Determinants of Poverty in Kenya: Household-Level Analysis

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Abstract

Strategies aimed at reducing poverty need to identify factors that are strongly associated with poverty and that are amenable to modification by policy. This paper uses household-level data collected in 1994 to examine probable determinants of poverty status in Kenya, employing both binomial and polychotomous logit models of poverty analysis.

The study shows that poverty status is highly correlated with the level of education, household size and type of occupational activity, and it is most prevalent in rural areas. Specifically, poverty falls as the level of education increases; it rises with household size and with engagement in agricultural activities. These effects persist in both binomial and polychotomous models used to determine poverty. In particular, extreme poverty falls rapidly as education increases and as farm households shift to non-agricultural activities. Size of landholding does not emerge as a major determinant of hard-core poverty in the sample analysed.

Contents

Executive Summary

Objective and methodology

The government of Kenya has prepared a poverty reduction strategy paper (PRSP) to guide the poverty reduction effort. One major weakness in the government's PRSP is lack of information that can be used to implement and monitor the strategy. This study should help the government to realize its poverty reduction goals, because it provides detailed information on causes of poverty, and thus it facilitates a better understanding of what can be done to overcome it. The information the study provides is especially useful in designing benchmarks for monitoring progress in poverty reduction.

The approach used in the study explains why population subgroups are non-poor, poor, or extremely poor. Different population subgroups are identified in several stages according to their poverty status. In the first stage, the poor and the non-poor subgroups are identified. In the second stage, the subgroup in hard-core poverty is identified from among the poor.

A binomial model is used to compute probabilities of being poor or non-poor, given the characteristics of the population. After modelling the process that generates the poor or non-poor status using binomial model, we focus attention on computing probabilities of being extremely poor, moderately poor or non-poor. The probabilistic identification of the three subgroups is done using a polychotomous logit model. This approach is justifiable, because population subgroups that form the analytic samples are classified using poverty lines as cut-off points in a cumulative distribution of household expenditure.

Conclusion and policy recommendation

The following conclusions and policy implications of the study stand out:

First, as expected, we have found that poverty is concentrated in rural areas in general, and in the agricultural sector in particular. Being employed in the agricultural sector accounts for a good part of the probability of being poor. Thus, investing in the agricultural sector to reduce poverty should be a matter of great priority in the antipoverty programmes of the government. Moreover, the finding that the size of land holding is not a determinant of poverty status suggests the importance, in poverty reduction, not only of improving the quality of land, but also of providing complementary inputs that may enhance its productivity.

Second, the educational attainment of the head of the household (in particular high school and university education) is found to be the most important factor that is associated with not being in poverty. Lack of education is a factor that accounts for a higher probability of being poor. Thus, promotion of education is central in addressing problems of moderate and extreme poverty. Specifically, primary education is found to be of paramount importance in reducing extreme poverty in rural areas.

Third, female education has a large impact on poverty reduction. Female-headed households are more likely to be poor relative to households headed by men. Female education can play a key role in reducing poverty among female-headed households. Since female-headed households are only about 30% of all households, reducing poverty among this subgroup using female education would reduce overall poverty only by a small proportion. However, because of positive externality effects of female education, such a policy could have large, generalized effects on poverty reduction.

Finally, in line with the key strategies that are outlined in the Poverty Reduction Strategy Paper (economic growth and macro stability; raising income opportunity of the poor; and improving quality of life), the findings in this study point to the importance of investing in education—especially primary education in rural areas—in order to achieve the poverty reduction goals of the government for the next five years and beyond.

1 Introduction

Poverty in Kenya is pervasive. Table 1 provides the general picture in 1994. Using a per adult-equivalent measure, the headcount (P_0), the poverty gap (P_1) and severity (P_2) of consumption-poverty indices were 48, 19 and 10%. These figures are in general larger than similar indices that the government of Kenya computed, given in parentheses. The table also shows that poverty is concentrated in rural areas. Its pervasive nature is one of the reasons for increasingly steering policies towards plans and strategies aimed at reducing it.

In line with this, the government of Kenya has designed a medium-term strategy aimed at reducing poverty and produced the influential document 'Poverty Reduction Strategy Paper' (PRSP). It is influential because policy-making in the short to medium term will be geared towards implementing this strategy and realizing its goal. One of its objectives is to reduce the incidence of poverty from its 1997 level of about 52% by 20% by year 2004. The important question is, how is the government going to achieve that goal? This question cannot be adequately answered unless we have information on characteristics of the poor and how these characteristics determine poverty. This policy aspect is the major justification for this study.

Although in general we are interested in identifying the major determinants of poverty, at a specific level we are concerned about how government policies can be linked to these determinants, so as to arrive at poverty-reducing policy measures. This means examining PRSP and its policy instruments. The effectiveness of the strategy then can be evaluated in using the available knowledge about poverty, especially its determinants. The results of the study will, we hope, provide a basis for evaluating the government's poverty reduction strategies and policies and may possibly suggest

Table 1. Poverty in Kenya in 1994 (figures in parentheses are Kenyan government estimates)

	Rural		Urban		National	
	C-b	I-b	C-b	I-b	C-b	I-b
	Per capita income- or consumption-based measures					
General poverty						
Head-count ratio	0.64 (0.42)	0.71	0.37 (0.29)	0.52	0.61 (0.40)	0.68
Poverty gap	0.27	0.38	0.13	0.23	0.26	0.36
Poverty severity	0.15	0.26	0.06	0.14	0.15	0.24
Extreme poverty						
Head-count ratio	0.52 (0.25)	0.60	0.20 (0.10)	0.37	0.48 (0.22)	0.56
Poverty gap	0.21	0.30	0.06	0.14	0.19	0.28
Poverty severity	0.11	0.19	0.03	0.08	0.11	0.18
	Per adult-equivalent income- or consumption-based measures					
General poverty						
Head-count ratio	0.50 (0.42)	0.61	0.27 (0.28)	0.42	0.48 (0.44)[a]	0.58
Poverty gap	0.20 (0.15)	0.31	0.08 (0.09	0.17	0.19 (0.14)	0.28
Poverty severity	0.10 (0.08)	0.20	0.04 (0.04)	0.09	0.10 (0.07)	0.18
Extreme poverty						
Head-count ratio	0.36 (0.25)	0.47	0.10 (0.10)	0.23	0.33 (0.22)	0.45
Poverty gap	0.13 (0.08)	0.22	0.03 (0.02)	0.09	0.12 (0.07)	0.21
Poverty severity	0.06 (0.04)	0.14	0.01 (0.01)	0.05	0.07 (0.03)	0.13

Source: Authors' calculations based on welfare monitoring survey 1994 (see annex 2 about the method used)

C-b – consumption-based; I-b – income based

Values in parentheses are computed by the government of Kenya (Kenya 1998, 2000) using internal consumption weights.

[a] The 40.25 figure in the 1998 report was adjusted to 43.7 in the 2000 version.

alternatives policies. To that end, we examine the main PRSP tenets. From our examination, we draw conclusions that will motivate our search for determinants of poverty and their policy implications.

2 The Poverty Reduction Strategy Paper and Poverty Determinants

The Poverty Reduction Strategy Paper is tied to a three-year Medium-Term Expenditure Framework budgeting approach. This budgeting framework in turn is linked to fiscal outcome, growth targets and projected developments in the world economy. Thus at macro level, policies geared towards improving the overall domestic economy are instruments in addressing the poverty issue. In PRSP, the following major components of the strategy are identified as important fundamentals for reducing poverty: accelerated economic growth, good governance, social security, increasing the ability of the poor to raise their incomes, improving equity and the quality of life, and increasing the participation of marginalized groups in the development process. This list is fundamentally similar to the strategy outlined in the recent World Bank report that suggests addressing the issue of reducing poverty through three dimensions of action: promoting opportunity, facilitating empowerment and enhancing security (World Bank 2000).

PRSP identifies landlessness and lack of education, the prevalence of sickness, declining level of attending schools (which is identified as influenced by the cost of education), low productivity, inequitable access to land and capital, and vulnerability (especially women's vulnerability to poverty) as major development problems. Identifying these factors, although an important task in itself, needs to be complemented by quantifying their effects on poverty status of households. Empirical analysis, such as the one we are carrying out in this study, helps not only to examine the validity of these factors but also their relative importance in determining the state of poverty. It might also lead to identifying other factors that are not explicitly addressed in the current strategy. Identifying the above-mentioned relative importance is crucial for policy

prioritization, given that the factors might be associated with particular policy measures. This study, combined with other studies at KIPPRA, should provide a concrete input into the design of appropriate social policy in Kenya.

After identifying these poverty-related characteristics, PRSP outlines in detail the components of the strategy, aimed at addressing the poverty problem. For the purpose of this paper, these components can be classified into two broad categories. The first comprises components of the strategy that can directly benefit from the present study: 'economic growth and macro stability', 'ability of the poor to raise their income', 'improving equity and the quality of life'. The other component, which comprises 'governance' and 'sectoral policies', may not directly benefit from this particular study, but can be informed, in combination with other studies at KIPPRA, by the results of our study. In what follows, we concentrate on the first category of issues and their links to the present study

Economic growth and macroeconomic stability. Sustained and credible macro policies, fiscal discipline and reduction of cost of doing business in Kenya are identified as issues worth of attention in this PRSP component. At the centre of realizing the objective of growth-cum-macroeconomic stability is prioritizing public expenditure. Obviously the reference point for prioritization is the expected impact this activity has on poverty. Questions such as 'do we need to spend on priority activity one or two?' need to be answered in reference to their expected impact on poverty. Thus, identifying determinants of poverty is central to informing such an expenditure prioritization. At a later stage, all efforts should be combined to better inform policy-making and policy-implementation processes.

