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DETERMINANTS OF POVERTY IN MOZAMBIQUE: 1996-97

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ABSTRACT

This report presents an analysis of the structural determinants of living standards and poverty in Mozambique, which is based on nationally-representative data from the first national household living standards survey since the end of the civil war: the Mozambique *Inquérito Nacional aos Agregados Familiares Sobre As Condições de Vida (MIAF),* or National Household Survey on Living Conditions.

Poverty in Mozambique is predominantly a rural phenomenon and is pervasive, with over two-thirds of the population falling below the poverty line. The degree of regional variation of poverty within the country is striking. Poverty levels are highest in Sofala, Tete, and Inhambane Provinces, where over 80 percent of the population lives below the poverty line, and lowest in Maputo City (although, with a headcount of 48 percent, poverty is still high in the capital city). The poverty estimates indicate that even though Mozambique is recovering from the emergency situation of the civil war, and becoming more self-reliant for its basic needs, there remains a great deal of structural poverty in the country. Areas that stand out in particular are low levels of human capital, including low educational levels and the poor health of most of the population; low productivity in the agricultural sector, where most Mozambicans are employed; a weak physical infrastructure and poor access to basic services, including potable water, health facilities, transportation, communications, and markets; and high rates of fertility and corresponding high dependency ratios.

The policy simulations that illustrate the impact that changes in the levels of determinants of poverty have on poverty levels allow us to identify six possible elements of a prospective poverty alleviation strategy for Mozambique. These include (1) increased investment in education, (2) sustained economic growth, (3) a sectoral pattern of growth favoring faster growth in the industrial and services sectors, (4) measures to raise agricultural productivity, (5) improved rural infrastructure, and (6) reducing fertility and dependency load within households. In conclusion, any meaningful poverty reduction

strategy in Mozambique must give the highest priority to rural areas and must address these macro-level and household-level determinants of poverty in its policy formulations.

CONTENTS

TABLES

FIGURES

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1. INTRODUCTION

Mozambique is one of the last countries to emerge from colonial rule in Sub-Saharan Africa. Over more than three centuries of the colonial period, economic development in Mozambique was extremely modest at best. Independence from the Portuguese was attained in 1975, but the colonial period of low investment in economic and social development was followed by a devastating civil war shortly after independence. A peace accord was signed only in 1992, and the first multiparty democratic national elections were held in 1994. Once the war ended, millions of displaced people turned to task of resuming their normal lives, and the government turned to the task of initiating the process of economic development. These long, difficult times, however, had serious consequences for the living standards of the population. Thus, in 1995, Mozambique’s Gross Domestic Product (GDP) per capita was estimated to be US$80, the lowest in the world (World Bank 1997). When adjusted for purchasing power parity (PPP), Mozambique fared only slightly better, ranking as the 13th poorest country.

After the war, the Government of Mozambique has undertaken many actions to rebuild the infrastructure that had been destroyed or neglected during the war and to improve living standards. The government adopted policies to open the economy and make it more market-oriented, while at the same time attempting to maintain some form of economic and social safety net for the poorest. While there are signs that these recent efforts to rebuild and reform the economy of Mozambique have resulted in an improvement in general living conditions, a large proportion of the Mozambican population is believed to be living in a state of absolute poverty. Poverty reduction is thus a major objective of the government as well as nongovernmental organizations in Mozambique.

This report presents an analysis of the determinants of poverty in Mozambique, which is based on nationally-representative data from the first national household living standards survey since the end of the war: the Mozambique *Inquérito Nacional aos*

Agregados Familiares Sobre As Condições de Vida (MIAF), or National Household Survey on Living Conditions. The report is part of a larger research project on the state of poverty in Mozambique, undertaken jointly by IFPRI, the Ministry of Planning and Finance, the Government of Mozambique, and the Eduardo Mondlane University, Maputo. The detailed findings from the work on this project are presented in the report "*Understanding Poverty and Well-Being in Mozambique: The First National Assessment (1996-97),*" hereafter referred to as the Mozambique Poverty Assessment Report, or simply as MPAR. While the MPAR covers a wide range of topics including poverty, food security, nutrition, health, education, and formal and informal safety nets, in this report, we focus on the key question of the determinants of living standards and poverty in Mozambique.

This report is organized as follows. We begin with a brief discussion motivating the key research question in the following section. Our approach to modeling the determinants of poverty is described in Section 3. In Section 4, we introduce our primary data source, and also discuss our approach to the measurement of living standards. Section 5 presents details of the construction of region-specific absolute poverty lines. The estimates of poverty in Mozambique are presented in Section 6. In Section 7, we present the empirical model, introduce the set of determinants used in the analysis, and discuss a number of specification issues. Section 8 presents the results from our preferred estimates of the determinants model. Based on these estimates, in Section 9, we present a number of poverty simulations that indicate the poverty impact of specific policy interventions. Section 10 goes beyond the determinants analysis to look at the potential of general economic growth for poverty reduction in Mozambique. Concluding remarks are offered in the final section.

2. MOTIVATION FOR THE RESEARCH QUESTION

A useful starting point for an analysis of the determinants of poverty can be a poverty profile. A detailed poverty profile for Mozambique is presented in the MPAR. A poverty profile is an important descriptive tool for examining the characteristics of poverty in the country. Poverty profile tables provide key information on the correlates of poverty, and hence also provide important clues to the underlying determinants of poverty. However, the tabulations in poverty profiles are typically bivariate in nature, in that they show how poverty levels are correlated with one characteristic at a time.[1] This feature tends to limit their usefulness because bivariate comparisons may erroneously simplify complex relationships. For example, when education of the head of the household is compared with poverty status, it is not clear if the observed negative relationship is due to education, or due to some other factor that might be correlated with education, such as the amount of land held by the household. For this reason, the typical bivariate associations found in a poverty profile can be misleading; they leave unanswered the question of how a particular variable affects poverty *conditional* on the level of other potential determinants of poverty.

