for the effects of agro-eco zone characteristics on household welfare. Doing so allows us to gauge the effects of the other determinants on household welfare independent of the effect of the agro-eco zone location of the household.

To judge the validity of doing this, we test for the joint significance of agro-eco zone fixed effects. Our test confirms that the coefficients in our regression model for the agro-eco zone variables jointly are significantly different from zero.[7] Consequently, we include the agro-eco zone dummy variables in the model to control for agro-eco zone specific effects on household welfare levels.

Secondly, we use the agro-eco zones when considering the impact of the level of agricultural productivity in an area on household welfare. (The mean long-term maize yield in an area is used as a proxy for agricultural productivity.) In our model we interact mean maize yield with the agro-eco zone. The assumption is that the impact on household welfare of higher maize yields and agricultural productivity in general will vary systematically according to climate, soils, and, in particular, market access conditions in an area.

3. SOURCES OF DATA

3.1 Household survey

The primary data source for this study of the determinants of poverty in Malawi is the 1997-1998 Integrated Household Survey. The IHS was a comprehensive socio-economic survey of the living standards of households in all districts of Malawi. The then 25 administrative districts of Malawi, plus the four major urban centers of the country, constituted the 29 primary sampling strata. In rural areas a three-stage cluster selection procedure was used, while in urban areas two stages were employed:

[7] The F-statistic for this test is: $F(8, 79) = 2.12$, $p < 0.05$.

- In rural areas, the three stages consisted of the traditional authorities (TA) as the first stage and the enumeration areas (EA) within the TA as the second stage. Twelve EAs were selected in each selected TA. Both TAs and EAs were selected with probability of selection proportional to population size. Twenty households were randomly selected within the selected EAs as the third stage of sample selection. All selected households in an EA were interviewed in the same calendar month. Interviewing was carried out in each of the twelve selected EAs in turn through the twelve months of the survey year in order to capture seasonal variations in the socio-economic characteristics of the population in the TA.

- In urban areas, a two-stage sample selection procedure was employed using the enumeration areas. EAs within a city were selected with probability of selection proportional to population size. Ten households were randomly selected within these EAs. All selected households within a selected EA were interviewed in the same month. The number of EAs in an urban area in which interviews were conducted in any month was the total number of EAs selected in the urban area divided by 12.

The modules of the questionnaire are listed in Table 2. The questionnaire was administered in two parts:

1. a large questionnaire, which was administered to the respondent household in a single visit, and
2. the diary of expenditure. The diary was maintained over a minimum of 14 days by literate households or through frequent visits (twice-weekly) by the enumerator to the survey household to record any expenditures made since the previous visit.

NSO administered the IHS questionnaire to 12,960 households over a 12 month period, November 1997 to October 1998. The data was cleaned between May 1999 to April 2000. The data set consisted of 10,698 households when the cleaned IHS data was released in early May 2000. However, as the diary of expenditure was not consistently maintained by enumerators across the country, upon additional assessment of the data, only 6,586 households were judged to have reliable expenditure and consumption information for use in the derivation of a consumption and expenditure

based household welfare indicator.

Table 3 shows the size of the various samples by district, together with the expansion factors used to extend the survey results to the entire population. In several instances, the number of sample households remaining in a district in the 6,586 household data set is very small: In one district, Ntchisi, no survey households remain in the smaller data set. The households in districts with few survey households remaining in the 6,586 household data set were amalgamated with those of adjoining districts for purposes of deriving estimates for the population as a whole.

As the household welfare indicator is used as the dependent variable in this determinants of poverty analysis, data from the more restricted 6,586 household IHS data set must be used to compute our model. It is only for this set of IHS survey households for which we have reliable consumption and expenditure data from which to compute the household welfare indicator directly.

3.2 Community survey

Several months after the completion of the fieldwork of the IHS, a community level survey was carried out in all of the rural traditional authorities and urban wards in which IHS sample households had been selected.[8] Information on a range of community level variables and conditions was collected through interviewing key informants in each TA and ward. Some of this data was brought into the determinants of poverty model.

Unfortunately, community level data was not collected in nine TAs or wards enumerated in the household survey. This missing information further reduced our analytical data set from 6,586 households to 6,457. Our final analytical data set for the determinants of poverty analysis includes 2,423 IHS households in Southern rural, 2,378 households in Central rural, 810 households in Northern rural, and 846 households in the Urban areas of Malawi.

4. ESTIMATION ISSUES

Unfortunately, the survey data had limitations which compromised both the quality and the scope of our analysis. Variables with missing observations were

[8] In the spatial hierarchy of urban areas of Malawi, wards are equivalent to the TAs in rural areas. However, wards were not used in selecting household clusters for the IHS.

common. There also appeared to be a considerable degree of measurement error, especially in literacy, education, and household amenity related variables. Likewise, information on infrastructure and health-related issues was often found to be unreliable or difficult to interpret. Consequently, several potentially useful variables could not be considered in the model. Moreover, information on several potential determinants of household welfare, such as crop yields at the household level, availability of irrigation, quality of land (versus land availability), and soil fertility, was not collected in the questionnaire. Finally, most of the community level variables were at too coarse of a geographic scale for use.

These data quality considerations raised two model estimation issues. First, the subset of households with no missing data for any of the exogenous variables selected for inclusion in the model decreased in size as the number of these variables increased. In order to retain as large a number of households in our analytical data set as possible, we had to control for this missing data. Secondly, we also had to control for any omitted variable bias in our models. That is, we needed to take into account those key variables which were not included in the questionnaire, but which are important in determining the level of welfare of a household.

For the first problem, we chose to include in our analysis all households with missing household-level data. This was done so that we would not exclude useful information from those households for which data was not missing. To control for the inclusion of missing data, we constructed dummy variables corresponding to each of the variables with missing data. These variables took a value of one if the household was missing data for that particular variable, zero otherwise. Three such variables were used, one for education and two for cropping patterns.

The second problem of omitted variable bias was controlled for by using a fixed effects model employing dummy variables for the agro-eco zones described above as our fixed effect variables. In addition to accounting for agro-ecological and economic endowments, these agro-eco zone dummy variables were used to control for observed and unobserved determinants of living standards. The inclusion of the agro-eco zone dummies in the regression equation allows us to capture the effects of omitted variables (as well as other unobservable factors) that vary systematically between the agro-eco zones.

To illustrate this concept, the IHS does not have rainfall data (which makes it an omitted variable in our model), but we know that rainfall patterns vary systematically with agro-eco zones. Rainfall levels will determine to some undefined extent the consumption patterns of households in Malawi. Not including rainfall in the determinants of poverty model for Malawi would lead to assigning greater or lesser (depending on the sign of correlation) causal attribution to the included variable – for example, off-farm income – than is legitimately the case. If rainfall systematically varies across agro-eco zones, the agro-eco zone dummies will capture this variation. Using the fixed effects variables will remove the effect of rainfall levels on the estimate (coefficient) of the effect of off-farm income on welfare. By doing so, we end up with a much cleaner estimate of the true effect of off-farm income on household welfare in Malawi.

Note that we also could have used district level fixed effects to deal with the problem of omitted variables. We did not do so but decided to introduce agro-eco zone level fixed effects primarily for three reasons:

1. According to Malawian policymakers, agro-eco zones explain more variation in the living standards of Malawian households than do districts.
2. District level fixed effects would have absorbed all community level information in those less-populous rural districts in which only a single TA (the community survey unit) was selected at the first stage in the cluster selection procedure. It was judged wiser to use the range of variables available in the IHS community survey as determinants of welfare than to lose all of this information into a district level fixed effect dummy variable. The agro-eco zone fixed effect dummy variables will allow the community survey information to be used in the analysis while also controlling for missing key variables in the model.
3. To derive a model with a parsimonious specification which is operationally tractable.

   If we had used district level fixed effects, our right hand side regressors would increase by 29 dummy variables, corresponding to the 29 district strata in the IHS. Of more concern is that our interaction terms would explode multiplicatively, thus rendering the model considerably more

difficult to interpret and, for that matter, to use. By using agro-eco zone fixed effects, we have only eight fixed effect variables. The associated interaction terms are more limited and, thus, allow for a more thrifty specification to the model.

Moreover, one of the further risks with increasing interaction terms is that there is a real problem of multi-collinearity between the interaction terms and other exogenous variables.

5. MODEL VARIABLES

Having reviewed the criteria guiding the selection of the variables for the determinants of poverty model, the summary statistics of the variables selected are presented in Table 4. More detail is provided in the following sections.

5.1 Dependent variable

In discussing the variables used in the model, let us begin with our choice of the dependent variable, the household welfare indicator. As noted earlier, this is the *total daily per capita consumption and expenditure* reported by a survey household. This measure is expressed in MK deflated to April 1998 prices. (The fourth section of the Annex discusses the rationale for calculating the welfare indicator on a per capita basis rather than on an adult equivalent basis.)

An alternative household welfare measure could be developed using household income data. However, consumption and expenditure information is more suitable for several reasons:

1. First, particularly in an agricultural economy such as Malawi, income is often very lumpy. Farming households receive a large amount of cash income in May and June, and receive very little the rest of the year. On an income basis, a household which most would view as wealthy may be categorized as poor if the interview of that household was done after all farming income for the year was received. In contrast, households are constantly expending their income and consuming. Expenditure and consumption is a smoother measure of welfare through time.
2. Consumption and expenditure can be viewed as realized welfare, whereas income is more a measure of potential welfare.

3. Data on expenditures are generally more reliable and stable than income data. Households are often more willing to truthfully report their consumption and expenditure than their income, particularly when dealing with government enumerators.

4. Finally, in a strongly subsistence oriented economy such as Malawi, much income is derived from self-employed business or subsistence-oriented agricultural production. Assigning income values to the proceeds of these enterprises is often problematic.

The welfare measure is made up of four components:

1. *Total food consumption* – All food consumption reported was normalized to a daily value of food consumed in MK.

2. *Total non-food non-durable goods expenditures* – Similar to food items, a daily value in MK was determined for all non-food non-durable goods consumed by the household. Included in this component of the welfare measure are gifts to others outside the household (out-going income transfers).

3. *Estimated use-value of durable consumer goods*, e.g., vehicles, furniture, appliances, etc. – The use-value of these durable items was computed by deriving an imputed daily rental rate for each good.[9]

4. *Rental value of housing* for the household – actual or imputed.

The sum of the value in April 1998 MK of all reported daily expenditure and consumption of these items divided by the number of persons in the household constitutes the welfare indicator for a household, our dependent variable.

5.2 Independent variables

As noted earlier, only exogenous variables are selected as regressors for the determinants of poverty model, because our objective is to infer *causality* of the welfare level of a household. The set of regressors, or independent variables, that we chose as

[9] This rental rate is computed by taking into account the rate of depreciation for an item (which is the inverse of the estimated lifespan for the item), the opportunity cost of the capital locked up in the durable good (the bank savings interest rate is used as a proxy), and the replacement cost of the durable good. Formula: *Use-value of item = current replacement value * ((rate of interest + depreciation rate for item) / (1 – depreciation rate for item))*.

possible determinants of poverty in Malawi may be categorized as follows:

5.2.1 Demographic

These household composition variables include:

- age of the household head,
- sex of the household head,
- number in the household:
    - aged 0 to 9 years,
    - aged 10 to 17 years,
    - females in the productive age category of 18 to 59 years,
    - males aged 18 to 59 years, and
    - aged 60 and older.

We also consider a quadratic term of the household size squared to capture non-linear relationships between household size and welfare, i.e., the marginal effect on household welfare of one more person or one less person in the household may not necessarily be linear, but dependent on existing household size.

5.2.2 Education

We include measures to capture educational attainment in Malawi. As shown Table 4, they are:

- maximum education level attained by any adult (aged 25 to 59 years) in the household.
    - This is a categorical variable where the categories are:
        0 - Never attended school;
        1 - Completed Standards I-IV;
        2 - Completed Standards V-VIII;
        3 - Completed Junior Certificate of Education (JCE), and
        4 - Completed Malawi School Certificate of Education (MSCE).
- number of adult males in the household who have completed the JCE.
- number of adult females in the household who have completed the JCE.
- number of adult males in the household who have completed the MSCE.
- number of adult females in the household who have completed the MSCE.

5.2.3 Employment and occupation

In this category we seek to capture the effects of the distribution of different sorts of occupation at the household level. The variables used include:

- number of household members employed in primary industry (agriculture, fishing, forestry, mining, quarrying),
- number of household members employed in secondary industry (manufacturing, electricity/water, construction),
- number of household members employed in tertiary industry (transport, wholesale/retail, business & financial services),
- whether a household member is engaged in formal wage employment (dummy variable). Any member is defined as being engaged in formal employment if she or he has a professional, technical, administrative, managerial, clerical, sales, or service occupation as a main occupation. For this variable only two coefficients are computed: one for the three rural areas jointly and another for the Urban area.