Raising income opportunities of the poor. This strategy emphasizes deliberate intervention by the state to improve for the poor their access to resources and their opportunity to

acquire skills. Access to employment and growth in the agricultural sectors are identified as important ingredients of this component of the strategy. Thus, this strategy contemplates not only focusing on self-employment, but also emphasizing sectoral policies believed to have significant impact on reducing poverty. All these efforts may have an impact on raising incomes and earnings of the poor. The latter in turn depends on the household's access to learning skills, through education and training. This study may help to inform policy-making by examining the relative importance of these and related factors and identifying the major characteristics of the household that are responsible for the state of poverty observed in the country.

Improving quality of life. This component focuses on providing social services deemed essential for the poor. These services are in general related to issues such as education and health. This study, to some degree, investigates how these factors are related to poverty. Based on complementary studies at KIPPRA and from the literature on social services, we may also be able to explain why the demand for these services is declining. The policy-making process will be enriched with the provision of specific information about the causes of poverty and how these causes can be addressed.

Equity and participation. This component of the strategy is closely related to the quality of life issue discussed above. This component, however, squarely focuses on inequality of income and the spatial variation of poverty in the country. This study may help to examine the impact of inequality and spatial differences in determining the likelihood of being poor. Such identification is important in the policy prioritization—and hence in targeting the poor.

One major weakness in the government's PRSP is lack of in-depth information for the purpose of monitoring the strategy. Proper realization of the poverty reduction task requires timely and closer monitoring of poverty. In PRSP, the generation of

the data and poverty indicators by Central Bureau of Statistics, the link between implementation and the budgetary process, and the participation of stakeholders are explicitly emphasized. However, the institutional set-up for that process is not adequately spelled out. The need for analytical work for monitoring, in particular, is neglected or not explicitly emphasized. This study, by laying the foundation for analytical work on an in-depth understanding of poverty and by establishing benchmark conditions for poverty monitoring, should help government's efforts to realize its poverty reduction goals.

Another concern of the government relates to distinction among the categories of the poor. Hence, poverty-related documents of the government of Kenya emphasize not only the poor in general but also the category of extremely poor (see Kenya 1998, 2000). This points to the importance of focusing on these categories in policy analysis. Thus this study explicitly addresses and analyses the conditions of both the moderately poor and the extremely poor so as to inform policy making in this area.

In sum, because of the all-encompassing nature of PRSP, the present study cannot address all the issues involved in it. PRSP provides us with issues that need to be examined in detail to inform policy formulation. The prerequisite for policy intervention is sound empirical information on issues on which action is required, with a framework in place for monitoring results.

3 Theoretical Background

3.1 Previous studies

Analytical work on determinants of poverty in Kenya is at best scanty. Most of the available studies are descriptive and focus

mainly on measurement issues. Historical poverty studies focused on a discussion of inequality and welfare based on limited household-level data; see for instance House and Killick (1981), Hazlewood (1981) Bigsten (1981). Thus our review is based on the few recent studies in the country that follow an analytical approach similar to our own. One recent comprehensive study on the subject is that of Mwabu et al. (2000). The study deals with measurement, profile and determinants of poverty. The method employed to understand those determinants is household welfare (proxied by household expenditure per adult equivalent). The authors run two categories of regression, using *overall* expenditures and *food* expenditures as dependent variables. They estimate overall expenditures using three equations, which differ by the type of dependent variable: 1) total household expenditure, 2) total household expenditure gap (the difference between the absolute poverty line and the actual expenditure) and 3) the squared gap. A similar set of dependent variables is used for food expenditure, with the explanatory variables being identical in all cases.

Mwabu et al. (2000) justified their choice for this approach (rather than a logit–normit model) as follows. First, the two approaches (discrete or continuous choice-based regressions) yield basically similar results (see below, however); second, the logit–normit model involves unnecessary loss of information in transforming household expenditure into binary variables. Although the specification that Mwabu et al. (2000) used is simple and easy to follow, it has certain inherent weaknesses. One obvious weakness is that, unlike the logit–probit model, the levels regression cannot directly give us a probabilistic statement about poverty. Second, the major assumption of the welfare function approach is that consumption expenditures are negatively associated with absolute poverty at all expenditure levels. Thus factors that increase consumption expenditure reduce poverty. However, this basic assumption needs to be taken cautiously. For instance, an increase in the consumption

expenditure of households that are already above the poverty line will increase welfare but it will leave the poverty level (as for example measured by the head-count ratio) unchanged.

Notwithstanding such weaknesses, the approach is widely used in poverty analysis and is informative. The Kenyan study by Mwabu et al. (2000) identified the following variables as important in explaining poverty: unobserved region-specific factors, mean age, size of household, residence (rural versus urban), level of schooling, livestock holding, and sanitary conditions. The importance of these variables does not change whether the total, the gap or the square of the gap is taken as the dependent variable. The only noticeable change is that the sizes of the estimated coefficients are enormously reduced in the expenditure gap and in the square of the expenditure gap specifications of the estimated equations. Moreover, except for minor changes in the relative importance of some of the variables, the pattern of coefficients remain fundamentally unchanged when the regressions are run for the food expenditure, as opposed to the total expenditure indicator of welfare.

Another recent study on the determinants of poverty in Kenya is by Oyugi (2000), who justifies her study as an extension to earlier work by Greer and Thorbecke (1986a,b). The latter study used household calorie consumption as the dependent variable and a limited number of household characteristics as explanatory variables. Oyugi (2000) used both discrete and continuous indicators of poverty as dependent variables and employed a much larger set of household characteristics as explanatory variables. Moreover, she carried out the study at both micro (household) and meso (district) levels, with the meso-level analysis being the innovative component of her study.

Oyugi (2000) used a probit model in her analysis of discrete poverty. The model is estimated using data from the household

rather than the individual. The dependent variable in the model is the poverty status, a binary variable derived using poverty lines established by Mwabu et al. (2000). This dependent variable is computed at national, rural and urban levels. The explanatory variables (household characteristics) include holding area; livestock unit; proportion of household members able to read and write; household size; work in agriculture or in the manufacturing and industrial sector, or in wholesale or retail trade; source of water for household use; and presence or absence of off-farm employment. The study is based on the 1994 Welfare Monitoring Survey data.

The results of Oyugi's probit analysis show that almost all variables used and noted above are important determinants of poverty in rural areas and overall nationally, but that there are important exceptions in urban areas (Oyugi 2000). The probit results are consistent with results obtained from the meso-level regression analysis.

It is interesting to compare the implications of the levels and the probit regressions approaches. From the levels regressions (the welfare function model), the results show that age, household size, residence, reading and writing, and level of schooling are the top five important determinants of poverty at the national level. In the probit model, however, the key determinants in order of importance are reading and writing, employment in off-farm activities, agriculture, having a side-business in the service sector, source of water, and household size. Region of residence appears to be equally important in determining poverty status in both approaches. Although the two approaches did not employ the same explanatory variables, this comparison points to the possibility of getting different policy conclusions according to which approach is used.

The above brief literature review shows that our study is enriched by relevant previous studies. These studies have facilitated identification of the explanatory variables we use.

The Oyugi (2000) study has shown that results from meso- and household-level analyses do not differ substantially, a result that lends support to our household-level analysis.

3.2 Theoretical model

As mentioned earlier, the general approach we follow is intended to explain why a particular population group is non-poor, poor, or extremely poor. The motivation is our desire to generate information that will assist the government to focus in its poverty alleviation strategies, not just on the poor in general, but in particular on the hard-core poor (the extremely poor). Explaining why some individuals are non-poor, poor, or extremely poor is best done with ordered probit or logit. This approach is justifiable, because we explicitly order the population sub-samples, using poverty lines as cut-off points in a cumulative distribution of expenditure. We identify different population subgroups in several stages. In the first stage, we identify the poor and the non-poor. In the second stage, we examine the probability of being extremely poor once a person is identified as poor. That is, we also compute the probability of being in hard-core poverty. This poverty identification process is displayed in figure 1.

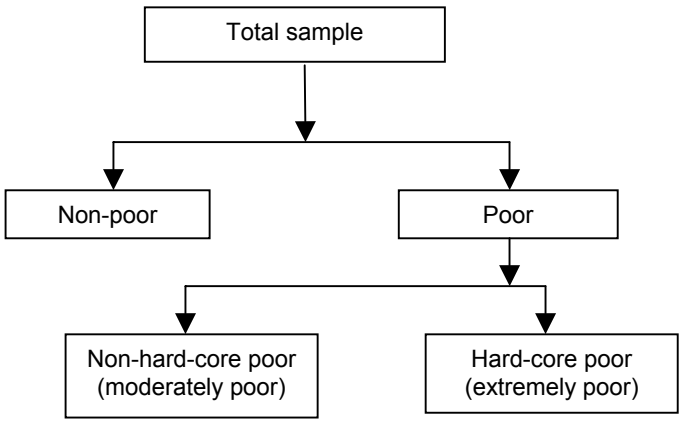

Figure 1. A nested structure of poverty status.