There are contexts where unconditional poverty profiles are relevant to a policy decision, as, for instance, in the case of geographical or indicator targeting, but, more often, "conditional" poverty effects are more relevant for evaluating proposed policy interventions that seek to alter only one or a limited set of conditions at a time. In other words, the effect of a policy intervention is correctly identified when the other potential factors affecting poverty are controlled for. It is not surprising, therefore, that recent

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[1] To be sure, the profile tables need not be limited to two-way tables only, but higher-order tabulations are cumbersome and, not surprisingly, rare.

empirical poverty assessments have included multivariate analysis of living standards and poverty.[2]

While there has been some work on the empirical modeling of the determinants of poverty at the subnational level for Mozambique,[3] to our knowledge there has been no such modeling effort using nationally-representative data. This is presumably due to the nonavailability of nationally representative data, a constraint that has been alleviated with the recent completion of the 1996-97 MIAF survey.[4] In this report, we present the results of an analysis of poverty determinants based on the MIAF data.

3. MODELING DETERMINANTS OF POVERTY

We can distinguish two main approaches to modeling the determinants of poverty. We now introduce these two approaches, and discuss our reasons for preferring one of them for the current study.

Our preferred approach to modeling the determinants of poverty can be described as a two-step procedure. In the first step, we model determinants of the log of consumption at the household level.[5] The simplest form of such a model could be as follows:

$$\ln c_j = \hat{a}' x_j + \text{ç}_j, \qquad (1)$$

where c_j is consumption of household j (usually on a per capita basis), x_j is a set of household characteristics or other determinants, and ç_j is a random error term. The

[2] See, for instance, Glewwe (1991), World Bank (1994a, 1994b, 1995a, 1995b, 1995c, 1996a, 1996b), Grootaert (1997), and Dorosh et al. (1988).

[3] See Sahn and del Ninno's (1994) analysis for Maputo and Matola.

[4] See Section 4 for a description of this data set.

[5] The logarithm of consumption is estimated because its distribution more closely approximates the normal distribution than does the distribution of consumption levels.

second step defines poverty in terms of the household's consumption level. Thus, we can write the poverty measure for household j as

$$p_{\alpha,j} \;=\; [\max((1 - c_j/z), 0)]^{\alpha} \qquad \alpha \geq 0, \tag{2}$$

where z denotes the poverty line and α is a nonnegative parameter.[6] The household equivalents of the head-count index, the poverty gap index, and the squared poverty gap index are obtained when α is 0, 1, and 2, respectively.[7]

This approach contrasts with a direct modeling of household-level poverty measures wherein

$$p_{\alpha j} \;=\; \beta_{\alpha}^{/} x_j \;+\; \eta_{\alpha j}. \tag{3}$$

This direct approach has been used often; see, for example, Bardhan (1984), Gaiha (1988), Sahn and del Ninno (1994), World Bank (1994a, 1995a, 1995b, 1996a, 1996b), and Grootaert (1997). Despite the popularity of this approach, there are several reasons why modeling household consumption may be preferable to modeling household poverty levels.

First, using data on only $p_{\alpha j}$ is inefficient. It involves a loss of information because the information on the household living standards above the poverty line is deliberately suppressed. All nonpoor households are thus treated alike, as censored data.

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[6] Aggregate poverty for a population with n households is simply the mean of this measure across all households weighted by household size (h_j), giving $P_{\alpha} = \left(\sum_{j=1}^{n} h_j p_{\alpha,j}\right) \div \left(\sum_{j=1}^{n} h_j\right)$.

[7] These three poverty measures are members of the Foster-Greer-Thorbecke (FGT) class, introduced by Foster, Greer, and Thorbecke (1984).

Second, there is an element of inherent arbitrariness about the exact level of the absolute poverty line, even if relative differentials in cost of living, as established by the regional poverty lines, are considered robust. Different poverty lines would imply that household consumption data would be censored at different levels. The estimated parameters of the poverty model (3.3) would therefore change with the level of poverty line used. While this change in parameter estimates conveys some information about stochastic dominance, modeling consumption directly has the potentially attractive feature that the consumption model estimates are independent of the poverty line. The link with household poverty level is established in a subsequent, discrete step.

Third, estimation of the consumption model avoids strong distributional assumptions that would typically be necessary for nonlinear limited dependent variable models (Powell 1994).[8] As a final comparison of the two methods, it is also worth noting that, once household consumption, c_j, is modeled, the household's poverty level, p_j, is readily determined.[9]

Following the reasons listed above, the approach used in this study is to model consumption as in (1), and then employ (?) to make inferences or predictions about poverty levels.

4. DATA

[8] A related issue has to do with the number of nonlimit observations, which is directly determined by the observed headcount index for the sample. A low headcount index can seriously limit the number of nonlimit observations available for estimation.

[9] It is worth noting that most applications of the direct approach use a binary dependent variable to indicate whether a household is poor or nonpoor, and then using a probit or logit estimation. This has the additional disadvantage that all information about the distribution below the poverty line is also suppressed in the binary dependent variable specification.