5.2.4 Agriculture

A range of variables for agriculture were computed from the IHS:

- dummy variable for whether the household engaged in tobacco cultivation.
- the natural logarithm of the per capita real MK value of livestock owned. Cattle, goats, sheep, pigs, and chickens were the livestock considered.
- the number of crops cultivated that are not maize or tobacco. This includes the food crops cassava, groundnut, rice, millet, sorghum, and beans, and the cash crops cotton, sugar cane, soyabean, sunflower, and tea. This variable measures the diversity of crop cultivation by the household.
- the per capita acreage cultivated by the household.

Although we have considered per capita acreage cultivated as a potential determinant, it is essential to recognize that in the context of Malawi there is not much scope for increasing landholding sizes. One cannot increase landholdings by one acre per capita, for instance, simply because there is insufficient unused arable land remaining in the country to allow this to be done.[10]

While we recognize that the opportunities for using cultivated land expansion to raise welfare are limited, we have proceeded with considering the per capita amount of land cultivated by the household as a determinant because land is a factor in the production and consumption functions of agrarian based societies, such as rural Malawi. Consequently, we would be remiss to omit land from our consumption function.

[10] There are about 3,100,000 ha of arable land in the country. The IHS results indicate that about 1,700,000 ha are now used, leaving 1,400,000 available. We can see from Table 4 that the mean per capita landholding size currently is 0.177 ha (or 0.48 acres) in the rural areas. The maximum per capita landholding size possible is 0.32 ha (0.8 acres) if you use the entire population of the country, and ten percent higher if you only consider the rural population.

Moreover, as we were unable to capture household crop yield or productivity measures from the IHS, examining increases of cultivated land per capita will provide some indication of the effects on household welfare of increasing yields. This is done on the assumption that agricultural productivity increases from other sources would have similar effects on household welfare as do increases in cultivated landholdings.

Our final agricultural variables are made up by interacting the average maize yield for an area with the eight agro-ecological zones. The average maize yield at the EA level is computed using Extension Planning Area agricultural production statistics from the Ministry of Agriculture from 1984 to 2000 with a Geographic Information System. The rationale for interacting mean maize yields with agro-eco zones was described earlier when the agro-eco zones were described.

5.2.5 Access to services and utilities at the household level

One variable is chosen from the IHS:

- mean travel time (in hours) for household to nearest health center, bus stage, ADMARC, bank, and post office. Note that this index captures overall access of the household to this infrastructure and does not attempt to measure the unique effects of access to each type of facility.

5.2.6 Community characteristics and access to services at the community level

From the community survey which complemented the IHS, several variables were used:

- electricity or gas as source of light in TA/ward.
- availability of agricultural inputs in TA/ward.
- access to public works program in TA/ward.

These community level variables are not interacted with the poverty line areas to generate multiple coefficients for the model. A single coefficient applies to these variables nationally.

Note that items such as gas or electricity as source of light are possibly endogenous if this information is collected at the household level. However, in this instance the information is collected at the community level (TA and urban ward level). Consequently, this variable can be considered exogenous in that the decision to provide a TA with electricity is external to the household.

5.2.7 Agro-eco zone fixed effects variables

As mentioned earlier, we captured fixed effects based on eight agro-eco zones. These zones are conglomerations of districts such that each district falls wholly within one zone. Moreover each agro-ecological zone is wholly contained within one of the poverty line regions of Malawi. The agro-eco zones are defined by the following districts and can be found on the map in Figure 1, with additional details in Table 1.

- agro1: Nsanje & Chikwawa– corresponding to the Lower Shire Valley
- agro2: Blantyre, Zomba, Thyolo, Mulanje, Chiradzulu, Phalombe – corresponding to the Shire Highlands and Lake Chilwa Plains.
- agro3: Mwanza, Balaka, Machinga, Mangochi – corresponding to the Middle and Upper Shire River Valley and Southern lakeshore.
- agro4: Dedza, Dowa, Ntchisi – corresponding to the Central Highlands.
- agro5: Lilongwe, Mchinji, Kasungu – corresponding to the Central mid-altitude plateau.
- agro6: Ntcheu, Salima, Nkhotakota – corresponding to the Central lakeshore and Bwanje Valley.
- agro7: Mzimba, Rumphi, Chitipa - corresponding to the Northern mid-altitude plateau.
- agro8: Nkhata Bay, Karonga - corresponding to the Northern lakeshore.

Note that these agro-eco zones are rural. The residual zone is necessarily that of the urban centers, which is left unspecified here because of linear dependence in the estimation procedure.

6. THE MALAWI DETERMINANTS OF POVERTY MODEL

Table 5 presents the parameter estimates of the regression model for the determinants of poverty. Note that because the dependent variable is in natural log form, the estimated regression coefficients measure *the percentage change in per capita consumption within the household from a unit change in the independent variable*. With a few exceptions, the signs on the parameters are as expected. The fit of the fixed

effects model is estimated with an R^2 of 0.3282.[11]

6.1 Demographic variables

As shown in Table 5, the age of the household head has a relatively small impact on the welfare of the household. However, it is important to note the high level of statistical significance of the coefficients in the three rural areas. Households headed by older individuals in rural areas, holding other variables constant, will tend to be poorer than those headed by younger individuals. In contrast, in the urban centers the level of household welfare does not seem to be determined by the age of the head.

One reason for this finding may be in the differences between the nature of economic activities in urban areas and those in rural areas. If they have insufficient labour within their households, older household heads in rural areas are at a disadvantage economically in undertaking the heavy physical labor required in agriculture in Malawi. In contrast, the less physically demanding occupations more common in the urban centers will not place an older household head at an economic disadvantage, particularly if the household head has a relatively high level of education.

To investigate this finding further, we did two statistical tests. In the first case we test whether the age of the household head matters to household welfare in each of the four regions *separately* – essentially attempting to confirm with a more rigorous statistical test the results of the regression analysis. Our test shows that in the urban area, the marginal effect of the age of the household head is trivial – that is the coefficient is zero. In the rural areas, the marginal effect of the age of the household head is significantly different from zero. This confirms the results of the regression analysis: In urban areas, the age of the household head does not matter to household welfare, but in the rural areas, the age of the household head matters.[12]

---

[11] Similar determinants work was undertaken by IFPRI recently in Egypt (Datt & Jolliffe 1999) and in Mozambique (Datt, *et al.* 2000). In Egypt, the R^2 obtained for the rural model was 0.41, based on a sample of 1,326 households. For the urban model, the R^2 was 0.49 with a sample of 1,122 households. In the Mozambican determinants of poverty analysis, the R^2 for the rural model was 0.538 with a sample of 5,811 households. For the urban model the R^2 was 0.502 for a sample of 2,439 households.

While the Malawi adjusted- R^2 is lower than those obtained in the Mozambique and Egypt models, the R^2 is only one statistic to evaluate the "goodness" of an estimated regression. Indeed, it is a summary statistic and therefore is best used with caution. However, a possible reason for the relatively low R^2 is the data limitations, noted earlier, that were characteristic of the IHS.

[12] The null hypothesis is the marginal effect of the age of household head on household welfare is zero:
- Urban: $F(1, 86) = 0.67$, $p = 0.416$, accept null hypothesis.
- Southern rural: $F(1, 86) = 29.56$, $p < 0.001$, reject null.

In the second case, we test for the significance of the age of household head in all four regions *jointly*. This amounts to a test of whether the coefficients on age of household head for south, center, north and urban are each simultaneously zero. We find that the age of the household head is *jointly significant* in all four regions simultaneously. Although the t-test results in the regression analysis indicate that the effect of the age of the household head varies by region, the results here indicate that the effect of the age of household head on household welfare really is not conditional on where the household resides.[13]

Turning to the gender of the head of household, we find a puzzling result in that the marginal effect of a male-headed household is negative at -5.4 percent and statistically significant in the Southern rural area of Malawi. In Central rural this coefficient is statistically significant and positive at 4.1 percent. In the remaining regions the effect of the sex of the household head on household welfare is not statistically significant. This result may reflect differences in the economic migration patterns of adult males across the country, with male wage labour migration potentially being an important livelihood strategy for rural households in the South. One possible hypothesis for understanding the results here is that those households in the rural South whose adult males do *not* engage in wage labour migration are at a disadvantage economically.

In terms of the number of individuals in the household by age category, the impact on welfare follows expectations in that the coefficients are more negative for children than for adults and for females than for males in all four areas. The broad trends in the percentage reduction in the per capita consumption level of a household with the addition of an individual in the specific age and sex categories in the four poverty line areas is as follows:

- The marginal effect on household welfare due to the addition of a child aged 9 years and under is negative, with urban areas seeing the largest reduction. Here the addition of a child will reduce per capita consumption by approximately 31 percent, compared to about 20 percent in the Southern and

- Central rural: $F(1, 86) = 10.94$, $p < 0.01$, reject null.
- Northern rural: $F(1, 86) = 7.21$, $p < 0.01$, reject null.

[13] The results of the adjusted Wald test of the joint significance of the age of household head on household welfare are: $F(4, 83) = 11.95$, $p < 0.001$, reject null hypothesis.

Northern rural and about 15 percent in Central rural. All coefficients are significant at the one percent level.

- The contrast between females and males in the productive years of the 18 to 59 year age category is very stark in the urban areas, likely reflecting higher economic opportunities in urban areas for men relative to women. The addition of a female adult reduces per capita consumption in urban households by 13.6 percent, whereas the effect on welfare with the addition of a male is not conclusive, as the coefficient of 0.6 percent is not statistically significant.

  In rural areas, in contrast, differences in the impact on welfare of the addition of a man or a woman to the household are mixed and somewhat less dramatic. It is interesting to note that in the Southern rural area the marginal effect on household welfare is *more negative* with the addition of an adult male than with that of an adult female. This finding support that observed when considering the sex of the head of household in Southern rural, noted earlier. In the Central and Northern rural areas, however, the effect on welfare with the addition of an adult female is larger and more negative than it is with the addition of an adult male.

- The addition of an elderly individual to a household does not have a statistically significant effect on per capita consumption in any of the regions of Malawi, rural or urban, likely reflecting the continued economic productivity of elderly Malawians.

- The only other demographic variable considered, household size squared, is shown to be significant and positive. Although additional analysis would be required, this result indicates that there may be economies of scale of household welfare derived from increasing household size.[14]

6.2 Education variables

The coefficients for the variable for maximum level of education of any adult in the household is consistently positive and significant in all areas: Attainment of higher

[14] Further investigations should also consider whether the *composition* of the growing household is also important. That is, with increasing household size the effect on household welfare may be determined as much by who, in terms of age and gender, is being added to a household than simply by the fact that an individual is being added.

levels of education will provide higher levels of welfare for the household. Raising the maximum level of education attained by adults in the household by one step, i.e., from Standard IV to Standard VIII, from Standard VIII to JCE, or from JCE to MSCE, will raise household per capita consumption on average by 22 percent in Southern rural, by 19 percent in Central rural, by 11.5 percent in Northern rural, and by 17 percent in the urban centers.

We consider the impact of the number of adult males and females who have completed Junior Certificate, both in the rural and urban areas. In Southern and Central rural, attainment of JCE, by adult males or females appears to have no impact on household welfare. In Northern rural, as well as in the urban areas of Malawi, completion of JCE by adult females has a positive and significant impact on household welfare of the order of 19.6% and 32%, respectively. The same variable for adult males is trivial in magnitude and not statistically significant in both regions.

Secondly, we consider the impact on household welfare of the number of adult males and females in a household who have completed the Junior Certificate of Education. For households throughout the country the presence of an adult male who has a JCE qualification appears to have no impact on household welfare beyond the effects which can be ascribed to simply increasing the maximum level of education attained by adults in the household, as described in the previous paragraph: The coefficients for the variable of the number of adult males in the household who have attained the JCE are all of a relatively small magnitude and none are statistically significant.

For the variable on the number of female adults in the household who have earned the JCE, the model coefficients are of a greater magnitude than that seen for the corresponding variable for males. However, in spite of this, a statistically significant effect on household welfare is only found in the Urban area, where an important 32 percent increase in household consumption is attributed to the presence of each adult female in a household with a JCE level of education.[15]

That the model does not detect a significant effect on household welfare with the attainment of a JCE by women in rural areas can be attributed to two factors. First, the

[15] Note in Table 5 that the coefficient for this variable in Northern rural is relatively high. Nevertheless, it is not statistically significantly different from zero, possibly because of the small number of women who have attained this level of education in the IHS sample in Northern rural.

number of women in rural areas with a JCE level of education or above is very small, making it difficult for the model to specify the effects of such education on household welfare. Secondly, and more importantly, remunerative economic opportunities in rural areas of Malawi for which a JCE-level of education or higher is necessary are very few for both women and men. As the poverty profile report noted, "It is in the cities where people can use their education to their own economic advantage: In Malawi, as elsewhere, if you are educated, you go to the city." (NEC 2000, p.20).