A formal analysis of the relative importance of various factors associated with the likelihood of being in each of the above categories of poverty can be carried out with the help of probability models such as logit or probit–normit. This approach rests on the assumption that the probability of being in a particular poverty category is determined by an underlying response variable. In the case of a binary poverty status, let the underlying response variable *y** be defined by the regression relationship:

$$y_i^* = \Sigma x'_i \beta + u_i \qquad [1]$$

where $\beta' = [\beta_1, \beta_2 ... \beta_k]$ and $x'_i = [1, x_{i2}, x_{i3} ... x_{ik}]$

In equation 1, *y** is not observable, as it is a latent variable. What is observable is an event represented by a dummy variable *y* defined by

$y = 1$ if $y^* > 0$, and
$y = 0$ otherwise [2]

From equations 1 and 2 we can derive the following expression:

$$\begin{aligned} \Pr ob(y_i = 1) &= \Pr ob\left(u_i > -\sum X_i \beta_i\right) \\ &= 1 - F\left(-\sum X_i \beta_i\right) \end{aligned} \qquad [3]$$

where F is the cumulative distribution function for u_i and $\Pr(y_i = 0 | \beta, x_i) = F(-\Sigma x'_i \beta)$.

The observed values of *y* are the realization of the binomial with probabilities given by equation 3, which varies depending on x_i. Thus, the likelihood function could be given by

$$L = \prod_{y_i=0} \left[F\left(-\Sigma X'_i \beta\right) \right] \prod_{y_i=1} \left[1 - F\left(-\Sigma X'_i \beta\right) \right] \qquad [4a]$$

which can be written as

$$L = \prod_{y_i=1} \left[F\left(-\Sigma X'_i \beta\right) \right]^{1-y_i} \left[1 - F\left(-\Sigma X'_i \beta\right) \right]^{y_i} \qquad [4b]$$

The functional form imposed on F in equation 4[1] depends on the assumptions made about u_i in equation 1, which are the basis for the distinction between *logit* and *probit (normit)* models. If the cumulative distribution of u_i is logistic, we will have the *logit model*, whereas, the *probit (normit) model* results from the assumption that u_i is normally distributed.

The cumulative normal and logistic distributions are very close to each other. Thus using one or the other will not result in substantial differences (see Maddala 1983). Moreover, following Amemiya (1981), it is possible to derive the would-be estimates of a probit model once we have parameters derived from the logit model. Thus the logit model is used in this study.[2]

The logit model for this study can readily be derived by assuming a logistic cumulative distribution of u_i in F (in equations 4a and 4b). The relevant logistic expressions are:

$$1 - F\left(-\Sigma x'_i\ \beta\right) = \frac{e^{\sum X'_i \beta}}{1 + e^{\sum X'_i \beta}} \qquad [5a]$$

$$F\left(-\Sigma x'_i\ \beta\right) = \frac{e^{-\sum X_i' \beta}}{1 + e^{-\sum X'_i \beta}} = \frac{1}{1 + e^{-\sum X'_i \beta}} \qquad [5b]$$

As before, $\mathbf{x}_i$ are the characteristics of the households or individuals, and β_i the coefficients for the respective variables in the logit regression. As we have estimated equation 4 by the maximum likelihood (ML) technique, equation 5a basically

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[1] The log likelihood function for expression 4a and 4b can be simplified as

$$l(\beta) = \log L(\beta) = \sum_{i=0}^{n} y_i \log\left(1 - F(-\Sigma x'_i\ \beta)\right) + (1 - y_i) \log F(-\Sigma x'_i\ \beta)$$

[2] In a wider context, using a logit model allows us to bring out patterns in the data that might be obscured if we used proportions and percentages (Mukherjee et al. 1998). As noted by Tukey (1977), cited in Mukherjee et al. 1998) logits are 'first aid bandages'. Thus they can help wrap various factors in a meaningful form.

gives us the probability of being poor [Prob ($i = 1$)] and equations [5b] the probability of being non-poor [Prob ($i = 0$)].

After modelling the process that generates the poor or the non-poor status, we focus attention on the hard-core poor. This can be handled using a polychotomous model. We explicitly determined the cut-off points for poverty categories and classified population groups into non-poor, moderately poor and extremely poor using total and food poverty lines. Since these categories have a natural order, the ordered logit is the appropriate model to employ (see Maddala 1983; Amemiya 1985; Greene 1993) in the estimation of relevant probabilities.[3]

Assuming three categories (1, 2 and 3 and associated probabilities P_1, P_2 and P_3), an individual would fall in category 3 if $u < \beta' x$, in category 2 if $\beta' x < u \leq \beta' x + \alpha$; and in category 1 if $u \geq \beta' x + \alpha$, where $\alpha > 0$ and u, the error term in the underlining response model (see equation 1). These relationships may be formalized as follows:

$$\begin{aligned} P_3 &= F(\beta' x) \\ P_2 &= F(\beta' x + \alpha) - F(\beta' x) \\ P_1 &= 1 - F(\beta' x + \alpha) \end{aligned} \qquad [6]$$

where the distribution F is logistic in the ordered logit model. This can easily be generalized for m categories (see Maddala 1983). Assuming the underlying response model is given by

$$Y_i = \beta' x_i + u_i \qquad [7]$$

we can define a set of ordinal variables as

$Z_{ij} = 1$ if Y_i falls in the j^{th} category

[3] Given the nested nature of the categories in our model, nested model seems also a relevant approach. However, such models are relevant in the context when agents make choices and there is dependence among choices. Since our categories do not refer to choices being made, we have opted for the ordered logit model (see Maddala 1983:70).

$Z_{ij} = 0$ otherwise ($I = 1,2 ..., n; j = 1,2\ldots, m$)

$$\Pr ob(Z_{ij} = 1) = \Phi(\alpha_j - \beta' x_i) - \Phi(\alpha_{j-1} - \beta' x_i) \quad [8]$$

Where Φ is the cumulative logistic distribution and the α_i's are the equivalents of the α's in equation 6. The likelihood and log-likelihood functions for the model could be given by equations 9 and 10 respectively as

$$L = \prod_{i=1}^{n}\prod_{j=1}^{m}\left[\Phi(\alpha_j - \beta' x_i) - \Phi(\alpha_{j-1} - \beta' x_i)\right]^{Z_{ij}} \quad [9]$$

$$L^* = \log L = \sum_{i=1}^{n}\sum_{j=1}^{k} Z_{ij} \log \Phi\left[(\alpha_j - \beta' x_i) - \Phi(\alpha_{j-1} - \beta' x_i)\right] \quad [10]$$

Equation 10 can be maximized in the usual way (by setting its partial derivates to zero) and can be solved iteratively by numerical methods to yield the maximum likelihood estimates (see Maddala 1983).

4 Empirical Analysis and Results

4.1 The data

The data used are based on the 1994 Welfare Monitoring Survey. These data were collected for the whole country and covered nearly ten thousand households, comprising about sixty thousand individuals (see Mwabu et al. 2000). Although the quality of the data we use is in general relatively high, two factors need to be borne in mind in using the results derived from them. First, the results might be affected by the seasonal effect on household expenditure, since no control was used for seasonality while the data were being collected. Second, some districts, especially those from North Eastern Province, may be underrepresented in the sample.[4]

[4] Because of security and related problems about 7% of the arid and semi-arid districts were not visited.

4.2 Estimation results

We have used a comprehensive list of explanatory variables, which may be grouped into the following categories: *property-related* (such as land and livestock holding); *household characteristics* such as status of employment, age, gender, educational level, household size; and *other*, such as time spent to fetch water and to obtain energy, residence of the household—whether rural or urban, or in a particular province (table 2).

The estimation was made after inflating the number of households in the sample (about 10,000) to that in the total population (nearly 26 million), using sample weights. The household characteristics are assumed to affect members of the household equally. The fundamental rationale behind the choice of a household as a unit of analysis is the assumption that resources are shared in the household. The sample weight is, however, adjusted downward when it is used for adult-equivalent-based estimation—so as to reflect the fact that children would need fewer resources than adults to satisfy basic needs.

4.3 Estimation results: binomial logit—poor versus non-poor

The estimation was carried out for models with four different types of dependent variables: poverty defined on the basis of 1) income per capita and 2) per adult equivalent, and poverty defined on the basis of 3) consumption per capita and 4) per adult equivalent. Estimates from these four models exhibit similar signs, although the magnitudes of coefficients differ substantially across models (see annex 1).

According to the estimation results, male-headed households are less likely to be poor. Similarly, the likelihood of being poor is smaller in urban than in rural areas. Probably to some extent related to this, people living in households mainly engaged in agricultural activities are more likely to be poor. In all the

Table 2. Definitions of variables used in estimating regression models

Variables	Definition	Symbol in the estimated equation	Mean	Std dev.
Dependent variable				
Poverty	P = 1 if poor, 0 otherwise; poverty estimate based on ypc (_ypae) income per capita (per adult equiv.) or cpc (_cpae) consumption per capita (per adult equiv.)	p_0_ypc, p_0_cpc p_0_ypae, p_0_cpae in binomial logit model; pm_ypc, pm_cpc pm_ypae, pm_cpae in ordered logit model		
Explanatory variables		Symbols used	Mean	Std dev.
Sex	= 1 if male, 0 otherwise	Sexd	0.75	0.43
Age and age square	years	Age, Age2	43.11	14.30
Member can read and write	= 1 if yes, 0 otherwise	Canrewte	0.64	0.48
Marital status	= 1 if married and mono-gamous, 0 otherwise;	Marymono	0.69	0.46
	= 1 if married and polygamous, 0 otherwise	Marypoly	0.10	0.30
Employment sector	= 1 if formal or public, 0 otherwise	Empsecd	0.27	0.45
Main occupation of member	= 1 if in agriculture (commercial farmer, subsistence farmer, pastoralist), 0 otherwise	Occpd	0.56	0.50
Highest level attained (three categories: primary, secondary, university)	= 1 if in primary (standard 1–8 and KCPE); 0 otherwise	Primard	0.37	0.42
	= 1 if in secondary and certificate (form 1–4, KCE/KCSE/KAC, trade test cert I–III, other post-secondary cert.); 0 otherwise	Secondd	0.23	0.48
	= 1 if university degree, 0 otherwise	Univdd	0.01	0.10
Area of residence	= 1 if rural, 0 otherwise	Urbrur	0.84	0.36
Total holding of land	in acres	Toholnow	3.98	0.31
Number of animals owned	livestock units	Animanow	14.60	56.98

Provincial dummies: Coast for Coast Province; RiftV for Rift Valley; Western for Western; Eastern for Eastern; NEast for North Eastern, Nyanza for Nyanza, Central for Central

models, the most influential factor as to poverty status is the level of education. The effects of this variable are similar across

the four models. The coefficient for household size is almost twice as high in the consumption-based as in the income-based models, while the impact of employment and of the number of animals owned is insignificant in the consumption-based models. Total holding of land does not seem to be important in any of the specifications. An explanation for this may lie in the importance of the quality of land and the lack of complementary agricultural inputs. Tables 3 and 4 report the marginal effects of each explanatory variable on the probability of being poor based on per adult-equivalent models for income and consumption-based measures of poverty. The full model estimation results using per capita income and consumption are reported in annex 1.