The primary data source for this study is the Mozambique *Inquérito Nacional aos Agregados Familiares Sobre As Condições de Vida (MIAF)*, or National Household Survey on Living Conditions. The survey was designed and implemented by the *Instituto Nacional de Estatística* (INE, formerly the *Direcção Nacional de Estatística*) and was conducted from February 1996 through April 1997. The sample consists of 8,274 households and is nationally representative. The survey covered rural and urban areas of all ten of Mozambique's provinces, and the city of Maputo as a separate stratum. This survey includes information about consumption patterns, incomes, health, nutrition, education, agriculture, and numerous other aspects of Mozambicans' living conditions. See Table 1 for details on the geographic distribution of the sample households.

OVERVIEW OF THE MIAF QUESTIONNAIRE

Each participating household was visited three times within a seven-day period, with three households interviewed per day in rural areas and four households interviewed per day in urban areas. There were three instruments used for household-level interviews: a principal survey questionnaire (Sections 1 through 11), a daily household expenditure questionnaire, and a daily personal expenditure questionnaire administered to all income-earning members within the household.

The principal survey instrument collected information at both the individual and household level. At the individual level, it obtained information for every household member on a broad range of topics, including demographic characteristics, migration history, health, education, and employment status. At the household level, additional information was obtained on landholding size and description, agricultural production during the previous year, livestock and tree holdings, dwelling characteristics, types of basic services used (for example, source of drinking water and type of lighting), asset ownership, major nonfood expenditures during the three months, regular nonfood expenditures during the past month, transfers into and out of the household, and sources of income. Data collection for both the principal survey and daily expenditures were spread over the three visits to the household to reduce respondent fatigue.

The daily expenditure questionnaire consisted of recall data on major food items and a few typical nonfood items (for example, charcoal and matches) consumed during a seven-day period. During the first interview, recall data from the previous day's consumption were obtained. At the second interview, which was three days after the first interview, consumption data for the days between interviews were collected. At the final interview three days later, recall data on the preceding three days of consumption were obtained.

The same principle of recall data collection was followed for the daily personal expenditure questionnaire. However, one difference was that in the majority of cases for income-earning urban workers, the personal diaries were left at the first interview for the income-earning household member to fill out because that person was frequently absent from the household. In practice, many difficulties were encountered in the collection of these data, and because of insufficient compliance, these data suffered from a high (and uneven) response rate. Hence, it was decided not to use these data in the construction of the poverty line.[10]

In addition to data collected at individual and household levels, there were two instruments administered once during the survey period at higher levels of aggregation. First, within each village (*aldeia*), a community-level survey of available infrastructure, access to services, and general community characteristics was collected. These data were not collected in any urban areas. Second, detailed market price information (including weighing all items sold in nonstandard containers) was collected in the major market for each sampled *bairro* (urban areas) or *localidade* (rural areas).

[10] This means working with a somewhat more restricted definition of consumption—a less than ideal situation, but arguably better than using a more inclusive but less consistent (or comparable) measure of consumption.

SAMPLE DESIGN

The sample frame or universe from which the sample was selected covered the population of Mozambique residing in households, excluding those residing in prisons, army camps, hotels, etc. At the time of the survey design, the most recent census data available were from 1980. Given the substantial population growth and movements that had occurred since 1980, a sampling frame based on noncensus data had to be devised. For rural areas and small urban areas (outside provincial capitals), the most recent information with national coverage was the Electoral Census conducted in preparation for the elections in 1994. However, the electoral census proved unsuitable for larger urban centers where persons were often registered at locations not corresponding to their place of residence. Consequently, an alternative selection methodology was devised for provincial capitals and Maputo City. This methodology is described later in this section.

The sample was selected in three stages and geographically stratified to ensure that (1) the entire sample is nationally representative, (2) the urban (rural) sample is representative of urban (rural) households, and (3) each provincial sample is representative at the province level (treating the capital city of Maputo as a separate province). This design allows for analysis at national, provincial, and urban/rural levels. Data collection occurred throughout the year within the rural sample of each province to assure coverage during the different seasons of the year. See Table 2 for the temporal distribution of completed interviews.

In the first step of the selection process, the sample consisted of 10 provinces divided into urban and rural strata plus an additional stratum consisting of Maputo City. Administrative divisions for urban areas (from largest to smallest) are *distrito* (district), *bairro* (neighborhood or ward), and *quarteirão* (block). The divisions in rural areas are *distrito*, *posto administrativo* (Administrative Post), *localidade* (locality), and *aldeia* (village).

In each of the rural strata, *localidades* were chosen as the primary sampling unit (PSU). Because of limited resources, the survey did not construct its own population lists, but instead relied upon existing population data at the local level for selection of *localidades* and *aldeias*. Selection was based on probability proportional to total estimated population within the province. The process was complicated by the fact that in some *aldeia*s, actual population data were available; in others only the number of households were available. Within a given *localidade*, *aldeias* were selected proportional to total *localidade* population when all *aldeias* had population data. Otherwise selection procedures were based on the number of households per *aldeia*. In total, three to four *aldeias* were selected within each *localidade*, completing the second stage of sampling.

For the final stage within the rural areas of each province, a list of all households within the selected *aldeias* was constructed by the survey team and simple random selection procedures were used to choose nine households to be interviewed per *aldeia*.