This same pattern will also apply to men. However, the fact that even in urban areas a man is unlikely to economically benefit from a JCE qualification suggests either that there are too few economic opportunities even in the cities for which a JCE is necessary, or that there are too many men seeking too few such positions, or that a JCE educational qualification is irrelevant in the urban labour market.

Finally, in the Urban area we were able to consider an additional educational variable – that of the number of adult males and females who have successfully completed the Malawi School Certificate of Education. We were unable to consider this variable for the rural areas because, as shown in Table 4, the number of adults who have earned an MSCE in rural areas is practically zero.

The coefficient for this variable for women allows one to infer that the level of per capita consumption in an urban household in which an adult women who has completed the MSCE is resident should be 47 percent higher than a similar urban household in which no adult woman has attained such an educational level, all other things being equal. In contrast, the presence in the household of an adult male who has completed the MSCE should provide a level of consumption 29 percent above that of similar households without an adult male with an MSCE, all other things being equal.

In summary, the results of the model can be interpreted to mean that the attainment of higher levels of education by women in the urban centers of Malawi, both at the JCE and at the MSCE level, will provide large welfare gains for the households of which they are a part. In contrast, urban men need to attain an educational qualification of at least an MSCE to be assured of deriving welfare benefits for their household from their education – a JCE qualification appears to be insufficient.

6.3 Employment and occupation variables

The addition of members employed in primary industry (agriculture, fishing,

mining, etc.) leads to a modest rise of 7 percent in Southern rural, is inconclusive in Northern rural (because the coefficient is not statistically significant), but interestingly leads to a *decline* of 15.3 percent in welfare in Central rural. (This variable was not computed for the Urban area since workers in primary industries are not commonly found in the cities.)

As the vast majority of rural households are engaged in agriculture, the relatively modest coefficients for this variable are not surprising. However, what is surprising is the negative coefficient for Central rural, the part of the country in which cash cropping – specifically, tobacco – is most intensively practiced by smallholder farmers. One would expect that, if anywhere, it would be in the Central region that agriculture would be the most rewarding. In the same vein, the small landholding sizes in Southern Malawi would lead one to expect that agriculture in this region is unlikely to provide any notable welfare benefits. Yet the results of the modeling exercise show that engaging in agriculture does provide some benefits to household welfare there.[16]

The coefficients on employment in secondary industries (manufacturing), although positive, are all statistically insignificant in both rural and urban areas. The returns in household welfare to employment in secondary industry therefore, appear to be inconsequential.

However, there are welfare advantages to finding employment in the tertiary sector (sales and service industries) of the economy in Malawi. The results shown in Table 5 reveal that the marginal effect of having an additional household member employed in a tertiary industry occupation increases per capita consumption in all parts of the country. The welfare increases are by 26 percent in Southern rural and by nine percent in Central rural. However, although positive and of a relatively high magnitude, the coefficients are statistically not significant in Northern rural and in the Urban area. The increase in recent years in the number of traders and vendors throughout the country is reflective of the results seen. People believe that they can derive an economic return for themselves and their households by engaging in trade. The results here would support this view.

Finally, having at least one household member engaged in formal wage employment will lead to a significant increase in per capita consumption, all other

[16] However, one should treat the results for this variable with some caution, as reporting of agricultural occupations in the IHS was not done in a wholly consistent and comprehensive manner.

things being equal. In the urban areas, the coefficient is 10 percent whereas in the rural areas the coefficient is 15 percent, both being statistically significant.

6.4 Agriculture variables

The coefficient for the land area cultivated illustrates the magnitude of welfare increase which would result from increasing the per capita acreage cultivated, if it were feasible to do so. Thus, we find that an increase in cultivated area per capita by one acre increases per capita consumption in Southern rural by 13 percent, in Central rural by 17 percent, and in Northern rural by 13 percent, all other things being equal. No agricultural variables were evaluated in the Urban area.

We also find that if a household cultivates tobacco, there is a substantial welfare gain in the Southern and Central rural areas of the order of 16 percent and 14 percent respectively. In Northern rural, the coefficient for this variable is negative, but insignificant, possibly reflecting the increased marketing costs faced by farmers growing the crop in this area which is somewhat remote from the centers of tobacco marketing and processing.

Diversity of production of crops other than maize and tobacco does appear to be a determinant of household welfare. In Central rural the marginal effect is 5 percent, whereas in the south and north these coefficients, although positive, are not statistically significant. The results, while modest, do confirm that welfare gains are possible from engaging in risk-diversifying crop cultivation, rather than solely concentrating on maize and tobacco.

Although the importance of livestock as a means of livelihood is on the decline in Malawi, our regression results shows that the value of livestock for household welfare is statistically significant in the rural areas of Malawi with relatively small positive coefficients in all three rural areas.

We have estimated the marginal effect of average maize yield on household welfare, specifically by agro-ecological zones. We find that the marginal effect of the maize yield in agro-eco zone 3 (Mwanza, Balaka, Machinga, & Mangochi) is overwhelmingly *negative* at 62 percent, whereas the welfare effect of local average maize yield in agro-eco zone 6 (Salima, Nkhotakota, & Ntcheu) is substantially *positive* at 36 percent. In the other agro-zones, coefficients for the variables interacting average maize yield with agro-eco zone are not statistically significant.

The interpretation of these results is that households residing in areas of high yield potential in agro-eco zone 3 are unable to derive welfare benefits from their agro-ecological endowments for reasons which are unclear at present, but which might include lack of access to markets. In contrast, household in those areas of zone 6 which produce good yields are favorably situated to also utilize these higher yields to their own advantage. However, further investigations are required to understand fully what sorts of policy efforts might follow on from these results.

6.5 Access to services at the household level

This variable, which measures access to general infrastructure at the household level, shows, as expected, that the more time in hours it takes on average to reach the health center, bank, ADMARC, bus station, or post-office the more negative is the marginal effect on welfare. Our coefficient is -10.4 percent and statistically significant at the 1 percent level. Reducing the mean time it takes rural households to reach these various facilities should lead to improvements in their welfare.

6.6 Community characteristics

For the coefficients that are estimated at the community level, the most pivotal to enhancing welfare appears to be the access to public works programs, such as the Malawi Social Action Fund (MASAF), in the TA or ward. Access to such programmes is shown to increase welfare by 19 percent. If further analysis confirms the seeming importance of the relationship between household welfare and the availability of public works programmes, such programmes should become an important component of future safety net strategies in the country.

However, any household welfare effects of the availability of agricultural inputs in the TA/ward are statistically not significant. Agricultural inputs are quite commonly available throughout the country. It is important to highlight, however, that availability of inputs does not necessarily mean that poorer households are able to acquire them, i.e., availability does not translate into access. Access is required before agricultural inputs will enhance household welfare.

The availability of electricity in a TA/ward is also shown not be a significant determinant of the welfare level of a household. Even if electricity is available in a rural TA, frequently it is only available in a very small section of the TA. In poorer urban areas, as with agricultural inputs, availability does not necessarily imply that

households living there will have access to electricity, so the potential welfare benefits of electric power are not assured.

6.7 Agro-eco zone fixed effects variables

The level of the coefficients for the fixed effects variables tell us what should be the marginal benefit to household welfare by virtue of simply living in a particular agro-eco zone. In interpreting the coefficients for the agro-eco zone fixed effects, it is important to realize that one is looking at the marginal benefit, so one interprets them on the basis of *holding all other factors in the model equal*. In general our own layman's understanding of the general level of welfare in these agro-eco zones will not be done on this basis: We take into account the full complexity of the livelihood strategies employed, the level of human capital, and the natural resource base. For example, we know that the general level of education is higher in one area than another, so naturally assess the general welfare level of the more educated area to be higher. The interpretation of the coefficients here requires us to assume that educational levels (and all of the other variables in the model) are the same across all zones. Consequently the results of the model will not necessarily coincide with one might expect from the conditions in the agro-eco zones described in Table 1.

Recall that the results of the bi-variate poverty analysis of the IHS showed the population of the Southern rural area to have the highest incidence of poverty and the Northern rural area to have the least incidence of poverty. According to the determinants of poverty model, what is being inferred is that not only is Northern rural better off, but it is agro-eco zone 8, the lakeshore areas of Northern rural, which is the best off. Additionally, we find that the marginal effect of being located in agro-eco zone 1, the Lower Shire Valley, and agro-eco zone 3, the Middle and Upper Shire areas, are positive. In contrast, the marginal effect on household welfare of being resident in agro-eco zones 2, 5, or 7, the major agricultural areas of the country, or in area 4, the upland areas, is very small. Living in agro-eco zone 6, the Central lakeshore and Bwanje valley area, seemingly has the most negative impact on household welfare.[17]

[17] However, this interpretation on the coefficients of the fixed effect variables is not quite as straight forward as that for other variables in the model. One should recall the discussion on estimation issues earlier in which it was noted that employing fixed effect variables in the model is one way in which missing or omitted variables are taken into account. The magnitude of the coefficients on these fixed effect variables reflects in part the degree to which the model does or does not include all of the locally-

Accounting for the pattern revealed by these coefficients requires a close knowledge of the conditions in the agro-eco zones. The policies which might be drawn from these coefficients would also depend on such knowledge. If in fact one finds that general welfare is quite low in an agro-eco zone for which the model gives quite a high coefficient for the fixed effect variable, one must assume in this instance that in reality all other factors in the model are *not* equal. If they were, that agro-eco zone should have a superior welfare level to the others. Consequently, one should consider policy interventions to address some of the other components of the model. Such policies might include raising educational levels or improving agricultural yields to levels comparable to those found in other agro-eco zones.

7. POVERTY SIMULATIONS

7.1 The methodology

Having estimated a consumption model, we now can generate simulations to predict the reductions or increases in general poverty levels that result from unit changes in selected aggregate household or community characteristics. These changes are such as those which may result from the implementation of specific government policy aimed at reducing poverty. The details of the methodology that generates these simulations are given here:

Using the estimated parameters of the model ($\hat{\beta}$), we generate predictions of consumption per capita ($\hat{c}_j$) for every household j by changing the level of the independent variable x_j. That is, we estimate $\hat{c}_j = e^{\beta x_j}$.

Now, corresponding to every predicted consumption level, there is a probability of the household being poor (p_{0j}) that is given by:

$$\hat{p}_{0j} = prob(\ln \hat{c}j < \ln z) = prob(\eta_j < \ln z - \hat{\beta}\, x_j) = \Phi((\ln z - \hat{\beta}\, x_j)/\hat{\sigma})$$

where Φ is the standard normal distribution function, $\hat{\sigma}$ is the standard error of the

---

specific variables which might be significant in accounting for the welfare level of the households in the IHS sample in a particular agro-eco zone.

Only one fixed-effect variable has a coefficient which is statistically significant, that for the Upper and Middle Shire districts. One might postulate that the lack of information on fishing in our model, an important and often lucrative occupation in this agro-eco zone, means that the existing variables will not model the determinants of welfare quite as accurately as they would if a fishing occupation variable was included. In the absence in the model of this locally-specific variable, the magnitude of the coefficient of the fixed effect variables will reflect in part the impact of the missing variable on household welfare.

regression, and z is the poverty line, with ^ indicating estimated values (Datt, *et al.*, p.169).

Based on predicted consumption, one could construct a binary variable to classify a household as poor or non-poor. However, we do not do so as predicted consumption is only a point estimate which comes with its own forecast error. Thus, even if predicted consumption were above the poverty line for a given household, there remains a positive probability that the true value of that household's predicted consumption is actually below the poverty line. Thus, in the simulations here we go on to compute the probability of being poor that is associated with any given level of predicted consumption (*ibid*, p. 169).

A weighted average of the household probabilities of being poor gives the predicted poverty line area and national headcount indices. Predicted measures of the poverty gap and the severity of poverty are similarly derived.

7.2 The simulations

The purpose of these simulations is to illustrate how changes in the levels of the determinants will alter aggregate poverty levels. Therefore we choose those variables that are amenable to policy changes in order to show in a lucid manner the effect of various policies on household consumption levels and poverty.

Before running the simulations, it is necessary to establish a reference point, or a base simulation. It would be incorrect to compare the actual consumption and poverty levels derived through the poverty analysis of the IHS with the simulated levels derived using the determinants of poverty model. Instead the correct reference point for simulated consumption levels is the mean of the predicted per capita consumption values ($\hat{c}_j$) from the determinants of poverty regression model, using the original values for x_j.

Table 6 compares the actual measures of consumption and poverty with the results of the base simulation. We see that the predicted mean consumption and poverty levels (the reference points) are close to the observed consumption and poverty levels, as calculated from the primary IHS data.