Table 3. Marginal effects: income per adult-equivalent model

Variable	dy/dx	Std. error	Z	P > |z|
Sexd*	–0.042	0.024	–1.75	0.08
Marymono*	0.033	0.027	1.23	0.22
Marypoly*	–0.005	0.033	–0.15	0.88
Occpd*	0.187	0.023	8.07	0.00
Empsecd*	0.034	0.026	1.33	0.19
Primard*	–0.069	0.021	–3.26	0.001
Secondd*	–0.245	0.023	–10.44	0.00
Univdd*	–0.475	0.037	–12.78	0.00
Hhsize	0.028	0.004	7.17	0.00
Animanow	–0.001	0.000	–4.58	0.00
Toholnow	0.000	0.000	–0.24	0.80
Urbrur	–0.031	0.029	–1.06	0.29
Age	–0.003	0.003	–1.09	0.28
Age2	0.000	0.000	0.64	0.52
Coast*	0.018	0.064	0.28	0.78
RiftV*	–0.002	0.057	–0.03	0.98
Western*	0.087	0.062	1.41	0.16
Eastern*	0.065	0.059	1.10	0.27
NEast*	–0.016	0.074	–0.22	0.83
Nyanza*	0.022	0.058	0.38	0.70
Central*	–0.022	0.058	–0.37	0.71

* dy/dx is for discrete change of dummy variable from 0 to 1

Table 4. Marginal effects: consumption per adult-equivalent model

Variable	dy/dx	Std. error	Z	P > |z|
Sexd*	–0.033	0.022	–1.49	0.14
Marymono*	0.014	0.025	0.55	0.58
Marypoly*	–0.034	0.033	–1.04	0.30
Occpd*	0.088	0.022	3.94	0.00
Empsecd*	0.001	0.024	0.04	0.97
Primard*	–0.076	0.019	–3.95	0.00
Secondd*	–0.230	0.021	–11.07	0.00
Univdd*	–0.350	0.030	–11.72	0.00
Hhsize	0.051	0.004	13.74	0.00
Animanow	0.000	0.000	–1.01	0.31
Toholnow	–0.003	0.001	–2.44	0.02
Urbrur	0.031	0.034	0.92	0.36
Age	0.008	0.003	2.70	0.01
Age2	0.000	0.000	–2.02	0.04
Coast*	–0.033	0.075	–0.44	0.66
RiftV*	–0.022	0.075	–0.29	0.77
Western*	0.101	0.082	1.23	0.22
Eastern*	0.065	0.080	0.81	0.42
NEast*	–0.138	0.080	–1.74	0.08
Nyanza*	0.000	0.078	0.00	1.00
Central*	–0.086	0.074	–1.17	0.24

* dy/dx is for discrete change of dummy variable from 0 to 1

4.4 The rural–urban dimension of poverty

Following the finding that place of residence is associated with level of poverty, we have fitted the model to data for rural and urban areas separately. The marginal effects derived from such models are given in tables 5 to 8; the full model results are shown in annex 1. In general, the results show that the factors strongly associated with poverty (level of education, household size, engagement in agricultural activities) are the same in both rural and urban areas. However, the sizes of the coefficients associated with these regressors are larger in rural areas. Moreover, polygamous marriage seems to worsen poverty in urban more than in rural areas. This may indicate that labour

Table 5. Marginal effects: income per adult-equivalent model for rural sub-sample

Variable	dy/dx	Std. error	Z	P > |z|
Sexd*	–0.037	0.026	–1.42	0.16
Marymono*	0.047	0.031	1.53	0.13
Marypoly*	–0.028	0.036	–0.76	0.45
Occpd*	0.198	0.026	7.72	0.00
Empsecd*	0.048	0.030	1.58	0.12
Primard*	–0.068	0.022	–3.08	0.00
Secondd*	–0.246	0.025	–9.78	0.00
Univdd*	–0.457	0.051	–8.93	0.00
Hhsize	0.029	0.004	6.79	0.00
Animanow	–0.001	0.000	–4.67	0.00
Toholnow	0.000	0.000	0.08	0.94
Age	–0.001	0.003	–0.41	0.68
Age2	0.000	0.000	0.15	0.88
Coast*	–0.013	0.066	–0.20	0.85
RiftV*	–0.043	0.052	–0.82	0.41
Western*	0.042	0.061	0.69	0.49
Eastern*	0.029	0.056	0.51	0.61
Nyanza*	–0.012	0.055	–0.21	0.83
Central*	–0.061	0.056	–1.09	0.28

* dy/dx is for discrete change of dummy variable

input is more important in rural areas than in urban areas. This result does not seem to hold in the consumption-based estimation, however. The consumption-based estimation exhibits fairly similar results about determinants of poverty, particularly with regard to educational attainment. The coefficients obtained in the latter model are relatively weaker, however. Moreover, factors such as age, size of land holding (albeit with very small coefficients) are found to be statistically significant in this version of the model. Regional dummies for Western and Eastern Provinces that are virtually insignificant in the income-based model are found to be statistically significant in the consumption-based version of the model for rural areas. Working in the urban modern sector seems to reduce the

Table 6. Marginal effects: income per adult-equivalent model for the urban subsample

Variable	dy/dx	Std. error	Z	P>|z|
Sexd*	–0.120	0.055	–2.18	0.03
Marymono*	–0.013	0.052	–0.25	0.80
Marypoly*	0.228	0.095	2.40	0.02
Occpd*	0.249	0.078	3.20	0.00
Empsecd*	0.012	0.045	0.28	0.78
Primard*	–0.017	0.070	–0.24	0.81
Secondd*	–0.190	0.067	–2.84	0.00
Univdd*	–0.362	0.045	–8.03	0.00
Hhsize	0.031	0.009	3.42	0.00
Animanow	–0.001	0.001	–2.05	0.04
Toholnow	–0.009	0.007	–1.30	0.19
Age	–0.002	0.011	–0.22	0.83
Age2	0.000	0.000	–0.20	0.84
Coast*	0.047	0.078	0.61	0.54
Riftv*	0.046	0.061	0.76	0.45
Western*	0.220	0.080	2.76	0.01
Eastern*	–0.033	0.066	–0.49	0.62
Neast*	–0.175	0.064	–2.72	0.01
Nyanza*	0.000	0.063	–0.01	0.99
Central*	0.006	0.067	0.09	0.93

(*) dy/dx is for discrete change of dummy variable

likelihood of being poor (although only with the consumption-based model).

4.5 Estimation results of the ordered logit model

Following the theoretical discussion in section 3.2 above, we have divided the sample into three categories: non-poor (category 1), moderately poor (category 2) and hard-core or extremely poor (category 3). This classification is based on the poverty and food poverty lines (see annex 3).

The marginal effects of the regressors for the income-based models are given in tables 9 and 10 and consumption-based in tables 11 and 12 (see annex 2 for the full estimation results).

Table 7. Marginal effects: consumption per adult-equivalent model for rural subsample

Variable	dy/dx	Std. error	z	P>|z|
Sexd*	–0.040	0.023	–1.71	0.09
Marymono*	0.031	0.027	1.15	0.25
Marypoly*	–0.041	0.035	–1.18	0.24
Occpd*	0.101	0.023	4.28	0.00
Empsecd*	0.034	0.027	1.23	0.22
Primard*	–0.083	0.021	–4.06	0.00
Secondd*	–0.238	0.023	–10.54	0.00
Univdd*	–0.391	0.028	–13.71	0.00
Hhsize	0.053	0.004	13.63	0.00
Animanow	0.000	0.000	–0.97	0.33
Toholnow	–0.002	0.001	–2.14	0.03
Age	0.008	0.003	2.50	0.01
Age2	0.000	0.000	–1.63	0.10
Coast*	0.093	0.071	1.32	0.19
Riftv*	0.066	0.057	1.16	0.25
Western*	0.200	0.066	3.02	0.00
Eastern*	0.169	0.062	2.71	0.01
Nyanza*	0.098	0.065	1.51	0.13
Central*	0.002	0.063	0.02	0.98

* dy/dx is for discrete change of dummy variable

These four tables show that the consumption-based model is substantially different from the income-based model; it exhibits regressors with statistically significant coefficients as well as weaker explanatory effects in category 1 (non-poor) and category 2 (poor).[5]

In general, it is interesting to note that the factors that are important in the binomial model are still important in the ordered model. More importantly, by comparing the marginal effects for categories 2 and 3, we note that these variables are

[5] The marginal coefficients for category 3 (extremely or hard-core poor) are not reported as they could be derived from the sum of the three, which should add to zero. This is because the probabilities of falling in any one of the three categories adds up to one.