In the urban provincial capitals and Maputo City, the PSUs were *bairros*, which were systematically selected with a probability proportional to size. In this instance, size was not defined in terms of the total number of persons, but on the number of *quarteirões* (blocks) found in each *bairro*. Underlying this selection procedure was the knowledge that in the early postindependence period (1975-1980), a *quarteirão* corresponded to 25 households. Therefore, in this selection procedure, an assumption is being made that *quarteirões* are approximately of equal size. In the second stage of sampling, *quarteirões* were selected. The final stage of sample selection in each urban area entailed a simple random selection procedure of 12 households chosen from a list of all households compiled for each *quarteirão* selected.

At the end of the sampling exercise, 8,289 households had been selected, distributed among provinces as shown in Table 1 (Cavero 1998). Among the selected households, 8,276 were interviewed and data were entered for 8,274 households. In total, 112 of 128 districts *(Distritos)* nationwide had households included in the survey (INE 1999). More details on the sample design are in Cavero (1998) and an overview is presented in Figure 1.

FIELDWORK

Work related to sample design began in June 1995. Training of survey interviewers and supervisors took place during a two-week period in November 1995. Pilot testing of the questionnaire took place in December 1995 and January 1996. Extensive field manuals with instructions for interviewers, field supervisors, and provincial-level supervisors were developed along with documentation concerning concepts and definitions used in the survey and codebooks for all survey instruments. These are available in Cavero (1998). Each of the 11 provinces had a team consisting of the provincial supervisor (an INE permanent employee), the field supervisor, three household enumerators, one anthropometrist (for measuring children), and one market enumerator (for community price data).

Actual data collection at the household level in the field started in February 1996 and continued through March 1997. Collection of price data in each *bairro* or *localidade* began in mid-1996 and was completed in March 1997. Collection of community-level data on infrastructure was completed in October 1997. All data were digitized at INE headquarters in Maputo. Data entry began concurrent with data collection, with all data entered using IMPS (Integrated Microcomputer Processing System). All data were entered once, with data entry programs incorporating range checks to reduce data entry errors. One exception to this process is the price data, which were double-entered. Significant delays occurred in the processing of the data, particularly during the cleaning phase (consistency checks), with data becoming available for analysis in January 1998.

MEASURE OF INDIVIDUAL WELFARE

Throughout this study, we use per capita consumption (i.e., total household consumption divided by the number of household members) as the basic measure of individual welfare. Either consumption or income is a defensible measure of welfare as they both measure an individual's ability to obtain goods and services, and both measures should produce fairly similar results for many issues. While we believe consumption (or income) is a useful aggregate money metric of welfare, we acknowledge that both measures fail to incorporate some important aspects of individual welfare, such as consumption of public goods (for example, schools, health services, public sewage facilities) and quality of life (for example, consumption of leisure, length and health of life).

The decision to use a consumption-based rather than an income-based measure of individual welfare in this study is motivated by several considerations. First, income can be interpreted as a measure of welfare *opportunity* while consumption is interpretable as a measure of welfare *achievement* (Atkinson 1989). Since not all income is consumed, nor is all consumption financed out of income, the two measures typically differ. Consumption is arguably a more appropriate indicator if we are concerned with realized, rather than potential, welfare. Second, consumption typically fluctuates less than income. Individuals rely on savings, credit, and transfers to smooth the effects of fluctuations in income on their consumption, and therefore consumption provides a more accurate and more stable measure of an individual's welfare over time.[11] Third, some researchers and policymakers hold the belief that survey respondents are more willing to reveal their consumption behavior than they are willing to reveal their income.[12] Fourth, in developing countries a relatively large proportion of the labor force is engaged in self-employed

[11] Economic theory suggests, for instance, that individuals respond to fluctuations in income streams by saving in good periods and dis-saving in lean periods. Even though the permanent income hypothesis is often rejected by available data, there is enough consumption smoothing performed by households to render consumption a better measure of long-term welfare. This consideration is likely to be even more important for a survey like the Mozambique National Household Survey on Living Conditions, which obtains measures of income and consumption at only one point in time.

[12] A result that lends some support to this conjecture is that household survey data have sometimes found that direct estimates of household savings are greater than savings estimated as income *minus* consumption. But there also exist examples where the reverse is true. See Kochar (1997) for a discussion of this issue.

activities and measuring income for these individuals is particularly difficult.[13] (See World Bank [1995d] for a discussion of the composition of labor forces in developing countries.) Similarly, many individuals are engaged in multiple income-generating activities in a given year, and the process of recalling and aggregating income from different sources is also difficult. (See Reardon [1997] and references therein for more information on household income diversification in Sub-Saharan Africa.)

While consistent with standard practice, the use of per capita normalization of consumption nevertheless also involves the strong assumption of no economies of household size. Later, we will explore the sensitivity of some of our results to a relaxation of this assumption.

In this study, we use a comprehensive measure of consumption as the money metric of welfare, drawing from several modules of the household survey. It includes expenditures and auto-consumption of food and nonfood items, as well as imputed use-values for owner-occupied housing and household durable goods. The only significant omission from the consumption measure is consumption of public goods. For example, an all-weather road, or a public market, or a public water tap, presumably enhances the well-being of the people who use those facilities. However, the MIAF data do not permit quantification of those benefits, and they are therefore not included in the consumption measure.[14] Further details of the construction of the measure of household consumption are given in the Appendix.

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[13] For example, one important form of self-employment is working on the household farm, and measuring total income from farming and then allocating income to the individual workers is difficult. Also, an annual reference period is needed for an adequate estimate of agricultural incomes, which either requires multiple visits to households or longer recall periods, with potentially larger errors.

[14] This is, however, not unique to the Mozambique survey. It is rarely possible to integrate the consumption of public goods into an aggregate measure of consumption.