Table 7 shows the results from the simulations considered by presenting the percentage change in per capita consumption and poverty levels for the population as a

whole, disaggregated by the Southern rural, Central rural, Northern rural, and Urban poverty line areas.[18]

When interpreting the simulation results it is worthwhile to keep in mind that the magnitude of the changes in mean consumption and poverty for each simulation will depend essentially upon three factors:

(a) the magnitude and sign of the coefficients from the regression.

(b) the proportion of the population affected by the simulation.

(c) the size of the change considered in the determinants variable.

Additionally, in judging the importance of the simulation results one should not assume that the effects are instantaneous. They are estimated from static models. For example, the effects on household welfare realized from a change in an agricultural variable will be observed considerably sooner – possibly the following agricultural season – than would those realized from a change in the educational attainment of a teenage girl. In the latter case, the positive effects on household welfare will only be realized when that girl is an adult within a household, perhaps five to fifteen years later.

Cautious interpretation of the changes in poverty levels due to the simulations is further advised because the simulations assume that the changes in the determinant variables do not affect other model parameters or other exogenous variables, when in reality feedback mechanisms between separate variables do operate.

It should also be noted that only those variables that were estimated in the regression were candidates for the simulations. Thus, explanatory variables that would appear to be important determinants of household welfare in Malawi, but which were not part of the determinants analysis, could not qualify for simulated changes. For example, it is not feasible for us to estimate how the availability of potable water might

[18] Three poverty measures are presented for each simulation. All three poverty measures are members of the Foster-Greer-Thorbecke (FGT) class of measures (Foster, Greer, and Thorbecke, 1984).

Headcount index – This index measures the incidence of poverty by simply indicating the proportion of the population whose consumption is below the poverty line.

Poverty gap index – This index is defined as the mean for the population as a whole of the difference between the level of consumption of an individual and the poverty line, when that difference is expressed as a proportion of the poverty line – the poverty gap. Non-poor households have a poverty gap of zero. This measure is superior to the headcount insofar as it provides a better indication of the depth of poverty.

Poverty severity index – This index is the mean of the *squared* poverty gap. As poorer households receive greater weight than less poor households in calculating this index, it provides a better measure than the other two indices of the severity of poverty.

For all measures, the greater the index, the worse the poverty.

impact household welfare, since "availability of potable water" was not a determinant in the model.[19]

7.2.1 Household size and composition simulations

For household size and composition, we estimate the effects of two scenarios. In the first, we look at the impact of an increase in household size by the addition of a child between the ages of 0 to 9 years, if that household already has a child in that age category. This simulation is undertaken in the context of family planning to estimate the effect on household welfare of the addition of more children when the family already has one child. As expected, we find that the there is a sizable decline in per capita consumption widely across Malawi due to the addition of an extra child in the household. In the urban regions of Malawi, per capita consumption decreases by 16.1 percent. In rural areas the decrease in welfare ranges from 11 percent to 13.5 percent on average. The rise in poverty headcount index, however, is more dramatic in urban than in rural areas. In the cities the headcount increases by 23.1 percent under this scenario, while in the Southern rural the increase is 13.2 percent, in Central rural by 12.7 percent, and in Northern rural by 15.0 percent.

The second simulation in this category estimates the effect of adding a child to *all households* in Malawi, irrespective of whether or not they have children. This simulation seeks to capture the effect on household welfare of orphans being taken in by households, as this is an issue of current importance with increasing numbers of HIV/AIDS orphans in Malawi. With this change in household composition, there is a dramatic reduction in per capita consumption in the urban areas by 26.9 percent, while in rural areas consumption reduces by 18.6 percent in the Southern, 14.5 percent in the Central, and by 18.9 percent in the Northern rural areas. In terms of the increase in poverty due to the addition of orphans to households, we find that the poverty headcount index increases by similar magnitudes, increasing by an estimated 18.4 percent nationally, with the largest increase in the urban areas.[20] Although these indices are disturbingly high, the poverty gap and severity indices increase even more. The

[19] In fact, this variable was considered for inclusion in the model, but measurement error in the variable produced spurious results. Consequently, we were unable to retain it in the final model.

[20] The poverty headcount increases much more in urban than in rural areas with the addition of a child, because the mean dependency ratio in urban areas is much lower than in rural areas – 0.63 vs. 0.92 (NEC 2000, p.47). Consequently, adding an additional dependent to urban households has a greater proportional effect on household consumption levels than it would in rural households.

poorest of the poor will be the most adversely affected by the added burden of the increasing numbers of orphans in Malawi society.

7.2.2 Education simulations

The simulations of the effects of increasing the educational attainment level of adults in a household are very encouraging. Women's education has maximal impact on welfare, although the impact of the increased educational attainment of males is also important. It has been widely documented globally that increasing levels of education, particularly for women, greatly improves the well-being of households. Similar results are found here.

First we examined the effect on aggregate household welfare of increasing by one the number of adult females in the household with an MSCE level of education, if there are adult females in the household who have not completed the MSCE. In this simulation we want to see the impact of having at least one adult woman in the household who has completed the MSCE. Note that this simulation involves altering two variables in our models: We are able to estimate the direct effect for attaining the MSCE only for urban regions of Malawi via the variable *adf_mx4a*, while an indirect effect for the rural regions is estimated via the variable *maxed*. (See Table 4.)

With MSCE attainment by adult women, we see a dramatic increase in per capita consumption by 34.4 percent overall in urban areas, with less dramatic but substantial increases in household welfare in the rural areas. The corresponding decrease in poverty levels is by 28.1 percent in the urban areas, 10.1 percent in Southern rural, 8.8 percent in Central, and 5.3 percent in Northern rural.

A similar education simulation was run for men. As expected, lesser gains in per capita consumption resulted with increased educational attainment for men than it did for women. On the same principle as the previous one, there is a direct effect and an indirect effect. Thus, if we increased by one the number of adult males in the household with an MSCE, if there are adult males in the household with no MSCE, we find in Table 7 that per capita consumption increases by 21.6 percent in the urban areas and, consequently, the poverty headcount decreases by 21.3 percent. The rural areas also see a rise in welfare, but by half the magnitude seen in the urban areas. This confirms that in Malawi the returns to education are higher in urban areas than in rural areas. Although the largest benefit to household welfare is derived through educating women,

one should not lose sight of the important aggregate welfare benefits which universal education to the MSCE level will provide.

The next type of education simulation we considered was increasing the attainment of educational level to MSCE if an adult household member *has already* completed the JCE, the next lower educational qualification. We find that returns to education of completing MSCE are relatively high in urban areas, whereas they are rather trivial in rural areas, for both adult females and adult males. For adult females, the gain in per capita consumption due to increasing attainment of education from JCE to MSCE is 8.7 percent in urban areas, while less than one percent in rural areas. The reduction in the urban poverty headcount is modest at 3.2 percent, virtually nil in rural areas. For adult males, the gain in per capita consumption due to increasing attainment of education from JCE to MSCE is 20 percent in urban areas with a corresponding reduction of poverty headcount by 14.2 percent. Increasing adult male educational levels from JCE to MSCE in rural areas will only increase consumption by about one percent.

The results of these education simulations of either simply raising educational attainment to the MSCE level or raising educational levels from JCE to MSCE support the following conclusions:

- There are limited welfare returns to higher levels of educational attainment in rural areas. Although higher education does provide some welfare benefits in rural areas, the results of the simulation indicate that they are less than those found in urban areas, and they occur at levels of education of JCE or lower – the economic returns to raising ones education from JCE to MSCE in rural areas are very small, likely because there are so few economic opportunities there which provide significant benefits to those with higher levels of training.
- There are important welfare benefits for urban households of women attaining the JCE level of education and, if slightly less so, the MSCE. The larger welfare increase through female education occurs at the JCE level or below, and less so in moving from JCE to MSCE.
- Men need to attain an MSCE level of education in urban areas if they are to derive significant welfare benefits for their households. Simply attaining the

Junior Certificate will provide relatively modest economic returns for men in the urban centers.

7.2.3 Employment and occupation simulations

In the realm of employment and occupation, we look at the impact for rural households of re-allocating household adult labor from a primary industry occupation (farming, fishing, mining) to a secondary industry (manufacturing), if there is already an adult household member employed in a primary industry. Similarly we also examine the effects on household welfare of a member moving from a primary to a tertiary industry (sales and services). These simulations apply only for rural households because the variable *primind* is estimated only for rural areas.

In the first simulation, we examine the effect of a household member shifting employment from a primary industry to a secondary industry. As shown in Table 7, we find that there is a large increase in welfare in the Central (17.1 percent) and Northern rural (7.8 percent) areas. In the Southern rural area, per capita consumption actually *declines* slightly with this change in employment (-2.1 percent).

Differing conditions in the regional rural labour markets for manufacturing likely account for the different results observed, together with the opportunity costs involved in moving from agriculture to a non-agricultural occupation. Moreover, seasonal agro-ecological conditions may contribute to this pattern. Rural households in the Central region do not receive the *Chiperoni* winter rainfall experienced in the Southern region. Consequently, while winter agriculture provides economic returns in the South, in the Central region rural handicraft production is a common activity in the dry season. One would speculate that a disproportionately greater number of individuals in IHS households in the Central region interviewed in the dry season noted that they were engaged in handicraft manufacture (a secondary industry) to meet the consumption needs of their households at the time of interview than did individuals from the Southern region.

When we examine the impact of moving adult household labor from a primary industry to a tertiary industry, we find that the largest gain in per capita consumption is in the Southern and Central rural areas of the country, whereas the Northern rural areas experience more modest gains. The gain in per capita consumption is 26.2 percent in Southern rural, 23.8 percent in Central rural, and 11.9 percent in the Northern rural area.

The gains in poverty reductions are of similar relative magnitudes.

These gains in household welfare related to participation in trading and service provision likely are closely correlated to the degree of commercialization of the local economy. The more densely populated Southern and Central rural areas are better serviced with market infrastructure than the northern areas of Malawi. The welfare benefits derived from engaging in commerce likely are greater in these areas in consequence.

Lastly, we estimate the welfare effects of moving adult household labour from a secondary to a tertiary industry, if there is already a household member engaged in a secondary industry. This simulation applies to both rural and urban households. It is found that the largest welfare gains occur in Southern rural, while the lowest gains occur in Central rural. Southern rural sees a rise of 29.8 percent in per capita consumption, Central rural by 9.1 percent, Northern rural by 12.6 percent, and the Urban area by 10.6 percent. The distribution of the poverty headcount decline follows a similar trend with the Southern rural seeing the most dramatic decrease in poverty by 24.5 percent and the urban areas experiencing a decrease by 11.1 percent. Accounting for these patterns would require taking into account differentials in regional wage levels across industrial sectors, the relative sizes of the different industrial sectors in the four areas, and the level of commercialization of the household economy in these areas. More detailed studies would be required to understand the patterns observed here.

7.2.4 Agriculture simulations

We have examined four agricultural based simulations. The first simulation is a land-based simulation. Recall, however, that raising everyone's landholding size by one acre is not feasible because there is not sufficient land in Malawi for that. An increase by a quarter of an acre per capita is the maximum that might be practically possible. This is what is considered in our simulation.

By nature this simulation is applicable in the rural areas only. It estimates the effect of increasing the per capita cultivable land by one-quarter of an acre for all households in the rural areas. We see that for the entire population, the mean consumption per capita increases by 3.3 percent only. The Southern rural region of the country sees a modest increase of only 3.4 percent in per capita consumption, the Central rural has an increase of 4.2 percent and the Northern rural has an increase of 3.4

percent only. The increase in consumption per capita is distributed such that the poverty headcount reduction is also fairly modest for the rural areas, at about 3.3 percent nationally.

Note that while land expansion based changes will lead to modest gains in consumption and poverty levels, it has been found in the experience of other countries (for example, Mozambique and Egypt) that land expansion alone will not be very effective for raising welfare unless it is combined with access to modern agricultural inputs. Thus, land expansion alone is not the strategy to pursue for long-term development. Rather, overall productivity increases are necessary. While we recognize that it is useful to examine the effects of land expansion in conjunction with productivity-enhancing agricultural inputs (such as fertilizers, pesticides, irrigation and other equipment), as noted, we were unable to examine the interaction of land area cultivated with these inputs because we could not confidently derive measures of agricultural input use from the survey data.

The next two agricultural simulations estimate the effects of increasing the diversity of crops cultivated by rural households. Recall that the diversity of crop cultivation variable measures the number of different type of food and cash crops that are cultivated that are not maize or tobacco. This variable ranges in value from 0 to 7.

In the first simulation of its type, we examine the effects on welfare if we increase the diversity of crops cultivated from 0 to 1. This simulation applies to those households which reported cultivating only tobacco or maize. We find by increasing crop diversity in this way that the welfare level of households in the Northern rural increases on average by 5.5 percent, with Southern and Central rural gaining approximately 2.2 percent and 2.9 percent, respectively. The poverty headcount reductions are of similar magnitudes.