Table 8. Marginal effects: consumption per adult-equivalent model for the urban subsample

Variable	dy/dx	Std. error	Z	P > |z|
Sexd*	–0.013	0.053	–0.24	0.81
Marymono*	–0.039	0.053	–0.72	0.47
Marypoly*	0.007	0.086	0.08	0.94
Occpd*	0.239	0.092	2.60	0.01
Empsecd*	–0.064	0.034	–1.86	0.06
Primard*	–0.023	0.049	–0.48	0.63
Secondd*	–0.158	0.049	–3.21	0.00
Univdd*	–0.188	0.028	–6.74	0.00
Hhsize	0.037	0.007	5.42	0.00
Animanow	0.001	0.001	0.74	0.46
Toholnow	–0.014	0.008	–1.88	0.06
Age	0.026	0.008	3.21	0.00
Age2	0.000	0.000	–3.31	0.00
Coast*	–0.057	0.045	–1.25	0.21
Riftv*	0.043	0.065	0.66	0.51
Western*	0.126	0.116	1.09	0.27
Eastern*	–0.026	0.076	–0.34	0.73
Neast*	–0.188	0.027	–6.95	0.00
Nyanza*	0.050	0.082	0.61	0.54
Central*	0.013	0.066	0.19	0.85

* dy/dx is for discrete change of dummy variable

much more important in tackling hard-core poverty than moderate poverty.

The ordered logit model is estimated for rural and urban sub-samples too (see annex 2). Basically the results are similar to those obtained for the national sample. However, we observe interesting differences. First, although secondary and university level education are important in both rural and urban areas, primary education is found to be extremely important in rural areas. Second, agriculture as the main occupation is associated with poverty more in urban than in rural areas. This may indicate that the poorer you are in an urban area the more likely you attempt to eke a living out of agriculture. Third, the negative impact of aging is stronger in urban than in rural areas.

Table 9. Marginal effects: income per adult-equivalent model (probability of being non-poor)

Variable	dy/dx	Std. error	Z	P > |z|
Sexd*	0.041	0.023	1.81	0.07
Marymono*	–0.038	0.025	–1.50	0.13
Marypoly*	–0.002	0.031	–0.05	0.96
Occpd*	–0.199	0.022	–8.97	0.00
Empsecd*	–0.024	0.024	–0.99	0.32
Primard*	0.077	0.020	3.86	0.00
Secondd*	0.256	0.022	11.55	0.00
Univdd*	0.478	0.036	13.20	0.00
Hhsize	–0.028	0.004	–7.82	0.00
Animanow	0.001	0.000	4.62	0.00
Toholnow	0.000	0.000	1.08	0.28
Urbrur	–0.004	0.026	–0.15	0.88
Age	0.002	0.003	0.77	0.44
Age2	0.000	0.000	–0.21	0.84
Coast*	–0.014	0.058	–0.25	0.80
Riftv*	0.013	0.053	0.25	0.81
Western*	–0.090	0.056	–1.59	0.11
Eastern*	–0.070	0.055	–1.27	0.20
Neast*	0.013	0.069	0.19	0.85
Nyanza*	–0.004	0.054	–0.07	0.95
Central*	0.043	0.054	0.80	0.42

* dy/dx is for discrete change of dummy variable from 0 to 1

This may reflect the collapse of the extended family network in urban areas, which normally serves as an insurance scheme in Africa. Finally, urban poverty is worst in Western and North Eastern Provinces.

The ordered logit estimation of income-based models also shows that nationally the probability of falling into the non-poor category is 42%, into the moderately poor 13%, and into the extremely poor 45%. The figures for rural areas are similar; for urban areas they are 58, 19 and 23%. This basically shows that for a poor Kenyan residing in a rural area the probability of falling into extreme poverty is much greater than for an urban

Table 10. Marginal effects: income per adult-equivalent model (probability of being moderately poor)

Variable	dy/dx	Std. error	Z	P > |z|
Sexd*	0.000	0.000	–0.83	0.41
Marymono*	0.001	0.001	1.08	0.28
Marypoly*	0.000	0.001	0.05	0.96
Occpd*	0.006	0.002	3.23	0.00
Empsecd*	0.000	0.000	1.10	0.27
Primard*	–0.002	0.001	–2.15	0.03
Secondd*	–0.023	0.004	–5.77	0.00
Univdd*	–0.109	0.013	–8.32	0.00
Hhsize	0.001	0.000	1.92	0.06
Animanow	0.000	0.000	–1.78	0.08
Toholnow	0.000	0.000	–0.98	0.33
Urbrur	0.000	0.001	0.15	0.88
Age	0.000	0.000	–0.72	0.47
Age2	0.000	0.000	0.21	0.84
Coast*	0.000	0.000	0.47	0.64
Riftv*	0.000	0.001	–0.21	0.83
Western*	–0.002	0.004	–0.53	0.60
Eastern*	0.000	0.002	–0.24	0.81
Neast*	0.000	0.002	–0.15	0.88
Nyanza*	0.000	0.001	0.07	0.94
Central*	–0.002	0.003	–0.55	0.58

(*) dy/dx is for discrete change of dummy variable from 0 to 1

counterpart. A similar pattern is observed when the ordered logit estimation is derived using consumption-based data. However, the probability for the first category in general declines while that for the third category rises. This information is summarized in table 13. The details are shown in annex 2.

5 Policy Implications

In this paper we explore the determinants of poverty in Kenya. We have employed both binomial and polychotomous logit models using 1994 Welfare Monitoring Survey data. Although a

Table 11. Marginal effects: consumption per adult-equivalent model (probability of being non-poor)

Variable	dy/dx	Std. error	Z	P > |z|
Sexd*	0.025	0.021	1.20	0.23
Marymono*	–0.014	0.024	–0.60	0.55
Marypoly*	0.029	0.031	0.92	0.36
Occpd*	–0.075	0.022	–3.40	0.00
Empsecd*	0.005	0.024	0.20	0.84
Primard*	0.101	0.018	5.58	0.00
Secondd*	0.248	0.020	12.29	0.00
Univdd*	0.356	0.026	13.80	0.00
Hhsize	–0.048	0.003	–14.91	0.00
Animanow	0.000	0.000	0.97	0.33
Toholnow	0.003	0.001	2.55	0.01
Urbrur	–0.069	0.032	–2.19	0.03
Age	–0.010	0.003	–3.26	0.00
Age2	0.000	0.000	2.77	0.01
Coast*	0.039	0.069	0.56	0.57
Riftv*	0.022	0.070	0.31	0.75
Western*	–0.092	0.075	–1.22	0.22
Eastern*	–0.070	0.074	–0.94	0.35
Neast*	0.143	0.074	1.94	0.05
Nyanza*	0.007	0.072	0.10	0.92
Central*	0.093	0.068	1.36	0.17

(*) dy/dx is for discrete change of dummy variable from 0 to 1

number of specific conclusions can be drawn from the dozen or so estimation results we report, the following major points stand out as policy implications of the study.

First, as expected, we have found that poverty is concentrated in rural areas in general and in the agricultural sector in particular. Being employed in the agricultural sector explains a good part of the probability of being poor. Thus, investing in this sector in ways that reduce poverty should be a matter of great priority. Moreover, the finding that the size of land holding is not important may suggest the importance not only

Table 12. Marginal effects: consumption per adult-equivalent model (probability of being moderately poor)

Variable	dy/dx	Std. error	Z	P > |z|
Sexd*	–0.006	0.005	–1.22	0.22
Marymono*	0.004	0.006	0.59	0.55
Marypoly*	–0.007	0.008	–0.88	0.38
Occpd*	0.019	0.006	3.31	0.00
Empsecd*	–0.001	0.006	–0.20	0.84
Primard*	–0.026	0.005	–5.23	0.00
Secondd*	–0.075	0.007	–10.00	0.00
Univdd*	–0.139	0.014	–10.14	0.00
Hhsize	0.012	0.001	11.03	0.00
Animanow	0.000	0.000	–0.96	0.34
Toholnow	–0.001	0.000	–2.51	0.01
Urbrur	0.017	0.008	2.17	0.03
Age	0.002	0.001	3.19	0.00
Age2	0.000	0.000	–2.73	0.01
Coast*	–0.010	0.019	–0.54	0.59
Riftv*	–0.006	0.018	–0.31	0.76
Western*	0.019	0.013	1.53	0.13
Eastern*	0.016	0.015	1.07	0.29
Neast*	–0.044	0.025	–1.73	0.08
Nyanza*	–0.002	0.018	–0.10	0.92
Central*	–0.026	0.021	–1.25	0.21

* dy/dx is for discrete change of dummy variable from 0 to 1

Table 13. Predicted probabilities of being non-poor, moderately poor and extremely poor*

Sample	Income-based model			Consumption-based model		
	Probability of being			Probability of being		
	Non-poor	Poor	Extremelly poor	Non-poor	Poor	Extremelly poor
National	0.42	0.13	0.45	0.52	0.15	0.33
Rural	0.39	0.11	0.50	0.49	0.15	0.33
Urban	0.58	0.19	0.23	0.72	0.17	0.13

* Figures may not add to 1 due to rounding up.