5. POVERTY LINES

In this study, we are concerned with *absolute* poverty, by which we mean that the poverty line is *fixed* in terms of the standard of living it commands over the domain of poverty measurement. As we will be concerned with measurement of poverty in Mozambique as a whole, our domain of measurement is the entire country. However, prices, household demographics, and consumption patterns differ across regions, and hence a single poverty line in nominal terms for Mozambique as a whole would typically support different standards of living across regions. Thus, to measure absolute poverty consistently, we need a set of region-specific (nominal) poverty lines that approximate a uniform standard of living. A detailed discussion of the construction of poverty lines follows next.

COST OF BASIC NEEDS APPROACH

There can be a number of different approaches to the determination of poverty lines. In this study, we follow the cost of basic needs methodology to construct region-specific poverty lines (Ravallion 1994, 1998). By this approach, the total poverty line is constructed as the sum of a food and a nonfood poverty line. The food and nonfood poverty lines embody value judgments on basic food and nonfood needs. The poverty lines are set in terms of a level of per capita consumption expenditure that is deemed consistent with meeting these basic needs. The following discussion on the derivation of the poverty lines is organized into four main parts dealing, respectively, with the identification of spatial domains, the steps in the construction of the food and nonfood poverty lines, and the total region-specific poverty lines and the spatial price indices implied by them.

IDENTIFYING SPATIAL DOMAINS

It is useful to recall here that our primary interest is in examining *absolute* poverty and hence we would like to ensure that our poverty line implies a fixed standard of living over the full domain of poverty measurement. However, a single poverty line in nominal terms for the whole country will almost surely command different standards of living across regions, most important because prices vary across regions, especially for a country such as Mozambique, where markets are often not spatially integrated and regional price differentials can be large.

From a more welfarist perspective, it is further arguable that regional differences in household composition and consumption patterns should also be allowed for in the determination of poverty lines. Starting from a uniform set of age-sex specific caloric requirements, differences in household composition directly translate into differences in caloric requirements. Similarly, it is arguable that differences in consumption patterns matter to how spatial price or cost of living differentials are assessed. Thus, an important first step is to define an appropriate level of spatial disaggregation for the construction of poverty lines.

In defining the spatial domains for constructing separate poverty lines, the following three considerations were deemed important. First, we wanted to maintain a rural-urban distinction across the spatial domains because of existing evidence that prices and consumption patterns varied systematically across urban and rural areas. Second, to avoid problems with small subsample sizes, we wanted to ensure a minimum of about 150 households for each domain. Third, we wanted to group those provinces together that are believed to be relatively homogeneous in terms of prices, household composition, and consumption patterns. The second consideration suggested that disaggregating by both rural/urban zone and province was not a feasible option, for it implied that the samples for the urban sectors of Cabo Delgado, Zambézia, Tete, Inhambane, and Gaza provinces were each less than 150 households. Thus, we aggregated over provinces to form the 13 regional domains as shown in Table 3. The minimum sample size for a domain is 179 for urban Gaza and Inhambane; the maximum sample size is 1,301 for rural Sofala and Zambézia.

FOOD POVERTY LINE

As mentioned above, food poverty lines, under the cost of basic needs approach, are tied to the notion of basic food needs, which, in turn, are typically anchored to minimum energy requirements.[15] For each spatial domain, the food poverty line is constructed by determining the food energy (caloric) intake requirements for the reference population (the poor), the caloric content of the typical diet of the poor, and the average cost (at local prices) of a calorie when consuming that diet. The food poverty line—expressed in monetary cost per person per day—is then calculated as the product of the *average daily per capita calorie requirement* and the *average price per calorie*. Put differently, the food poverty line is the domain-specific cost of meeting the minimum caloric requirements when consuming a typical food bundle for the poor in that spatial domain.[16] It is easy to show that the two notions of the food poverty line are equivalent so long as the average price per calorie is determined with reference to the same reference food bundle.

Minimum Caloric Requirements

The estimated per capita caloric requirement in each poverty line domain depends on the average household characteristics of the reference sample in that domain. For example, a region with a greater proportion of children in the population will require

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[15] It is well understood that food energy is only one facet of human nutrition, and that adequate micronutrient consumption is also essential for a healthy and active life. However, like most multipurpose household surveys, the information on food consumption in the MIAF data set is not sufficiently detailed to permit estimation of micronutrient intake.

[16] The typical food bundle of the poor may, of course, contain more or less calories than the requirement for that domain. This bundle is then proportionally scaled up or down until it yields exactly the pre-established caloric requirement, and the cost of this rescaled bundle at domain-specific prices determines the food poverty line for that domain.

fewer calories per capita than a region with a higher proportion of middle-aged adults, as children typically have lower caloric requirements.

In principle, when calculating caloric requirements, one needs to take into account an individual's age, sex, body size and composition, physical activity level (PAL), and, for women, whether they are pregnant or in the first six months of breast-feeding. As the MIAF does not include adequate data on physical activity levels or adult body size and composition,[17] we estimated caloric requirements using the available variables: age, sex, pregnancy status,[18] and breast-feeding status.[19] We began with the age-sex specific calorie requirements reported by the World Health Organization (WHO 1985), presented in Table 22. The requirements range from 820 kilocalories per day for children less than one year old to 3,000 kilocalories per day for males between the ages of 18 and 30.