In the second simulation of the same category, we estimate the gain in per capita consumption due to an increase in diversity of crop cultivation to two from less than two. The impacts are predictably larger than the previous simulation, with the welfare of households in Northern rural increasing by 11.9 percent, while those in Southern and Central rural areas gain by 4.5 and 6.7 percent, respectively. The poverty headcount reduction is similarly distributed across the rural areas.

In the last agricultural simulation, we assess the impact on welfare of all rural

households engaging in tobacco cultivation. This simulation amounts to changing the dummy variable from 0 to 1 for those households who do not cultivate tobacco. Given that tobacco is a cash crop, the effects are predictably substantial. As shown in Table 7, per capita consumption in Southern rural increases by 16.2 percent, and by 9.6 percent in Central rural. However, the results show a welfare *loss* of 6.5 percent in Northern rural households. Although this is in line with the coefficient for tobacco cultivation in the model for Northern rural, it should be observed that this parameter estimate is not statistically significant, making forecasting on that coefficient unreliable.

Of the agricultural simulations, the tobacco simulation and the simulation whereby the diversity of crops grown in addition to maize and tobacco is increased to two appear to be the most effective in reducing the poverty headcount nationally.

7.2.5 Improvements in access to services and infrastructure simulation

This simulation looks at the impact of a reduction by one hour in the time it takes household members to reach a health center, bus stop, bank, post office or an ADMARC facility, if the respondents reported that it took them over two hours on average to reach any one of these facilities. It only is carried out in rural areas. Recall that this is an index variable. This simulation is trying to capture improvements in general accessibility to infrastructure. The impact of this simulation on changes in consumption and poverty levels is not as sizable as we might expect. Per capita consumption increases by 4.0 percent in the Northern rural, but by half in the Southern (2.7 percent) and Central rural areas (2.3 percent). These results are predictable, as the Northern rural part of the country has the sparsest level of infrastructure and services, concomitant with it having the lowest population density.

7.2.6 Community level simulations

We consider two types of simulations with community level variables. The first simulation is to change the source of light to electricity (or gas) if the source of light is otherwise. Recall that this is a dummy variable that takes a value of one if source of light is electricity and zero otherwise. Here we change the dummy variable from zero to one to capture the effect of electrification in the community. The impact of this simulation is modest at 2.6 percent nationally. Recall the earlier comment that even if electricity is available in a rural TA, frequently it is only available in a very small section of the TA may account for this finding. The current aggregate impact on

welfare of electricity in those *communities* where it is found is likely so limited that the model cannot reflect the actual sizeable impact the provision of electricity would have on welfare at the *household* level. Hence, the relatively small impact seen here in simulating the electrification of communities across the country.

The second type of simulation we consider is increasing access to public works programs in the community, if there is reported to be no access to them. This also is a dummy variable that takes the value of zero if there is no access and a value of one if there is a public works program. Thus, in this simulation we change the zeroes to ones. The size of the increase in per capita consumption levels in the Northern rural and in the Urban areas of the country are substantial and about the same at 18 percent, whereas in the Southern and Central rural areas the increase in per capita consumption is 8.5 percent and 12.3 percent, respectively. The corresponding decrease in the poverty headcount is similarly distributed, with the most dramatic decline in the Northern rural and urban areas, of the order of 16.9 percent and 18.9 percent, respectively. Of more significance is the important reductions seen in the poverty gap and the poverty severity indices with the provision of public works programmes in a community – the most poor apparently are being reached by such programmes.

Accounting for the relatively high poverty reduction seen through the implementation of public works programmes is difficult. The effect is the outcome of both direct effects through improvement in infrastructure and cash or food incomes for the participants, as well as through indirect effects which may account for the presence of a public works programme in a community. The indirect effects would include the level of political mobilization of a community, its organizational skills, and its level of expertise in dealing with the organizations who oversee the public works programmes. Nevertheless, these results are encouraging and, although in depth studies should closely examine how the implementation of a public works programme translates into higher levels of household welfare in communities in Malawi, these findings certainly point to an expansion of programmes such as MASAF across the country. Such programmes appear to be good for Malawian households in poverty.

8. CONCLUSIONS

This determinants analysis has sought to improve our understanding of the structural determinants of poverty in Malawi by going beyond the bi-variate poverty

profile. It is useful at this point to summarize its limitations and key implications.

As the first Integrated Household Survey for the nation, the IHS of 1997-98 provides a wealth of information on household living conditions. However, data limitations suggest considerable scope for improvement in future data collection efforts. Moreover, these limitations also require that readers cautiously interpret these results. One should use the models and the simulation results as indicative of broad patterns and trends, rather than for the exact numbers produced.

Moreover, future such analyses in Malawi need to be refined and extended to include more supplementary information. Among the most promising of such data are those which can be geo-referenced using a Geographic Information System. This would include the agricultural production statistics used in the model presented here, but also might include the administrative records of the Ministries of Health and of Education, population census statistics, and information gathered in separate household surveys, such as the Demographic and Health Survey.

On the subject of simulations, one must bear in mind that this is a static model. As such, the simulations will provide no indication as to the time frame of the changes examined. While, for example, a dollar increase in support to education will produce a sustainable and self-propelling impact on reducing poverty, it likely will be only after a long gestation period. On the other hand, a free agricultural inputs distribution will show instantaneous impact. However, the effect on household welfare of such a distribution will rapidly taper off if such a programme is undertaken for only one season. Discounting of the impact of various longer-term policies to account for this time-lag needs to be done in drawing policy actions from these results. However, similarly, discounting must also be done of short-term, but unsustainable efforts aimed at improving household welfare. These kinds of considerations will apply to all simulations, and we need to be aware of them in drawing policy conclusions. Moreover, although the model and simulations give some idea of the key directions for a poverty reduction strategy, the role of *equitable* economic growth in poverty reduction must also be considered.

In sum, the analysis here is not of sufficient complexity to allow a comprehensive poverty reduction strategy for Malawi to be devised from the results. Nevertheless, it does provide policy planners with objective measures on the potential poverty reduction impacts which might be realized from several key sectoral strategies. Policy planners

should view these results as a guide to allocate resources for poverty reduction in a more informed manner than hitherto. These results do allow for an objective technical assessment to now be carried out in parallel with the political considerations and debates which typically guide and dominate government policy formulation.

9. REFERENCES

Datt, Gaurav; and Dean Jolliffe. October 1999. *Determinants of poverty in Egypt: 1997*. International Food Policy Research Institute, Washington, D.C.. FCND discussion paper No. 75.

Datt, Gaurav; Kenneth Simler; Sanjukta Mukherjee; and Gabriel Dava. January 2000. *Determinants of poverty in Mozambique: 1996-97*. International Food Policy Research Institute, Washington, D.C.. FCND discussion paper No. 78.

Foster, James; Joel Greer; and Erik Thorbecke. 1984. A class of decomposable poverty measures. *Econometrica*. 52 (3): 761-765.

Johnson, Aaron; Marvin Johnson; and Rueben Buse. 1987. *Econometrics: Basic and Applied*. New York: Macmillan.

Judge, G.G., *et al*.. 1988. *Introduction to the Theory and Practice of Econometrics*. 2nd ed.. John Wiley & Sons.

National Economic Council (Poverty Monitoring System). 2000. *Profile of poverty in Malawi, 1998 – Poverty analysis of the Malawi Integrated Household Survey, 1997-98.* mimeo.

Skoufias, Emmanuel, *et al.*. June 1999. *An evaluation of the selection of beneficiary households in the education, health and nutrition program (PROGRESA) of Mexico*. International Food Policy Research Institute, Washington, D.C.. Final report. mimeo.

World Bank. 1995. *Malawi: Human resources and poverty – Profile and priorities for action*. Southern Africa Department.

10. TABLES AND FIGURES

Table 1: Agro-ecological and economic zones

Zone	Districts	Broad natural region	Market access	Agricultural potential	Agricultural risks	Crops	Notes
agro1	Nsanje & Chikwawa	Lower Shire Valley	Fair	High	High	Maize, cotton	Alluvial soils
agro2	Blantyre, Chiradzulu, Zomba, Thyolo, Mulanje, Phalombe	Shire Highlands and Lake Chilwa Plains	Good to fair	Moderate to high	Moderate	Maize, tobacco, pigeonpea	High population, peri-urban economic opportunities.
agro3	Mwanza, Balaka, Machinga, Mangochi	Middle & Upper Shire River Valley & Southern Lakeshore	Fair	Poor to moderate	Moderate to high	Maize, cotton, tobacco	Variable soils, variable rainfall.
agro4	Dedza, Dowa, Ntchisi	Central Highlands	Fair	Moderate	Low	Maize, tobacco, Irish potatoes	Cool, wet. Dowa also has agro5.
agro5	Lilongwe, Mchinji, Kasungu	Central mid-altitude plateau	Good	Moderate to high	Moderate	Maize, groundnuts, tobacco	Highest level of agricultural activity.
agro6	Salima, Nkhotakota, Ntcheu	Central Lakeshore and Bwanje Valley	Fair to poor	Moderate	Moderate to high	Cotton, rice, cassava, maize	Variable soils & rainfall. Ntcheu also has agro4.
agro7	Mzimba, Rumphi, Chitipa	Northern mid-altitude plateau	Fair to poor	Moderate to high	Moderate	Maize, tobacco	Land surplus areas.
agro8	Nkhata Bay, Karonga	Northern Lakeshore	Poor	Moderate	Moderate to high	Rice, cassava, maize	Variable soils, some high rainfall areas.
agro9	Urban centers	n.a.	Excellent	n.a.	n.a.	n.a.	n.a.

Table 2: 1997-98 Malawi Integrated Household Survey questionnaire table of contents

Section	Content	Coverage
A	Household Identification	Household head
B	Household roster	All individuals
C-1	Education of current potential students	All those aged under 25
C-2	Past education experience	All those aged 25 and above
D-1	Health condition in past 2 weeks	All individuals
D-2	Fertility	Women 15-45 years of age
D-3	Deaths in the household over past 12 months	Household head
E	Nutrition	Children between 6 mo. and 5 years
Annex E-1	Immunization	Children up to 5 years
F-1 & Annex	Agricultural crop production	Household head
F-2	Income from sale of livestock, poultry, and related products	Household head
F-3	Income from non-farming business (last one month)	Household head
F-4	Income from employment, transfers, and other income	Household head and those receiving such income
G-1	Employment and time use (last 12 months)	Individuals reported in Sec. B to be an 'employee', 'family business worker', self-employed' or 'employer'
G-2	Employment search (last 12 months)	If reported in Sec. B to be 'seeking work'
G-3	Time use of household members (last 7 days)	Individuals aged 5 and above
H	Migration	Individuals aged 10 and above
I & Annex	Housing and access to facilities	Household head
J-1	Assets – Household durables	Household head
J-2	Assets – Livestock and poultry	Household head
J-3 & Annex	Assets – Land (cultivated)	Household head
K-1 & Annex	Household expenditures – Own account (non-cash) food expenditure (last 3 days)	Household head
K-2	Major household expenditures	Household head
Annex L	Credit (last 12 months)	Household head
Diary	Diary of Expenditure	Household head

Table 3: Distribution of the 1997-98 Integrated Household Survey sample and the 10,698 household and 6,586 household analytical data sets

District	Traditional Authorities			Enumeration Areas			Survey Households			Est. HH popula-tion	Expansion factors *	
	Sample	10,698	6,586	Sample	10,698	6,586	Sample	10,698	6,586	*(1997-98)*	10,698	6,586
MALAWI	**48**	**47**	**45**	**720**	**614**	**538**	**12,960**	**10,698**	**6,586**	**2,242,605**	**210**	**341**
Southern Region	**24**	**23**	**23**	**372**	**307**	**269**	**6,600**	**5,215**	**3,046**	**1,084,852**	**208**	**356**
Nsanje	1	1	1	12	12	11	240	239	97	44,746	187	522
Chikwawa	2	2	2	24	15	11	480	288	132	74,700	259	522
Mwanza	1	1	1	12	4	1	240	80	17	31,542	394	386
Blantyre Rural	2	2	2	24	24	22	480	467	248	70,862	152	386
Blantyre City	-	-	-	60	60	60	600	590	414	116,045	197	280
Zomba Rural	3	3	3	36	35	18	720	696	268	117,911	169	440
Zomba Munic.	-	-	-	24	24	24	240	236	164	14,043	60	86
Thyolo	3	3	3	36	20	19	720	397	268	107,389	271	401
Mulanje	3	3	3	36	27	27	720	529	391	102,425	194	360
Phalombe	1	1	1	12	11	5	240	216	49	55,985	259	360
Machinga **	3	2	2	36	16	14	720	309	194	148,057	479	437
Mangochi	3	3	3	36	35	35	720	693	479	145,987	211	437
Chiradzulu	2	2	2	24	24	22	480	475	325	55,160	116	170
Central Region	**18**	**18**	**16**	**252**	**221**	**191**	**4,680**	**4,018**	**2,608**	**907,922**	**226**	**348**
Ntcheu	2	2	1	24	11	8	480	215	147	83,511	388	424
Dedza	2	2	2	24	22	18	480	439	310	110,321	251	424
Salima	1	1	1	12	12	12	240	239	192	60,006	251	313
Lilongwe Rural	5	5	5	60	50	44	1,200	985	594	207,598	211	349
Lilongwe City	-	-	-	36	36	36	360	357	229	93,199	261	407
Mchinji	2	2	2	24	22	20	480	437	308	70,874	162	230
Kasungu	2	2	2	24	24	23	480	473	381	102,819	217	270
Dowa	2	2	2	24	24	18	480	474	262	88,963	188	475
Ntchisi	1	1	-	12	8	-	240	159	-	35,442	223	-
Nkhotakota	1	1	1	12	12	12	240	240	185	55,189	230	298
Northern Region	**6**	**6**	**6**	**96**	**86**	**78**	**1,680**	**1,465**	**932**	**249,831**	**171**	**268**
Mzimba	2	2	2	24	24	23	480	473	347	109,641	232	368
Mzuzu City	-	-	-	24	24	22	240	235	122	17,745	76	145
Nkhata-Bay	1	1	1	12	12	10	240	239	162	35,581	149	220
Rumphi	1	1	1	12	3	2	240	58	22	26,158	451	368
Karonga	1	1	1	12	12	12	240	240	130	35,616	148	274
Chitipa	1	1	1	12	11	9	240	220	149	25,090	114	168
Rural	**48**	**47**	**45**	**576**	**470**	**396**	**11,520**	**9,280**	**5,657**	**2,001,573**	**216**	**354**
Urban	**-**	**-**	**-**	**144**	**144**	**142**	**1,440**	**1,418**	**929**	**241,032**	**170**	**259**

* The expansion factors indicate how many households in the district population as a whole each sample household in that district represents.