Finally, and related to the second point above, the importance of female education in reducing poverty should be noted. We have found that female-headed households are likely to be poor relative to their male counterparts and that female education plays a key role in reducing poverty. Thus, promoting female education should be an important element of poverty reduction policies. Because there is evidence that female education and fertility are negatively correlated, such a policy could also have an impact on household size, which is another important determinant of Kenyan poverty. Moreover, given the importance of female labour in rural Kenya and elsewhere in Africa, investing in female education should enhance productivity. On the other hand, since female-headed households are only about 30% of all households, reducing poverty among this subgroup using female education would reduce overall poverty only by a small proportion. However, because of positive externality effects of female education, such a policy could have large, generalized effects on poverty reduction

In sum, in line with the three strategies that are outlined in PRSP and directly related to issues of poverty (economic growth and macro-stability, raising income opportunity of the poor, and improving quality of life), the findings in this study point to the importance of focusing on education in general and primary education in rural areas in particular. The study also highlights the severity of poverty for those who are engaged in the agricultural sector. Thus PRSP's strategy of raising income opportunities of the poor should focus on investing in agriculture. Since the macroeconomic environment is important in determining the productivity of such an investment, macroeconomic and political stability are a prerequisite for addressing poverty.

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ANNEX 1

The binomial logit model

Using both income and consumption-based measure

Table A1-1. Income per capita model: national sample

p_0_ypc probability of poverty)	Coef.	Std. error	Z	P > |z|
Sexd	–0.189	0.105	–1.79	0.07
Marymono	–0.043	0.104	–0.42	0.68
Marypoly	–0.220	0.137	–1.61	0.11
Occpd	0.908	0.093	9.74	0.00
Empsecd	0.279	0.099	2.82	0.01
Primard	–0.222	0.094	–2.35	0.02
Secondd	–0.912	0.103	–8.84	0.00
Univdd	–2.697	0.347	–7.78	0.00
Hhsize	0.142	0.019	7.44	0.00
Animanow	–0.006	0.001	–4.85	0.00
Toholnow	0.000	0.000	–0.15	0.88
Urbrur	–0.073	0.121	–0.61	0.55
Age	–0.034	0.014	–2.39	0.02
Age2	0.000	0.000	1.29	0.20
Coast	0.063	0.265	0.24	0.81
RiftV	–0.059	0.234	–0.25	0.80
Western	0.425	0.265	1.60	0.11
Eastern	0.413	0.249	1.65	0.10
NEast	0.000	0.309	0.00	1.00
Nyanza	0.222	0.240	0.92	0.36
Central	0.102	0.239	0.43	0.67
_Cons	0.911	0.380	2.40	0.02

ratio of predicted to actual: 68%

log likelihood: –6102.2

Table A1-2. Income per capita model: rural sub-sample

p_0_ypc (probability of poverty)	Coef.	Std. error	Z	P > |z|
Sexd	–0.158	0.116	–1.37	0.17
Marymono	0.033	0.120	0.28	0.78
Marypoly	–0.281	0.144	–1.95	0.05
Occpd	0.923	0.102	9.07	0.00
Empsecd	0.314	0.118	2.66	0.01
Primard	–0.227	0.100	–2.27	0.02
Secondd	–0.919	0.110	–8.39	0.00
Univdd	–2.753	0.470	–5.85	0.00
Hhsize	0.146	0.021	6.94	0.00
Animanow	–0.006	0.001	–4.66	0.00
Toholnow	0.000	0.000	0.00	1.00
Age	–0.033	0.015	–2.15	0.03
Age2	0.000	0.000	1.27	0.21
Coast	–0.130	0.270	–0.48	0.63
RiftV	–0.275	0.213	–1.29	0.20
Western	0.254	0.265	0.96	0.34
Eastern	0.268	0.238	1.13	0.26
Nyanza	0.056	0.232	0.24	0.81
Central	–0.114	0.233	–0.49	0.62
_Cons	0.841	0.395	2.13	0.03

number of observations: 9063

log likelihood: –5041.509

Table A1-3. Income per capita model: urban sub-sample

p_0_ypc (probability of poverty)	Coef.	Std. error	Z	P > |z|
Sexd	–0.428	0.265	–1.61	0.11
Marymono	–0.258	0.215	–1.20	0.23
Marypoly	0.558	0.441	1.26	0.21
Occpd	1.246	0.391	3.18	0.00
Empsecd	0.247	0.184	1.34	0.18
Primard	–0.244	0.305	–0.80	0.42
Secondd	–0.948	0.304	–3.11	0.00
Univdd	–2.652	0.505	–5.25	0.00
Hhsize	0.152	0.039	3.92	0.00
Animanow	–0.002	0.002	–1.01	0.31
Toholnow	–0.043	0.029	–1.52	0.13
Age	–0.007	0.046	–0.15	0.88
Age2	0.000	0.001	–0.47	0.64
Coast	0.124	0.330	0.38	0.71
RiftV	0.200	0.266	0.75	0.45
Western	0.547	0.357	1.53	0.13
Eastern	–0.231	0.281	–0.82	0.41
NEast	–0.932	0.348	–2.68	0.01
Nyanza	0.088	0.286	0.31	0.76
Central	0.443	0.296	1.50	0.14
_Cons	0.861	1.008	0.85	0.39

number of observations: 1645

Log likelihood: –1025.933

Table A1-4. Income per adult-equivalent model: national sample

p_0_ypae (probability of poverty)	Coef.	Std. error	Z	P > |z|
Sexd	–0.172	0.099	–1.74	0.08
Marymono	0.132	0.107	1.23	0.22
Marypoly	–0.020	0.135	–0.15	0.88
Occpd	0.762	0.096	7.91	0.00
Empsecd	0.138	0.104	1.32	0.19
Primard	–0.277	0.085	–3.25	0.00
Secondd	–1.002	0.100	–10.00	0.00
Univdd	–2.665	0.436	–6.11	0.00
Hhsize	0.113	0.016	7.19	0.00
Animanow	–0.006	0.001	–4.59	0.00
Toholnow	0.000	0.001	–0.24	0.81
Urbrur	–0.124	0.116	–1.06	0.29
Age	–0.014	0.013	–1.09	0.28
Age2	0.000	0.000	0.64	0.52
Coast	0.073	0.259	0.28	0.78
RiftV	–0.006	0.230	–0.03	0.98
Western	0.360	0.258	1.39	0.16
Eastern	0.265	0.242	1.10	0.27
NEast	–0.066	0.297	–0.22	0.83
Nyanza	0.091	0.236	0.39	0.70
Central	–0.087	0.234	–0.37	0.71
_Cons	0.067	0.376	0.18	0.86

ratio of predicted to actual: 65%

log likelihood: –6642.0

Table A1-5. Income per adult-equivalent model: rural sub-sample

p_0_ypae (probability of poverty)	Coef.	Std. error	Z	P > |z|
Sexd	–0.151	0.108	–1.41	0.16
Marymono	0.193	0.125	1.54	0.12
Marypoly	–0.113	0.148	–0.76	0.44
Occpd	0.809	0.106	7.64	0.00
Empsecd	0.197	0.126	1.56	0.12
Primard	–0.279	0.090	–3.10	0.00
Secondd	–1.003	0.107	–9.37	0.00
Univdd	–2.292	0.473	–4.85	0.00
Hhsize	0.119	0.017	6.83	0.00
Animanow	–0.006	0.001	–4.69	0.00
Toholnow	0.000	0.001	0.08	0.94
Age	–0.006	0.014	–0.41	0.68
Age2	0.000	0.000	0.15	0.88
Coast	–0.053	0.270	–0.20	0.84
RiftV	–0.175	0.214	–0.82	0.41
Western	0.176	0.257	0.69	0.49
Eastern	0.118	0.233	0.51	0.61
Nyanza	–0.049	0.226	–0.21	0.83
Central	–0.247	0.227	–1.08	0.28
_Cons	–0.279	0.372	–0.75	0.45

number of observations: 9063

log likelihood: –5590.5

Table A1-6. Income per adult-equivalent model: urban sub-sample

p_0_ypae (probability of poverty)	Coef.	Std. error	Z	P > |z|
Sexd	–0.489	0.221	–2.21	0.03
Marymono	–0.054	0.215	–0.25	0.80
Marypoly	0.928	0.401	2.31	0.02
Occpd	1.020	0.335	3.04	0.00
Empsecd	0.052	0.188	0.28	0.78
Primard	–0.070	0.293	–0.24	0.81
Secondd	–0.800	0.288	–2.77	0.01
Univdd	–2.459	0.672	–3.66	0.00
Hhsize	0.128	0.038	3.36	0.00
Animanow	–0.005	0.003	–2.04	0.04
Toholnow	–0.039	0.030	–1.30	0.19
Age	–0.010	0.047	–0.22	0.83
Age2	0.000	0.001	–0.20	0.84
Coast	0.196	0.320	0.61	0.54
RiftV	0.190	0.250	0.76	0.45
Western	0.896	0.335	2.67	0.01
Eastern	–0.138	0.282	–0.49	0.62
NEast	–0.828	0.352	–2.35	0.02
Nyanza	–0.002	0.264	–0.01	0.99
Central	0.025	0.277	0.09	0.93
_Cons	0.357	1.012	0.35	0.72