We used the demographic information in the MIAF to calculate the average household composition within each domain. We then mapped the average number of persons in each requirements category (shown in Table 22) to the number of kilocalories required, and arrive at an average caloric requirement per household and per capita in each domain. The average per capita caloric requirement in each of the domains is

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[17] For all adults we assumed moderate physical activity levels, which, in fact, could represent an infinity of combinations of PAL and body mass. For example, the 3,000 calories for adult males aged 18 to 30 could represent the requirements of a 90 kilogram male with a PAL of 1.45, a 50 kilogram male with a PAL of 2.08, or any number of combinations of body mass and PAL.

[18] Although WHO indicates an additional requirement of 285 kilocalories per day in the last trimester of pregnancy, we do not have data on the stage of a woman's pregnancy. As pregnancies in Mozambique are not usually reported until at least the first trimester is completed, we assumed that half of the women who reported pregnancies were in the last trimester.

[19] We did not have data indicating how long an individual woman had been breast-feeding her child. However, we did have data on whether a children's ages and whether or not the child was breast-feeding. Thus, we assumed that for each child in the household who was breast-feeding, there was one woman nursing that child; if that child was six months old or less, the mother (and household) was assumed to require the additional 500 kilocalories daily indicated by WHO. Our method overestimates calorie requirements to the extent that multiple births (e.g., twins) occur and multiple infants survive the first six months.

approximately 2,150 kilocalories per day, with a narrow range of 2,115 to 2,217 kilocalories per capita, as shown in Table 4.[20]

To convert the physical quantities of household food consumption in grams to kilocalories, a number of different sources were used. As all of the sources contain information on some of the same basic food items, such as staple grains, and some of these sources have slightly conflicting values for the caloric content of specific items (due to differences in the food item itself, measurement differences, or other reasons), it was necessary to establish a preference ordering for the different sources. The sources used were, in decreasing order of preference, the Mozambique Ministry of Health (*Ministério de Saúde* 1991); a food table for Tanzania compiled by the University of Wageningen (West, Pepping, and Temalilwa 1988); an East, Central, and Southern Africa food table (West 1987); the U.S. Department of Agriculture (USDA 1998); the U.S. Department of Health, Education, and Welfare (USHEW 1968); and tables from the University of California.[21]

Reference Food Bundles and the Average Price Per Calorie

An estimate of the average price per calorie for any region can be derived from the total cost of the food bundle typically consumed by the poor in that region and the total calories contained in that bundle. Thus, to compute an average price per calorie for a region, it is necessary to use a reference food bundle. After experimenting with several

[20] The WHO calorie requirements could also be used to construct adult equivalency scales (with respect to calorie requirements). For example, if one takes the maximum requirement (3,000 kilocalories per day for males aged 18 to 30 years) as the base, representing 1.00 adult equivalence units (AEU), a woman in the same age category would have an AEU of 0.70, or 0.795 if she were in the last trimester of pregnancy, or 0.867 if she were in the first six months of breast-feeding. Likewise, the average AEU per capita in Mozambique is about 0.717.

[21] For further discussion of the factors relevant to establishing a preference ordering of food table sources, see MPAR.

alternative definitions of the "relatively poor,"[22] we finally chose to define the *relatively poor* as those households whose per capita calorie consumption was less than the per capita calorie requirement for their spatial domain. Using this set of relatively poor households, we calculated the weighted average price per calorie within each spatial domain as follows.

This weighted-average was calculated after imposing a 5 percent trim on the full sample. This trim was necessitated because of several extreme values of average price per calorie at the household level.[23] We trimmed 5 percent of the sample from the lower and upper tails of the distribution of the household average price per calorie. (This trim was only applied for the purpose of constructing the average price per calorie.)

Thus, from this trimmed sample, we selected the relatively poor households defined above as those deficient in their energy intake. Then, for each domain we constructed a weighted-average of these households' average price per calorie, with the weights equal to their total calorie intake times the household expansion factor, as our estimate of the domain-specific average price per calorie for the relatively poor households.[24]

The 13 food poverty lines were calculated by multiplying the mean price per calorie in each spatial domain by the average per capita calorie requirements in that domain (Table 4). Because the per capita calorie requirements are quite similar across the spatial domains, the variation in the food poverty lines result primarily from variations in the mean cost of a calorie in each domain. The food poverty lines, therefore, show the same pattern as the average price per calorie: within a provincial grouping, urban food poverty

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[22] For details, see MPAR.

[23] The extreme values are largely attributable to errors in recording the physical quantity of the food (whether in local or standard units), or the imperfect methods used to convert from nonstandard to standard units.

[24] For the food consumption bundles underlying these mean prices per calorie for the poor in each of the 13 spatial domains, and related details, see MPAR.

lines are higher than rural, and the food poverty lines tend to decrease as one moves from south to north.

NONFOOD POVERTY LINES

While the food poverty lines are anchored on physiological needs, no similar basis is readily available for defining nonfood needs. Yet, even the very poor households in virtually all settings allocate a nontrivial proportion of their total consumption to nonfood items. Thus, an obvious way of assessing nonfood needs is to look at how much the households who are barely in a position to meet their food needs typically spend on nonfood. This is the approach we use in this study.[25]

The nonfood poverty line is thus derived by examining the nonfood consumption among those households whose *total expenditure* is equal to the food poverty line. The rationale is that if a household's total consumption is only sufficient to purchase the minimum amount of calories using a food bundle typical for the poor, any expenditures on nonfoods is either displacing food expenditure, or forcing the household to buy a food bundle that is inferior to that normally consumed by the poor, or both. In either case, the nonfood consumption of such a household displaces "essential" food consumption. Hence, such nonfood consumption itself can be considered "essential" or "basic."