The expansion factors for the 10,698 household data set are simple, being the result of dividing the estimated household population of the district by the number of sample households in the district, e.g., for Chitipa district: 25,090 ÷ 220 = 114.

However, for fourteen districts of the 6,586 household data set, the expansion factors are based on the lumped population of adjoining districts. This was necessary due to the low sample numbers in this data set for some districts. The districts which were joined are Nsanje & Chikwawa, Mwanza & Blantyre Rural, Mulanje & Phalombe, Machinga & Mangochi, Ntcheu & Dedza, Dowa & Ntchisi, and Mzimba & Rumphi. The expansion factor for households in these districts is calculated as the sum of their household population divided by the sum of the sample households in each district, e.g., for Mzimba & Rumphi: (109,641 + 26,158) ÷ (347 + 22) = 368.

** Balaka district was not yet created when the survey was designed. It was part of Machinga district at the time

Table 4: Descriptive statistics of variables used in the determinants of poverty model

Variable	Variable description	Rural (5611 households)					Urban (846 households)			
		Mean	***Std. Dev.***	***Min***	***Max***		***Mean***	***Std. Dev.***	***Min***	***Max***
lcrdp	log of daily per capita household consumption	2.19	0.66	0.20	5.52		2.49	0.87	0.09	5.52
sr	Southern rural	0.46	0.50	0.00	1.00		-	-	-	-
cr	Central rural	0.43	0.49	0.00	1.00		-	-	-	-
nr	Northern rural	0.11	0.32	0.00	1.00		-	-	-	-
age_head	age of household head (yrs.)	43.28	14.71	16.00	118.0		39.09	10.87	18.00	78.00
sex_head	sex household head (1=male)	0.78	0.42	0.00	1.00		0.84	0.37	0.00	1.00
pi00_09	No. individuals in aged 9 years and younger	1.81	1.39	0.00	9.00		1.33	1.19	0.00	5.00
pi10_17	No. individuals aged 10 - 17 yrs	1.30	1.27	0.00	7.00		1.42	1.29	0.00	5.00
fi18_59	No. females aged 18 - 59 years	0.36	0.56	0.00	4.00		0.49	0.67	0.00	4.00
mi18_59	No. males aged 18 to 59 years	0.34	0.63	0.00	4.00		0.47	0.77	0.00	4.00
pi60_99	No. individuals aged 60 plus	0.22	0.51	0.00	2.00		0.07	0.30	0.00	2.00
hhszsq	Household size squared	37.43	35.13	1.00	324.0		35.67	30.73	1.00	144.0
maxed	Maximum education level attained by any adult aged 20 to 59 in the household	0.61	0.81	0.00	4.00		2.02	1.29	0.00	4.00
adm_mx3a	No. adult males (25-59 years) completed JCE	0.04	0.23	0.00	4.00		0.40	0.55	0.00	3.00
adf_mx3a	No. adult females (25-59 years) completed JCE	0.01	0.12	0.00	2.00		0.21	0.44	0.00	2.00
adm_mx4a	No. adult males (25-59 years) completed MSCE	0.00	0.06	0.00	1.00		0.11	0.32	0.00	2.00
adf_mx4a	No. adult females (25-59 years) completed MSCE	0.00	0.04	0.00	1.00		0.04	0.20	0.00	2.00
primind	No. household members with primary industry occupations	0.83	0.91	0.00	6.00		0.07	0.26	0.00	2.00
secind	No. household members with secondary industry occup.	0.08	0.33	0.00	5.00		0.22	0.43	0.00	2.00
tertind	No. household members with tertiary industry occup.	0.22	0.49	0.00	4.00		0.76	0.73	0.00	5.00
ysal_tb1	No. HH members who receive income from formal employ	0.03	0.19	0.00	3.00		0.26	0.61	0.00	3.00
tob_dum	Household cultivates tobacco (0/1)	0.17	0.38	0.00	1.00		-	-	-	-
avgmzyld	Average maize yield for EA between 1984 and 2000 (tons/ha)	1.04	0.30	0.57	1.94		-	-	-	-
lnvllst	ln of per capita deflated value of livestock owned	3.29	2.66	0.00	10.83		-	-	-	-
divcrops	No. crops cultivated by household that are not tobacco or maize	0.46	1.00	0.00	7.00		-	-	-	-

(continued)

Table 4: (continued)

Variable	Variable description	Rural (5611 households)					Urban (846 households)			
		Mean	***Std. Dev.***	***Min***	***Max***		***Mean***	***Std. Dev.***	***Min***	***Max***
pcland	Per capita land area cultivated (in acres)	0.48	0.51	0.00	10.00		-	-	-	-
aginput	Availability of ag inputs in TA/ward (0/1)	0.79	0.40	0.00	1.00		-	-	-	-
facaccss	Mean time in hours to health center, bus stage, ADMARC, bank, and PO	1.53	0.78	0.00	3.00		0.51	0.33	0.25	2.70
elec	Gas/electricity as source of light in TA/ward (0/1)	0.28	0.45	0.00	1.00		0.48	0.50	0.00	1.00
pubwk	Access to public works program in TA/ward (0/1)	0.44	0.50	0.00	1.00		0.08	0.27	0.00	1.00
agro1	Districts: Nsanje & Chikwawa	0.05	0.22	0.00	1.00		-	-	-	-
agro2	Districts: Blantyre, Zomba, Thyolo, Mulanje, Chiradzulu, Phalombe	0.26	0.44	0.00	1.00		-	-	-	-
agro3	Districts: Mwanza, Balaka, Machinga, Mangochi	0.15	0.36	0.00	1.00		-	-	-	-
agro4	Districts: Dedza, Dowa, Ntchisi	0.13	0.34	0.00	1.00		-	-	-	-
agro5	Districts: Lilongwe, Mchinji, Kasungu	0.20	0.40	0.00	1.00		-	-	-	-
agro6	Districts: Ntcheu, Salima, Nkhotakota	0.10	0.29	0.00	1.00		-	-	-	-
agro7	Districts: Mzimba, Rumphi, Chitipa	0.08	0.27	0.00	1.00		-	-	-	-
agro8	Districts: Nkhata Bay, Karonga	0.03	0.17	0.00	1.00		-	-	-	-
agmz1	Interaction terms: agro1*avgmzyld	0.02	0.11	0.00	0.76		-	-	-	-
agmz2	Interaction terms: agro2*avgmzyld	0.19	0.38	0.00	1.11		-	-	-	-
agmz3	Interaction terms: agro3*avgmzyld	0.07	0.23	0.00	1.10		-	-	-	-
agmz4	Interaction terms: agro4*avgmzyld	0.09	0.32	0.00	1.50		-	-	-	-
agmz5	Interaction terms: agro5*avgmzyld	0.24	0.52	0.00	1.94		-	-	-	-
agmz6	Interaction terms: agro6*avgmzyld	0.09	0.31	0.00	1.48		-	-	-	-
agmz7	Interaction terms: agro7*avgmzyld	0.09	0.33	0.00	1.61		-	-	-	-
agmz8	Interaction terms: agro8*avgmzyld	0.04	0.21	0.00	1.09		-	-	-	-

NB: These descriptive statistics are weighted.

Table 5: Model of the determinants of poverty in Malawi

Variable	Variable description	Urban		Southern rural		Central rural		Northern rural	
		Coef-ficient	***t-statistic***	***Coef-ficient***	***t-statistic***	***Coef-ficient***	***t-statistic***	***Coef-ficient***	***t-statistic***
age_head	age of household head (yrs.)	0.002	(0.82)	-0.005	(5.44)**	-0.004	(3.31)**	-0.004	(2.68)**
sex_head	sex of household head (male=1)	-0.026	(0.30)	-0.054	(1.93)	0.041	(1.66)	0.082	(1.29)
pi00_09	No. individuals aged 9 years and younger	-0.313	(12.06)**	-0.206	(11.21)**	-0.157	(9.61)**	-0.210	(12.71)**
pi10_17	No. individuals aged 10 to 17 years	-0.144	(5.89)**	-0.124	(7.79)**	-0.130	(7.12)**	-0.167	(3.61)**
fi18_59	No. females aged 18 to 59 years	-0.136	(2.56)*	-0.032	(1.10)	-0.076	(2.35)*	-0.174	(5.24)**
mi18_59	No. males aged 18 to 59 years	-0.006	(0.17)	-0.071	(2.26)*	-0.003	(0.11)	-0.121	(8.33)**
pi60_99	No. individuals aged 60 and older	-0.197	(1.59)	0.039	(1.23)	0.052	(1.18)	-0.080	(0.98)
hhszsq	Household size squared	0.005	(5.49)**	0.005	(5.49)**	0.005	(5.49)**	0.005	(5.49)**
maxed	Maximum education level attained by any adult	0.172	(3.94)**	0.224	(7.27)**	0.193	(5.24)**	0.115	(3.02)**
adm_mx3a	No. adult males (25-59 years) completed JCE	-0.082	(0.99)	0.016	(0.11)	0.058	(0.64)	0.007	(0.04)
adf_mx3a	No. adult females (25-59 years) completed JCE	0.320	(3.08)**	-0.343	(1.19)	-0.074	(0.43)	0.196	(1.76)
adm_mx4a	No. adult males (25-59 years) completed MSCE	0.288	(2.65)*	-	-	-	-	-	-
adf_mx4a	No. adult females (25-59 years) completed MSCE	0.467	(3.28)**	-	-	-	-	-	-
primind	No. household members with primary industry occupations	-	-	0.074	(2.36)*	-0.153	(5.45)**	0.023	(0.25)
secind	No. household members with secondary industry occup.	0.127	(1.58)	0.007	(0.14)	0.035	(0.64)	0.083	(0.56)
tertind	No. household members with tertiary industry occup.	0.128	(1.76)	0.261	(5.47)**	0.090	(2.33)*	0.119	(1.29)
ysal_tb1	No. HH members who receive income from formal employ	0.104	(2.01)*	0.148	(3.27)**	0.148	(3.27)**	0.148	(3.27)**
pcland	Per capita land area cultivated (in acres)	-	-	0.135	(3.67)**	0.166	(4.88)**	0.134	(2.43)*
tob_dum	Household cultivates tobacco (0/1)	-	-	0.156	(2.35)*	0.141	(2.51)*	-0.079	(0.81)
divcrops	No. crops cultivated by HH that are not tobacco or maize	-	-	0.024	(1.01)	0.050	(3.76)**	0.061	(1.32)
lnvllst	ln of per capita deflated value of livestock owned	-	-	0.036	(7.14)**	0.026	(4.34)**	0.023	(1.99)*
agmz1	Interaction of average maize yield by agro eco-zone 1	-	-	-0.846	(1.22)	-	-	-	-
agmz2	Interaction of average maize yield by agro eco-zone 2	-	-	-0.355	(0.76)	-	-	-	-
agmz3	Interaction of average maize yield by agro eco-zone 3	-	-	-0.620	(5.00)**	-	-	-	-

(continued)

Table 5: (continued)