number of observations: 1645

log likelihood: –1013.7

Table A1-7. Consumption per capita model: national sample

p_0_cpc (probability of povertyr)	Coef.	Std. error	Z	P > |z|
Sexd	–0.154	0.091	–1.7	0.1
Marymono	0.026	0.101	0.3	0.8
Marypoly	–0.218	0.137	–1.6	0.1
Occpd	0.456	0.094	4.9	0.0
Empsecd	–0.029	0.097	–0.3	0.8
Primard	–0.332	0.088	–3.8	0.0
Secondd	–1.094	0.103	–10.6	0.0
Univdd	–2.337	0.552	–4.2	0.0
Hhsize	0.282	0.017	17.0	0.0
Animanow	–0.002	0.001	–1.4	0.2
Toholnow	0.000	0.000	0.5	0.6
Urbrur	0.050	0.133	0.4	0.7
Age	–0.014	0.012	–1.2	0.2
Age2	0.000	0.000	0.6	0.5
Coast	0.105	0.318	0.3	0.7
RiftV	0.219	0.307	0.7	0.5
Western	0.767	0.329	2.3	0.0
Eastern	0.592	0.320	1.9	0.1
NEast	–0.430	0.409	–1.1	0.3
Nyanza	0.345	0.317	1.1	0.3
Central	0.158	0.314	0.5	0.6
_Cons	–0.919	0.404	–2.3	0.0

ratio of predicted to actual: 65%

log likelihood: –6055.9

Table A1-8. Consumption per capita model: rural sub-sample

p_0_cpc (probability of poverty)	Coef.	Std. error	Z	P > |z|
Sexd	–0.163	0.097	–1.68	0.09
Marymono	0.049	0.111	0.44	0.66
Marypoly	–0.260	0.144	–1.80	0.07
Occpd	0.529	0.098	5.37	0.00
Empsecd	0.147	0.107	1.37	0.17
Primard	–0.349	0.091	–3.84	0.00
Secondd	–1.143	0.110	–10.43	0.00
Univdd	–2.644	0.561	–4.72	0.00
Hhsize	0.284	0.018	15.46	0.00
Animanow	–0.002	0.002	–1.28	0.20
Toholnow	0.000	0.000	0.70	0.49
Age	–0.021	0.013	–1.60	0.11
Age2	0.000	0.000	1.26	0.21
Coast	0.324	0.281	1.15	0.25
RiftV	0.298	0.215	1.39	0.16
Western	0.903	0.266	3.40	0.00
Eastern	0.750	0.245	3.07	0.00
Nyanza	0.443	0.248	1.78	0.07
Central	0.254	0.243	1.04	0.30
_Cons	–0.962	0.375	–2.56	0.01

number of observations: 9063

log likelihood: –5590.46

Table A1-9. Consumption per capita model: urban sub-sample

p_0_cpc (probability of poverty)	Coef.	Std. error	Z	P > |z|
Sexd	0.063	0.295	0.21	0.83
Marymono	–0.178	0.247	–0.72	0.47
Marypoly	0.106	0.478	0.22	0.83
Occpd	1.298	0.415	3.13	0.00
Empsecd	–0.474	0.196	–2.41	0.02
Primard	–0.103	0.342	–0.30	0.76
Secondd	–0.932	0.353	–2.64	0.01
Univdd	–2.071	0.874	–2.37	0.02
Hhsize	0.326	0.045	7.24	0.00
Animanow	0.004	0.004	0.92	0.36
Toholnow	–0.128	0.053	–2.39	0.02
Age	0.091	0.038	2.41	0.02
Age2	–0.001	0.000	–3.06	0.00
Coast	–0.043	0.369	–0.12	0.91
RiftV	0.639	0.353	1.81	0.07
Western	0.938	0.519	1.81	0.07
Eastern	0.114	0.444	0.26	0.80
NEast	–2.707	0.976	–2.78	0.01
Nyanza	0.807	0.416	1.94	0.05
Central	0.571	0.372	1.53	0.13
_Cons	–3.014	0.928	–3.25	0.00

number of observations: 1645

log likelihood: –888.45

Table A1-10. Consumption per adult-equivalent model: national sample

p_0_cpae (probability of being poor)	Coef.	Std. error	Z	P > |z|
Sexd	–0.139	0.092	–1.50	0.13
Marymono	0.059	0.107	0.55	0.58
Marypoly	–0.146	0.142	–1.02	0.31
Occpd	0.373	0.097	3.85	0.00
Empsecd	0.004	0.103	0.04	0.97
Primard	–0.323	0.082	–3.93	0.00
Secondd	–1.062	0.105	–10.09	0.00
Univdd	–2.608	0.561	–4.65	0.00
Hhsize	0.213	0.016	13.66	0.00
Animanow	–0.002	0.002	–1.01	0.31
Toholnow	–0.012	0.005	–2.44	0.02
Urbrur	0.130	0.141	0.92	0.36
Age	0.035	0.013	2.69	0.01
Age2	0.000	0.000	–2.02	0.04
Coast	–0.142	0.325	–0.44	0.66
RiftV	–0.093	0.319	–0.29	0.77
Western	0.413	0.334	1.24	0.22
Eastern	0.270	0.330	0.82	0.41
NEast	–0.633	0.397	–1.59	0.11
Nyanza	0.000	0.328	0.00	1.00
Central	–0.373	0.328	–1.14	0.26
_Cons	–2.335	0.442	–5.29	0.00

ratio of predicted to actual: 61%

log likelihood: –6357.1

Table A1-11. Consumption per adult-equivalent model: rural sub-sample

p_0_cpae (probability of being poor)	Coef.	Std. error	Z	P > |z|
Sexd	–0.163	0.095	–1.72	0.09
Marymono	0.127	0.111	1.14	0.25
Marypoly	–0.170	0.146	–1.16	0.25
Occpd	0.417	0.100	4.19	0.00
Empsecd	0.138	0.111	1.24	0.22
Primard	–0.344	0.086	–4.02	0.00
Secondd	–1.071	0.116	–9.27	0.00
Univdd	–2.951	0.703	–4.20	0.00
Hhsize	0.218	0.016	13.55	0.00
Animanow	–0.002	0.002	–0.97	0.33
Toholnow	–0.010	0.005	–2.14	0.03
Age	0.034	0.013	2.50	0.01
Age2	0.000	0.000	–1.63	0.10
Coast	0.377	0.285	1.32	0.19
RiftV	0.269	0.232	1.16	0.25
Western	0.810	0.275	2.95	0.00
Eastern	0.684	0.256	2.67	0.01
Nyanza	0.398	0.263	1.52	0.13
Central	0.006	0.259	0.02	0.98
_Cons	–2.763	0.401	–6.89	0.00

number of observations: 9063

log likelihood: –5488.25

Table A1-12. Consumption per adult-equivalent model: urban sub-sample

p_0_cpae (probability of poverty)	Coef.	Std. error	Z	P > |z|
Sexd	–0.080	0.326	–0.25	0.81
Marymono	–0.236	0.315	–0.75	0.45
Marypoly	0.041	0.527	0.08	0.94
Occpd	1.162	0.380	3.05	0.00
Empsecd	–0.389	0.203	–1.91	0.06
Primard	–0.147	0.312	–0.47	0.64
Secondd	–0.989	0.305	–3.24	0.00
Univdd	–2.344	0.738	–3.18	0.00
Hhsize	0.230	0.045	5.06	0.00
Animanow	0.004	0.005	0.74	0.46
Toholnow	–0.091	0.049	–1.85	0.06
Age	0.165	0.052	3.18	0.00
Age2	–0.002	0.001	–3.29	0.00
Coast	–0.385	0.333	–1.16	0.25
RiftV	0.257	0.373	0.69	0.49
Western	0.673	0.538	1.25	0.21
Eastern	–0.169	0.514	–0.33	0.74
NEast	–2.553	0.915	–2.79	0.01
Nyanza	0.296	0.451	0.66	0.51
Central	0.079	0.401	0.20	0.84
_Cons	–4.563	1.255	–3.64	0.00

number of observations: 1645

log likelihood: –828.767

ANNEX 2
Ordered logit models

Using both income and consumption-based measures

Table A2-1. Income per adult-equivalent model: national sample

pm_ypae (probability of poverty)	Coef.	Std. error	Z	P > |z|
Sexd	–0.168	0.093	–1.80	0.07
Marymono	0.153	0.102	1.51	0.13
Marypoly	0.006	0.126	0.05	0.96
Occpd	0.811	0.094	8.64	0.00
Empsecd	0.095	0.097	0.99	0.32
Primard	–0.313	0.081	–3.84	0.00
Secondd	–1.048	0.095	–11.06	0.00
Univdd	–2.652	0.419	–6.33	0.00
Hhsize	0.115	0.015	7.85	0.00
Animanow	–0.006	0.001	–4.63	0.00
Toholnow	–0.001	0.000	–1.08	0.28
Urbrur	0.015	0.104	0.15	0.88
Age	–0.009	0.012	–0.77	0.44
Age2	0.000	0.000	0.21	0.84
Coast	0.059	0.234	0.25	0.80
RiftV	–0.053	0.215	–0.25	0.81
Western	0.372	0.239	1.56	0.12
Eastern	0.287	0.228	1.26	0.21
Neast	–0.052	0.279	–0.19	0.85
Nyanza	0.014	0.220	0.07	0.95
Central	–0.174	0.217	–0.80	0.42
_Cut1	0.099	0.351		
_Cut2	0.677	0.351		

number of observations: 10708

log likelihood: –9677.2

pm_ypae
1 = Pr(*xb* + *u* < _cut1) = 0.42
2 = Pr(_cut1 < *xb* + *u* < _cut2) = 0.13
3 = Pr(_cut2 < *xb* + *u*) = 0.45