It is, of course, highly improbable that any particular household in the sample has a level of total consumption per capita that exactly equals the food poverty line. Even if such a household did exist, it would not be reasonable to base the nonfood poverty line solely on a single household's consumption pattern. Therefore, we instead examine households whose per capita total consumption is in the neighborhood of the food poverty line, with the neighborhood defined as 80 to 120 percent of the food poverty line. Using these households, the cost of the minimum nonfood bundle, z^N, is then estimated nonparametrically as the weighted average nonfood expenditure. In constructing the

[25] For details of an alternative approach that permits a more generous basic nonfood allowance, see MPAR.

average, observations closer to the food poverty line, z^F, are given a higher weight, using a kernel with triangular weights (Hardle 1990). For example, households whose consumption is within 18 to 20 percent of the food poverty line are given a weight of one, households between 16 to 18 percent of the food poverty line receive a weight of two, and so forth, with the households within 2 percent of the food poverty line receiving a weight of 10. We proceeded to calculate the weighted average nonfood consumption per capita in each of the 13 spatial domains, weighting household-level observations by the product of the triangular kernel weights, the household expansion factor, and household size.

Table 5 presents the nonfood and food poverty lines, as well as the total poverty line, which is obtained as their sum.

SPATIAL PRICE INDICES

One can think of the 13 poverty lines in Table 5 as reflecting regional price differences in the cost of attaining the same minimum standard of living, and the ratios of poverty lines can therefore be considered as spatial price or cost of living indices for Mozambique. In addition to listing the food, nonfood, and total poverty lines, Table 5 also lists the (normalized) spatial price index implied by the 13 total poverty lines.[26] Like the poverty lines, the spatial price indices reflect differences in prices relevant to the household composition and consumption patterns among the relatively poor. It is these spatial price indices that are used to deflate the nominal values of per capita consumption to obtain comparable real values for defining the dependent variable for the estimable model (1).

6. POVERTY IN MOZAMBIQUE: ESTIMATES FOR 1996-97

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[26] National average prices are used as the base for normalization. This normalization ensures that the national average *nominal* total consumption is equal to the national average total consumption adjusted by the spatial price index.

Before embarking on the details of the empirical model of the determinants of poverty, it is instructive to look at the estimates of real mean consumption and absolute poverty obtained for the above set of poverty lines. The 1996-97 MIAF survey data indicate that real mean monthly consumption in Mozambique is 160,780 MT per person. This is equal to about US$170 per person per year at the average exchange rate prevailing during the survey period.[27] Using the poverty lines derived earlier, the national poverty rate (headcount) is 69.4 percent, indicating that in 1996-97 just over two-thirds of the Mozambican population, or 10.9 million people, lived in a state of absolute poverty. The national poverty gap index and squared poverty gap index are also quite high, at 29.3 and 15.6 percent, respectively. (See Table 6 for details.)

The incidence of poverty is higher in rural areas than in urban areas (Table 6), with the rural headcount reaching 71.2 percent, as compared to 62.0 percent in urban areas. The depth and severity of poverty is also higher in rural areas than in urban areas, although only the difference in headcount is statistically significant at the 95 percent level. With the vast majority of the population in rural areas, poverty in Mozambique is predominantly a rural phenomenon. About 82 percent of the poor live in rural areas; this is slightly higher than the share of rural population in total population. Turning to the regional disaggregation, we see that the incidence of poverty is highest in the central region, with the highest values for all three poverty measures, whereas the north and south are nearly equal in terms of the three poverty measures. For all three of the poverty measures used, the higher poverty rates in the central region are statistically significant, whereas there is no significant difference between the north and the south for any of the three. However, if Maputo City—which has low poverty rates relative to the rest of the country—is excluded from the southern region, the remainder of the southern region has poverty rates higher than the northern region, and is not significantly different from the central region.

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[27] The estimate from the MIAF data is considerably higher than other estimates of average individual well-being in Mozambique, such as the US$80 GDP per capita reported by the World Bank (1997).

Given that more than two out of every three Mozambicans live below the reference poverty line, there is a case for distinguishing a notion of ultra-poverty, which can help us focus on the poorest among the poor. There can be many ways to define ultra-poverty, all of which, while implying thresholds below the reference poverty line, are admittedly somewhat ad hoc in nature. For the analysis presented here, we set the ultra-poverty line at 60 percent of the total reference poverty line. However, we also experimented with an alternative "low" poverty line that was set at the *food* poverty line itself; the results of this experimentation are presented in this section only. This line is higher than the 60 percent ultra-poverty line; the weighted average of food poverty lines is about 76 percent of the reference poverty line. The results for the incidence and depth of poverty using the 60 percent ultra-poverty line and the food poverty line are presented in Table 7.

Using the 60 percent line, 37.8 percent of the Mozambican population is estimated to be ultra-poor (Table 7). Focusing on this subset of the poor, however, does not yield any particularly new insights at this level of aggregation. Like poverty, the incidence, depth, and severity[28] of ultra-poverty is greatest in rural areas and in the central region. In fact, the regional patterns are very similar with regard to the ranking of the regions and the statistical significance of the differences shown. We note, however, that none of the urban/rural differences in ultra-poverty are statistically significant, whereas the rural headcount is significantly higher when using the full reference poverty line. When considering the 60 percent poverty line as a measure of ultra-poverty, a greater proportion of the rural population falls below the line than the urban population, but on average, the urban ultra-poor have a slightly greater gap between their consumption levels and the ultra-poverty line, and greater inequality among the ultra-poor.