Variable	Variable description	Urban		Southern rural		Central rural		Northern rural	
		Coef-ficient	***t-statistic***	***Coef-ficient***	***t-statistic***	***Coef-ficient***	***t-statistic***	***Coef-ficient***	***t-statistic***
agmz4	Interaction of average maize yield by agro eco-zone 4	-	-	-	-	0.224	(0.67)	-	-
agmz5	Interaction of average maize yield by agro eco-zone 5	-	-	-	-	-0.122	(0.66)	-	-
agmz6	Interaction of average maize yield by agro eco-zone 6	-	-	-	-	0.362	(2.20)*	-	-
agmz7	Interaction of average maize yield by agro eco-zone 7	-	-	-	-	-	-	-0.072	(0.15)
agmz8	Interaction of average maize yield by agro eco-zone 8	-	-	-	-	-	-	-0.844	(1.13)
facaccss	Mean time in hours to health center, bus stage, ADMARC, bank, and PO	-	-	-0.104	(4.92)**	-0.104	(4.92)**	-0.104	(4.92)**
pubwk	Access to public works program in TA/ward (0/1)	0.190	(2.96)**	0.190	(2.96)**	0.190	(2.96)**	0.190	(2.96)**
aginput	Availability of ag inputs in TA (0/1)	-	-	0.050	(0.71)	0.050	(0.71)	0.050	(0.71)
elec	Gas/electricity as source of light in TA/ward (0/1)	0.037	(0.67)	0.037	(0.67)	0.037	(0.67)	0.037	(0.67)
agro1	Nsanje, Chikwawa	-	-	0.712	(1.65)	-	-	-	-
agro2	Blantyre, Chiradzulu, Zomba, Thyolo, Mulanje, Phalombe	-	-	0.335	(0.78)	-	-	-	-
agro3	Mwanza, Balaka, Machinga, Mangochi	-	-	0.548	(2.30)*	-	-	-	-
agro4	Dedza, Dowa, Ntchisi	-	-	-	-	-0.064	(0.17)	-	-
agro5	Lilongwe, Mchinji, Kasungu	-	-	-	-	0.269	(0.91)	-	-
agro6	Salima, Nkhotakota, Ntcheu	-	-	-	-	-0.446	(1.43)	-	-
agro7	Mzimba, Rumphi, Chitipa	-	-	-	-	-	-	0.232	(0.35)
agro8	Nkhata Bay, Karonga	-	-	-	-	-	-	1.374	(1.96)
constant	Model intercept term ()	2.313	(14.17)**	2.313	(14.17)**	2.313	(14.17)**	2.313	(14.17)**
	Number of households:	846		2,423		2,378		810	

NB: Absolute value of t-statistics in parentheses. * significant at 5 percent level. ** significant at 1 percent level.

dependent variable: log of daily per capita household consumption in April 1998 MK

Number of strata: 18

Number of primary sampling units: 104

$R^2 = 0.3282$

Table 6: Comparison of actual measures of welfare with base simulation

	Southern rural		Central rural		Northern rural		Urban		National	
	Actual	***Base***	***Actual***	***Base***	***Actual***	***Base***	***Actual***	***Base***	***Actual***	***Base***
Mean daily per capita consumption *	11.12	9.27	11.43	9.96	11.49	9.97	19.09	14.08	12.07	10.08
Poverty headcount	62.47	61.85	58.75	57.08	60.59	57.75	49.55	46.18	59.56	58.03
Poverty gap	25.80	25.53	22.27	22.29	22.49	23.24	18.18	18.12	23.35	23.31
Squared poverty gap	13.72	13.58	11.06	11.40	10.71	12.17	9.00	9.41	11.92	12.18

* Units are in MK per capita per day (in real terms).

These computations are based on the more restricted data set of 6,586 households from the Malawi Integrated Household Survey, which gave a poverty headcount nationally of 59.6 percent, rather than the larger 10,698 household data set which gave a poverty headcount of 65.3 percent.

Table 7: Simulation results - percent change in consumption and poverty indices

Simulation	Percent change in real per capita consumption					Percent change in poverty headcount					Percent change in poverty gap					Percent change in squared poverty gap (poverty severity)				
	South Rural	**Central Rural**	**Northern Rural**	**Urban**	**National**	**South Rural**	**Central Rural**	**Northern Rural**	**Urban**	**National**	**South Rural**	**Central Rural**	**Northern Rural**	**Urban**	**National**	**South Rural**	**Central Rural**	**Northern Rural**	**Urban**	**National**
Household size																				
Add child to HH, if HH has child now	-13.2	-11.4	-13.3	-16.1	-12.9	13.2	12.7	15.0	23.1	14.0	24.9	21.7	27.3	42.1	25.3	33.5	28.2	36.4	36.2	33.7
Add child to HH, for all HHs	-18.6	-14.5	-18.9	-26.9	-18.2	17.5	15.8	19.6	34.0	18.4	30.6	25.7	33.0	54.1	30.9	39.9	32.8	42.5	40.8	39.9
Education																				
Increase by 1 the no. of adult *females* with MSCE, if none in HH	11.7	9.0	5.6	34.4	13.2	-10.1	-8.8	-5.3	-28.1	-10.5	-14.4	-12.3	-7.6	-32.7	-14.3	-17.0	-14.4	-9.1	-35.4	-16.7
Increase by 1 the no. of adult *males* with MSCE, if none in HH	10.2	9.4	5.1	21.6	11.0	-8.3	-8.9	-4.9	-21.3	-9.2	-11.7	-12.4	-7.1	-26.0	-12.6	-13.7	-14.7	-8.4	-28.7	-14.7
Increase by 1 the no. of adult *females* with MSCE, if females with JCE in HH	0.6	0.5	-0.7	8.7	1.6	-0.2	-0.2	0.3	-3.2	-0.4	-0.1	-0.1	0.3	-2.7	-0.3	-0.1	-0.1	0.2	-2.4	-0.2
Increase by 1 the no. of adult *males* with MSCE, if males with JCE in HH	1.2	1.0	1.3	20.0	3.7	-0.4	-0.4	-0.8	-14.2	-1.5	-0.4	-0.3	-0.9	-14.3	-1.5	-0.3	-0.3	-0.9	-14.1	-1.4

(continued)

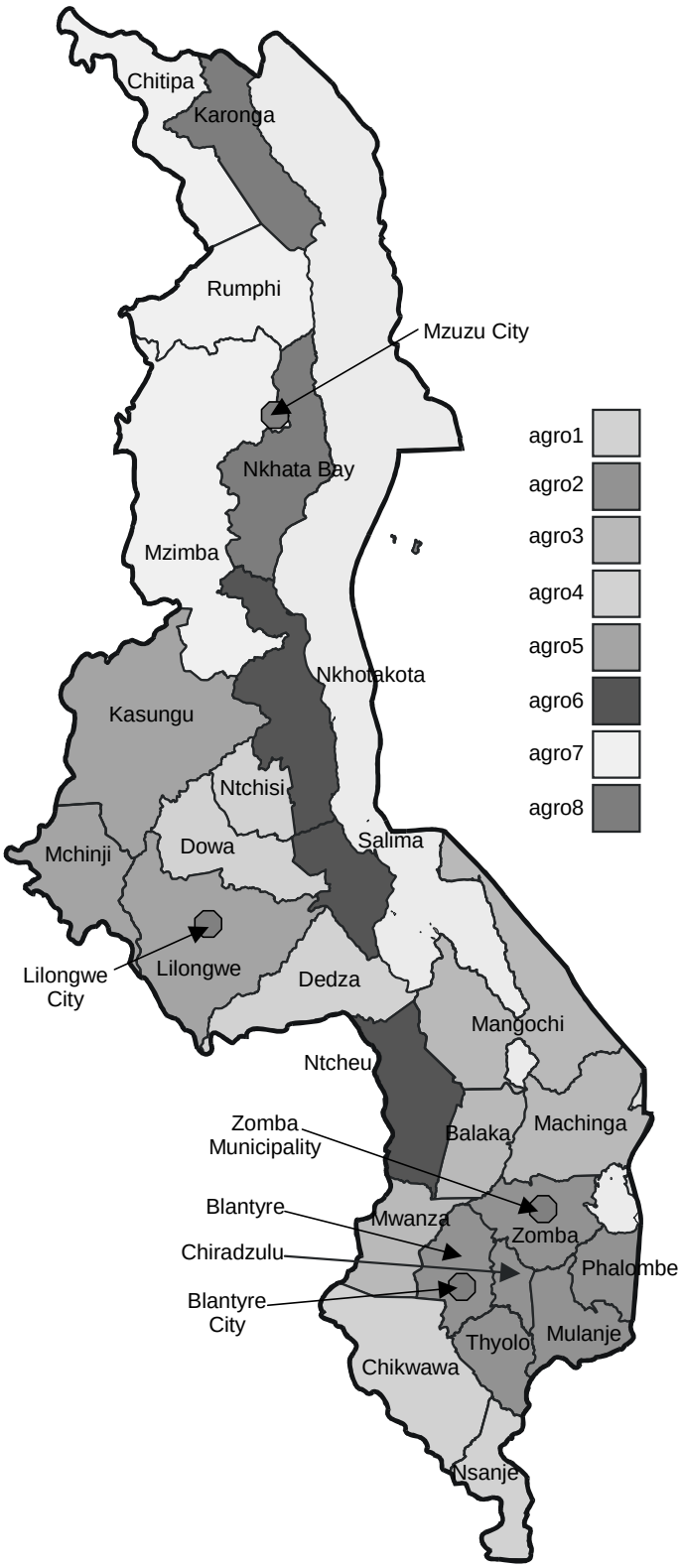
Table 7: (continued)

Simulation	Percent change in real per capita consumption					Percent change in poverty headcount					Percent change in poverty gap					Percent change in squared poverty gap (poverty severity)				
	South Rural	**Central Rural**	**Northern Rural**	**Urban**	**National**	**South Rural**	**Central Rural**	**Northern Rural**	**Urban**	**National**	**South Rural**	**Central Rural**	**Northern Rural**	**Urban**	**National**	**South Rural**	**Central Rural**	**Northern Rural**	**Urban**	**National**
Employment																				
Adult moves from primary industry occupation to secondary industry	-2.1	17.1	7.9	-	8.4	2.0	-17.1	-7.5	-	-7.5	2.9	-24.3	-11.5	-	-10.3	3.4	-28.8	-14.3	-	-11.9
Adult moves from primary industry occupation to tertiary	26.2	23.8	11.9	-	22.1	-21.9	-22.9	-11.2	-	-20.6	-30.8	-31.5	-16.3	-	-28.7	-36.2	-36.8	-19.6	-	-33.7
Adult moves from secondary industry occupation to tertiary	29.8	9.1	12.2	10.6	17.5	-24.5	-9.1	-11.5	-11.1	-16.3	-34.0	-13.3	-16.7	-15.0	-23.2	-39.7	-15.9	-20.1	-17.6	-27.4
Agriculture																				
Increasing per capita land cultivated by 0.25 acres	3.4	4.2	3.4	-	3.3	-3.1	-4.3	-3.3	-	-3.3	-4.8	-6.4	-4.9	-	-5.0	-5.8	-7.7	-6.0	-	-6.1
Increasing diversity of crops from 0 to 1	2.2	2.9	5.5	-	2.5	-2.0	-3.0	-5.2	-	-2.5	-3.1	-4.6	-7.9	-	-3.9	-3.9	-5.7	-9.6	-	-4.8
Increasing diversity of crops to 2, if 0 or 1	4.5	6.7	11.8	-	5.5	-4.0	-6.8	-10.9	-	-5.5	-6.4	-10.3	-16.2	-	-8.3	-7.9	-12.5	-19.7	-	-10.2
All households cultivate tobacco	16.2	9.6	-6.5	-	9.2	-13.9	-9.9	6.5	-	-9.2	-20.5	-15.1	9.7	-	-13.9	-24.7	-18.5	11.7	-	-16.8

Table 7: (continued)

Simulation	Percent change in real per capita consumption					Percent change in poverty headcount					Percent change in poverty gap					Percent change in squared poverty gap (poverty severity)				
	South Rural	**Central Rural**	**Northern Rural**	**Urban**	**National**	**South Rural**	**Central Rural**	**Northern Rural**	**Urban**	**National**	**South Rural**	**Central Rural**	**Northern Rural**	**Urban**	**National**	**South Rural**	**Central Rural**	**Northern Rural**	**Urban**	**National**
Access to services by household																				
Reduce time to reach key services by one hour, for HHs who now spend over 2 hours to services	2.7	2.3	4.0	-	2.3	-2.6	-2.6	-4.2	-	-2.6	-4.5	-4.3	-6.6	-	-4.3	-5.8	-5.4	-8.3	-	-5.5
Community infrastructure and services																				
Change light source to gas/electricity, if light is now other.	2.6	3.1	1.4	2.1	2.6	-2.4	-3.1	-1.4	-2.1	-2.6	-3.8	-4.7	-2.1	-2.8	-3.9	-4.8	-5.7	-2.6	-3.2	-4.8
Provide access to public works program in community	8.5	12.3	18.6	19.1	12.4	-7.8	-11.5	-16.9	-18.9	-11.0	-12.0	-15.8	-23.8	-25.1	-15.6	-14.8	-18.5	-28.2	-29.1	-18.6