Table A2-2. Income per adult-equivalent model: rural sub-sample

pm_ypae (probability of poverty)	Coef.	Std. error	Z	P > |z|
Sexd	–0.100	0.101	–0.99	0.32
Marymono	0.180	0.118	1.53	0.13
Marypoly	–0.045	0.140	–0.32	0.75
Occpd	0.820	0.105	7.82	0.00
Empsecd	0.138	0.120	1.15	0.25
Primard	–0.330	0.085	–3.88	0.00
Secondd	–1.096	0.103	–10.63	0.00
Univdd	–2.467	0.484	–5.09	0.00
Hhsize	0.115	0.016	7.26	0.00
Animanow	–0.006	0.001	–4.44	0.00
Toholnow	0.000	0.000	–1.02	0.31
Age	–0.007	0.013	–0.56	0.57
Age2	0.000	0.000	0.14	0.89
RiftV	–0.177	0.191	–0.93	0.35
Western	0.274	0.221	1.24	0.22
Eastern	0.222	0.206	1.08	0.28
NEast	–0.010	0.263	–0.04	0.97
Nyanza	–0.062	0.193	–0.32	0.75
Central	–0.272	0.189	–1.44	0.15
_Cut1	0.179002	0.36105		ancillary
_Cut2	0.689999	0.361012		

number of observations: 9063

log likelihood: –8117.2

pm_ypae
1 = Pr(*xb* + *u* < _cut1) = 0.39
2 = Pr(_cut1 < *xb* + *u* < _cut2) = 0.11
3 = Pr(_cut2 < *xb* + *u*) = 0.50

Table A2-3. Income per adult-equivalent model: urban sub-sample

pm_ypae (probability of poverty)	Coef.	Std. error	Z	P > |z|
Sexd	–0.663	0.215	–3.08	0.00
Marymono	0.108	0.203	0.53	0.60
Marypoly	0.550	0.309	1.78	0.08
Occpd	1.110	0.279	3.98	0.00
Empsecd	0.030	0.177	0.17	0.87
Primard	–0.108	0.282	–0.38	0.70
Secondd	–0.846	0.284	–2.98	0.00
Univdd	–2.633	0.668	–3.94	0.00
Hhsize	0.133	0.036	3.68	0.00
Animanow	–0.006	0.003	–2.13	0.03
Toholnow	–0.030	0.022	–1.33	0.18
Age	0.005	0.040	0.13	0.90
Age2	0.000	0.000	–0.55	0.58
Coast	0.046	0.306	0.15	0.88
RiftV	0.231	0.263	0.88	0.38
Western	0.811	0.393	2.06	0.04
Eastern	–0.192	0.290	–0.66	0.51
NEast	–0.859	0.355	–2.42	0.02
Nyanza	–0.102	0.274	–0.37	0.71
Central	0.033	0.298	0.11	0.91
_Cut1	–0.076	0.927		
_Cut2	0.929	0.917		

number of observations: 1645

log likelihood: –1473.47

pm_ypae
1 = Pr(*xb* + *u* < _cut1) = 0.58
2 = Pr(_cut1 < *xb* + *u* < _cut2) = 0.19
3 = Pr(_cut2 < *xb* + *u*) = 0.23

Table A2-4. Consumption per adult-equivalent model: national sample

pm_cpae (probability of poverty)	Coef.	Std. error	Z	P > |z|
Sexd	–0.104	0.086	–1.20	0.23
Marymono	0.060	0.100	0.60	0.55
Marypoly	–0.121	0.133	–0.91	0.36
Occpd	0.315	0.095	3.33	0.00
Empsecd	–0.020	0.100	–0.20	0.84
Primard	–0.430	0.078	–5.54	0.00
Secondd	–1.149	0.102	–11.22	0.00
Univdd	–2.642	0.549	–4.81	0.00
Hhsize	0.199	0.013	14.82	0.00
Animanow	–0.002	0.002	–0.97	0.33
Toholnow	–0.011	0.004	–2.55	0.01
Urbrur	0.291	0.133	2.19	0.03
Age	0.041	0.013	3.25	0.00
Age2	0.000	0.000	–2.76	0.01
Coast	–0.166	0.297	–0.56	0.58
RiftV	–0.092	0.293	–0.31	0.75
Western	0.375	0.305	1.23	0.22
Eastern	0.289	0.304	0.95	0.34
NEast	–0.651	0.365	–1.78	0.08
Nyanza	–0.029	0.301	–0.10	0.92
Central	–0.401	0.303	–1.32	0.19
_Cut1	2.379	0.425		
_Cut2	3.140	0.422		

no. of observations: 10708

log likelihood: –9426.21

pm_cpae
1 = Pr(*xb* + *u* < _cut1) = 0.52
2 = Pr(_cut1 < *xb* + *u* < _cut2) = 0.15
3 = Pr(_cut2 < *xb* + *u*) = 0.33

Table A2-5. Consumption per adult-equivalent model: rural sub-sample

pm_cpae (probability of poverty)	Coef.	Std. error	Z	P > |z|
Sexd	–0.101	0.090	–1.12	0.26
Marymono	0.112	0.104	1.07	0.29
Marypoly	–0.140	0.139	–1.01	0.31
Occpd	0.356	0.102	3.50	0.00
Empsecd	0.115	0.114	1.01	0.31
Primard	–0.434	0.080	–5.44	0.00
Secondd	–1.175	0.113	–10.43	0.00
Univdd	–3.019	0.754	–4.01	0.00
Hhsize	0.201	0.014	14.49	0.00
Animanow	–0.002	0.002	–0.98	0.33
Toholnow	–0.011	0.004	–2.43	0.02
Age	0.039	0.013	2.94	0.00
Age2	0.000	0.000	–2.31	0.02
RiftV	–0.091	0.171	–0.53	0.59
Western	0.407	0.194	2.10	0.04
Eastern	0.323	0.186	1.74	0.08
NEast	–0.442	0.267	–1.66	0.10
Nyanza	–0.012	0.184	–0.06	0.95
Central	–0.402	0.185	–2.17	0.03
_Cut1	2.229	0.362		
_Cut2	2.934	0.361		

number of observations: 9063

log likelihood: –8226.24

pm_cpae
1 = Pr(*xb* + *u* < _cut1) = 0.49
2 = Pr(_cut1 < *xb* + *u* < _cut2) = 0.15
3 = Pr(_cut2 < *xb* + *u*) = 0.37

Table A2-6. Consumption per adult-equivalent model: urban sub-sample

pm_cpae (probability of poverty)	Coef.	Std. error	Z	P > |z|
Sexd	–0.162	0.298	–0.54	0.59
Marymono	–0.191	0.305	–0.63	0.53
Marypoly	0.196	0.515	0.38	0.70
Occpd	1.461	0.411	3.56	0.00
Empsecd	–0.403	0.184	–2.19	0.03
Primard	–0.335	0.325	–1.03	0.30
Secondd	–1.180	0.319	–3.71	0.00
Univdd	–2.500	0.735	–3.40	0.00
Hhsize	0.234	0.041	5.64	0.00
Animanow	0.005	0.007	0.79	0.43
Toholnow	–0.091	0.054	–1.68	0.09
Age	0.153	0.053	2.90	0.00
Age2	–0.002	0.001	–3.09	0.00
Coast	–0.405	0.311	–1.30	0.19
RiftV	0.269	0.365	0.74	0.46
Western	0.580	0.473	1.23	0.22
Eastern	–0.024	0.541	–0.04	0.97
NEast	–2.532	0.937	–2.70	0.01
Nyanza	0.296	0.424	0.70	0.49
Central	0.188	0.396	0.47	0.64
_Cut1	4.029	1.247		
_Cut2	5.371	1.261		

number of observations: 1645

log likelihood: –1115.85

pm_cpae
1 = Pr(*xb* + *u* < _cut1) = 0.72
2 = Pr(_cut1 < *xb* + *u* < _cut2) = 0.17
3 = Pr(_cut2 < *xb* + *u*) = 0.11

ANNEX 3
Computations of poverty lines

The most important of the number of studies about the condition of poverty in Kenya is the series of reports published by the Ministry of Finance and Planning (Kenya 1998, 2000). In this paper, we have followed the method the ministry uses to determine the poverty line. Doing so allows comparison with its studies.

The first step we took was to value the monthly food consumption required to satisfy the 2250 calories that define the biological minimum required per adult per day. The ministry computed this value for 1994 to be Ksh 874.72 for urban areas and Ksh 702.99 for rural areas per adult per month.

If, for illustration, we use the urban areas, first we identified the household that spends approximately Ksh 874.72 per adult equivalent on food items. Then we computed non-food consumption per adult equivalent, by taking the mean non-food consumption per adult equivalent of households in the neighbourhood (+10% and –20%) of this particular household. Adding this mean non-food consumption, Ksh 452.24, to the Ksh 874.72 gives us the *poverty line per adult equivalent* of Ksh 1326.9 per adult per month.

A similar procedure is followed to compute the *per capita poverty line*. We have used the same Ksh 875 for urban and Ksh 702 for rural areas for food requirement per month per person as the starting point.[6] Taking the same range of households, we computed per capita non-food consumption (Ksh 377.7 for urban and Ksh 155.88 for rural). Adding these mean non-food consumption levels to the Ksh 875 for urban and Ksh 702 rural areas gives us the *poverty line per capita* of Ksh 1252 for urban and Ksh 857.88 for rural areas per month (see table A3-1).

[6] Notice the assumption of using the adult-equivalent requirement for each person in the household. This might be a limiting assumption, but it is often made because of the lack of an alternative.

Table A3-1. Poverty lines adjusted for price changes (Kenya shillings)

	1992	1994	1997
Per capita			
Urban	728.65	1252.70	1552.97
Rural	499.00	857.88	1063.51
Per adult equivalent			
Urban	771.85	1326.96	1645.03
Rural	527.33	906.59	1123.90
Deflators used (1986 = 100)*	275.07	472.9	586.252

* Consumer Pirice Index of December for 1992 and that of June for 1994 and 1997

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