Figure 1: Agro-eco zones used in the determinants of poverty analysis



11. ANNEXES

11.1 Abbreviations

ADMARC	Agricultural Development and Marketing Corporation *Until the early 1990s, this parastatal corporation with depots throughout the country held the monopoly for the marketing of smallholder crops in Malawi.*
CPI	Consumer Price Index
CSR	Centre for Social Research of the University of Malawi
EA	Enumeration Area
IFPRI	International Food Policy Research Institute
IHS	Integrated Household Survey
JCE	Junior Certificate of Education
MASAF	Malawi Social Action Fund
MK	Malawi Kwacha *(April 1998: MK 25.40 = US $1.00)*
MSCE	Malawi School Certificate of Education
NEC	National Economic Council
NSO	National Statistical Office
PMS	Poverty Monitoring System
TA	Traditional Authority

11.2 Glossary

adult equivalent — In making comparisons between households, household characteristics are standardized by dividing the aggregate characteristic for a household by the number of adult equivalent members of the household. The adult equivalent is a weight assigned to each of the members in a household according to their age and sex characteristics relative to that of an adult male, typically. See the fourth section of the Annex.

agro-eco zones — Regions with similar agricultural, ecological, and economic characteristics.

bi-variate — An analysis which isolates two characteristics of a household for assessment of the degree of correlation between them. In the case of a poverty profile, one of the characteristics will typically be the poverty status of a household.

causality — The relation of cause and effect. If there is a causal relationship between one characteristic of a household and another, we can state that the first characteristic causes the second. This is in contrast to the more simple relationship of correlation in which no causality between the characteristics is assumed.

correlates — If one observes that the levels of two or more variables in a system (such as a household) are such that when the level of one or the other goes up, the other goes up, these variables are said to be positively correlated. If one goes up when the other goes down, they are negatively correlated. These two variables are correlates. However, in identifying them as correlates, it is not implied that the level of one variable is determined by the level of the other. See *causality*.

dependent variable — That characteristic which is being predicted by the economic model. In the case here, the welfare level (and, hence, the poverty status) of a household is being predicted by the model.

determinants — The independent variables of our economic model which determine the welfare level of households in Malawi. Economic theory is used to assess which of a range of possible household variables are likely the determinants of poverty. Not all characteristics of household are determinants of the welfare of that household.

dummy variable — A variable which represents the presence or absence of a specific condition in an observation (here, the IHS households). If the specific condition is present, the variable takes a value of one; if absent, zero.

economic modeling — Constructing representations (hence, simplifications) of economic processes that cannot be observed directly in their entirety. This is done by employing a set of foundational assumptions and computing mathematical relationships between the components of the model.

endogenous — Endogenous variables in a model are those that are influenced by other variables in the model. In the analysis here, endogenous is used to describe a household characteristic which is determined by the present condition of the household, rather than independently of the current condition of the household. Contrast to *exogenous*.

exogenous — Exogenous variables in a model are those that are *not* influenced by other variables in the model. Here the term is used to describe a household characteristic which is set independently of the present condition of the household. Frequently exogenous household characteristics are determinants of the current condition of the household. Contrast to *endogenous*.

explanatory variable — See *independent variable*.

fixed effect variable — A variable which is held in the context of this analysis to capture unobservable or unmeasured characteristics of a related group of households (such as all households in the same agro-eco zone). Employing fixed effect variables in a reasoned manner should improve the fit of the economic model being constructed.

independent variable — The variables in an economic model which are used to predict the value of the dependent variable. In the case of the determinants of poverty model, we

assert that economic theory permits us to state that the independent variables *determine* the level of the dependent variable, the welfare level of the household. See *determinants* and *dependent variable*.

interaction terms — A constructed variable typically made up by multiplying the values of two simple variables. The assumption underlying the interaction term is that the magnitude of the joint effect on the dependent variable of the two terms making up the interaction term is different than simply the sum of the effect on the dependent variable of the two interacted variables in isolation.

nominal — Applied to prices, nominal prices are simply the market prices collected on a specific date at a specific place. They often are not directly comparable to other prices collected elsewhere or at a different time, because of price differences caused by inflation or regional price differences. Nominal prices must be normalized into real prices using price indices before direct comparisons of prices can be made.

omitted variable bias — In accounting for the level of the dependent variable, an economic model is incorrect if key variables strongly correlated with the dependent variable are missing from the model. In addition to simply specifying the model incorrectly, data limitations may prevent the inclusion of these key variables. The inclusion of fixed effects terms is one manner in which omitted variable bias can be managed within an economic model.

parameter — A constant value used to define a mathematical model. The coefficients for the variables in our determinants of poverty model are the parameters of the model.

per capita — In making comparisons between households, characteristics may be standardized by dividing the aggregate household characteristic by the household size. The per capita method simply uses the number of individuals in the household to do so, without reference to their age and sex characteristics. See the fourth section of the Annex.

poverty line — That level of consumption and expenditure (valued in monetary terms) which is deemed to be the minimum required to meet the basic needs of a household.

price indices — Temporal and spatial price indices takes into account price differences through time and space, respectively, so that nominal prices can be converted into real prices to allow real price comparisons to be made. The CPI is the most commonly used temporal price index.

public works programme — Such programmes are formulated for social safety net or developmental purposes and typically involve the construction of roads, schools, bridges, and other social or economic infrastructure by local residents in exchange for a cash or in-kind (food, agricultural inputs, etc.) wage.

real — When examining prices over time or over space, inflation and regional price differences result in the prices collected not being fully comparable. Real prices are directly comparable and are calculated by adjusting the collected prices – the nominal prices – by temporal and/or spatial price indices.

regression — The statistical analysis of the nature of the relationship between a dependent variable and a set of independent variables. In the case here, the dependent variable is the welfare level of the households in the IHS survey, while the independent variables are those characteristics of the household which economic theory tells us would determine the household welfare level.

regressors — The independent variables in a regression equation – the 'right-hand side variables' in the regression equation.

simulation — Having established an economic model, simulation involves adjusting the levels of selected exogenous variables of the model to assess the economic effect on the dependent variable. In the simulations here, we adjust components of the determinants of poverty model in order to judge the possible impact on household welfare levels. Doing so allows us to assess the potential impact on poverty of policies which would aim to alter the characteristics of Malawian households in a similar fashion.

11.3 Poverty line derivation

The *poverty line* – that level of welfare which distinguishes poor households from non-poor households – is also expressed in the same unit as the consumption-based measure of household welfare. The method used to determine the poverty line for the poverty analysis of the Malawi IHS is the cost-of-basic-needs method. In brief, the following steps were taken:

- The objective core of the poverty line is the per capita recommended daily calorie requirement for the households in the IHS data set used here. These requirements have been established by nutrition researchers.
- This recommended calorie requirement is used to establish the food component of the poverty line by determining what it costs for *poorer* households in Malawi to acquire sufficient calories to meet their recommended calorie requirements. The cost for each calorie is determined by calculating the value of each calorie reported consumed by these poorer households.
- More than simply food is needed to meet the basic needs of a household. There is a non-food component to the poverty line as well. Unfortunately, no independent objective criteria exists by which one can establish what should make up the non-food component of the poverty line. The method adopted here is to examine the non-food consumption of those households for whom the value of their *total* consumption and expenditure is in the neighborhood of the value of the *food* component of the poverty line. Since these households are sacrificing nutritionally necessary food consumption to consume these non-food items, the items can be considered basic necessities for household welfare. The value of these items makes up the non-food component of the poverty line.
- Summing the food and non-food components results in the poverty line. The poverty status of each household can then be assessed by comparing the level of its welfare indicator to the poverty line.

Poverty lines were constructed for four separate areas of the country – Southern rural, Central rural, Northern rural, and Urban. The three rural poverty line areas correspond to the administrative regions of the country, but do not include the four urban centers of Blantyre, Zomba, Lilongwe, and Mzuzu. These four cities make up the Urban poverty line area. District administrative centers, *bomas*, are included in the rural

poverty line areas, rather than in the Urban.

The different poverty lines areas were established so that the poverty lines in each would reflect any differences in the tastes or consumption preferences of the poorer households in their populations, any possible differences in the demographic make-up of their poorer households, and price differences between the areas. The differences between the three rural poverty line areas are not that great, whereas there are strong differences on these criteria between the Urban poverty line area and the others.

Using April 1998 Malawi Kwacha, Table 8 presents the poverty lines, together with their component food and non-food poverty lines. The poverty line is simply the sum of the food and non-food components of the line. The proportion of the poverty line made up by food consumption is also presented, showing that a large proportion of rural consumption is on food, whereas, as might be expected, urban dwellers have significantly higher levels of non-food consumption.

On any given day, most rural Malawians spend far less Kwacha than is indicated by the poverty line. However, this does not necessarily mean that they are poor. It is important to remember how the welfare indicator – total per capita daily consumption and expenditure – was derived. It includes four separate components, several of which are not monetized – non-cash food consumption, non-cash non-food consumption, the use value of durable items, and the imputed house rental value for household living in houses they own. For rural households, close to 60 percent of daily consumption does not involve a cash transaction. Production for home consumption remains a very important aspect of the household economy in rural Malawi.

Once the poverty line is established, households in each region are categorized as poor and non-poor depending on whether their per capita total daily consumption and expenditure, their welfare indicator, is below or above the poverty line. The poverty headcount can then be computed, indicating the proportion of individuals below the poverty line.

Table 8: Poverty, food poverty, and non-food poverty lines and spatial price indices at April 1998 prices, by poverty line area

	Poverty line (MK)	**Food** (MK)	**Non-food** (MK)	Food share of poverty line (%)	**Spatial price index ***
Southern rural	7.76	6.53	1.23	84.1	74.1
Central rural	9.27	7.76	1.51	83.7	92.3
Northern rural	11.16	8.90	2.26	79.7	112.4
Urban	25.38	16.95	8.43	66.8	222.1
National weighted average poverty line	10.47	-	-	-	100.0

* Spatial price differences are revealed by the different poverty lines in each region. The poverty lines represent the different prices across the country for a comparable basket of goods necessary to meet the daily basic needs of an individual in Malawi. The spatial price index uses the weighted average poverty line (6,586 household data set) as a base, and is calculated as: 100 * total poverty line ÷ national weighted average poverty line.

April 1998: MK 25.40 = US$ 1.00

11.4 Calculating welfare on a per capita versus an adult equivalent basis

Choosing per capita consumption as the basis of our welfare indicator versus choosing adult equivalent units as the basis is an important and debatable methodological detail. When we use per capita consumption as a measure of welfare we make the following set of assumptions:

(a) everyone in the household receives an equal allocation of items consumed irrespective of age or gender.

(b) everyone in the household has the same needs irrespective of age or gender.

(c) the cost for two or three or more people living together is the same as them living separately (Skoufias, *et al.* 1999, pg. 77).

However, it is possible that not everybody in the household has the same needs and in particular that needs vary depending upon age and gender. It is also possible that there are economies of scale to living together. For example, a nutritional study in Mexico calculated adult equivalents as follows (INN, 1987, cited in Skoufias, *et al.* 1999):

Age (years)	Male	Female
under 5	0.41	0.41
5 to 10	0.80	0.80
11 to 14	1.15	1.05
15 to 19	1.38	1.05
20 to 34	1.26	0.92
35 to 54	1.15	0.85
55 and older	1.03	0.78

If one employs an adult equivalent base when using household consumption as a measure of household welfare, we make the following set of assumptions:

(a) unequal allocation of consumption based on age and gender, for both food and non-food consumption.

(b) the needs of household members differ depending on their age and sex.

(c) the cost for two or three or more people living together is not the same as them living separately.

The problem with using adult equivalents is that consumption on non-food items in particular is not very closely linked, if at all, to the age and gender of an individual.

School fees or transport costs, for example, will typically be assessed on a per capita basis, rather than with any consideration of age and sex. Neither base is perfect. In the interests of simplicity, the per capita basis is used here.

However, the consequence of using a per capita based definition of household welfare rather than determining household welfare on a consumption per adult equivalent basis is that households with children are judged more poor on a per capita basis than they would be if their welfare level was determined on an adult equivalent basis. Using the adult equivalent method, children receive less weight than do adults in computing the welfare indicator. For example, the marginal effect on household welfare of adding a child in the age group 5 to 10 using the adult equivalent framework shown in the table above would be 20 percent *less* than if a per capita framework were employed. Thus, the per capita measure of welfare will provide a higher estimate of the negative impact on household welfare of the addition of a child to the household than would an adult equivalent framework.