Alternatively, using the food poverty line, 53.4 percent of the national population are estimated to have per capita consumption levels below this line (Table 7). The rural/urban and the regional profile of this subset of the poor is quite similar to that of the

[28] The results on severity are not presented in Table 7, but are available from the authors.

poor and the ultra-poor identified using the 60 percent line. In view of this similarity, in the following we use the 60 percent line as our ultra-poverty line.

Turning to Table 8, we see significant disparities in mean consumption and poverty measures when the data are disaggregated to the provincial level. Poverty headcounts range from a low of 47.8 percent in Maputo City to a high of 87.9 percent in Sofala Province. Other provinces with particularly high poverty incidence are Inhambane (82.6) and Tete (82.3), all far above the next poorest province (Niassa, 70.6). The wide variation within regions is particularly striking (e.g., contrast Cabo Delgado and Niassa in the north, Manica and Sofala in the center, and Maputo City and Inhambane in the south). The ordinal ranking of the provinces changes very little among the three poverty measures, and given the magnitude of the standard errors, most of the changes in rank are not statistically significant. The most interesting finding along these lines is the comparison between Maputo Province and neighboring Gaza. The two provinces have similar headcount indexes, but Maputo Province's poverty gap and squared poverty gap measures are considerably higher than Gaza's, indicating more unequal and, on average, lower incomes *among* the poor in Maputo Province. When considering ultra-poverty (defined as 60 percent of the reference poverty line), Table 9 shows that the distribution of ultra-poverty by province is similar to the distribution of poverty by province, as shown in Table 8. Of particular note is the extremely high ultra-poverty headcount in Sofala Province (65.2).

7. AN EMPIRICAL MODEL OF HOUSEHOLD LIVING STANDARDS

MODEL SPECIFICATION

In estimating model (1), consumption is expressed in real terms, i.e., nominal consumption per capita is normalized by the spatial cost of living index. This normalization is justifiable because the class of poverty measures used are homogeneous of degree zero in mean consumption and the poverty line. This is because the poverty measure $p_{áj}$ depends on the ratio of c_j to z. Thus, instead of defining poverty measures in terms of nominal consumption per capita and nominal poverty lines for different regions, we can express them directly in terms of real consumption per capita and a poverty line expressed in the same real units.[29]

In the regression analysis, we allow for regional heterogeneity by estimating separate models for five regions, three for rural areas and two for urban areas. The rural sample is split into three regions: North (Niassa, Cabo Delgado, and Nampula provinces), Central (Tete, Manica, Zambézia, and Sofala provinces), and South (Gaza, Inhambane, and Maputo provinces, and the city of Maputo). The urban areas are divided into large cities (Maputo, Matola, Beira, and Nampula), and all other areas classified as urban in the MIAF sample. We later test whether it is tenable to assume that there is no regional heterogeneity within urban and rural sectors.

SELECTION OF EXPLANATORY VARIABLES

The set of variables that are hypothesized to determine consumption, and hence poverty, includes household and community characteristics. A key consideration in selecting from potential determinants of consumption is to choose variables that are arguably exogenous to current consumption. Thus, for instance, we do not include value or possession of durable goods in the set of explanatory variables because the imputed use-value of durable goods is a component of consumption (see Appendix). Similarly, we do not include dwelling characteristics as these are likely to be determined by household living standards; these characteristics determine actual or imputed rents that are also components of aggregate consumption for the household (see Appendix).

Also, variables such as current school attendance by children are deliberately omitted from the model, as they are arguably an outcome, rather than a determinant of current living standards. For such attributes, causality runs in the other direction. Our

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[29] See Chapter 1 of the MPAR for further discussion of the construction of poverty lines and the spatial cost of living indices.

selection of potential determinants is also guided by the results of the poverty profile, which suggested some significant correlates of poverty in Mozambique, albeit based on bivariate associations (see MPAR 1998). The selected set of determinants broadly fall into the following categories.

Demographic Characteristics

These include household size and composition variables. Four age categories are distinguished: under 10 years of age, 10-17, 18-59, and 60 years of age and above. The number of productive age adults in the 18-59 age-group is further split by gender.[30] We introduce a quadratic term in household size to allow for nonlinearities in the household size-living standards relationship. The age and sex of the household head are also included in the model.

Other household characteristics that may be loosely categorized as demographic variables are also included in the set of determinants of living standards. For instance, to capture the potential adverse effects of adolescent childbearing on household living standards (adolescent childbearing may adversely affect women's schooling, labor force participation, or productivity), a variable is included for the number of women in the household who had their first child before the age of 16 years.[31] The number of adult members with any physical or mental deficiency is also included among the set of determinants. Finally, the number of members who were refugees or dislocated due to war is also included as an explanatory variable.

Education

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[30] We also included the number of household members with missing age as a separate variable. This variable together with the other five household composition variables exactly sum up to the total household size.

[31] This characteristic was found to be strongly associated with poverty levels in the poverty profile (see MPAR, Chapter 2).

We include several measures pertaining to different levels and dimensions of educational attainment in the household. First, we included measures related to the number of adult (18 years or older) household members who stated that they can read and write. We then also included the number of adult members with primary (EP2 level) or higher level of education.[32] Since there is good reason to suppose a priori that the returns to male and female education may be significantly different,[33] these variables were also differentiated by gender. We also include the maximum level of education attained by any household member as an additional variable to see if this has an independent effect.

Employment

In this category we include variables relating to the distribution of occupations within households. In particular, three broad sectors of employment are distinguished: agriculture including livestock and fisheries; industry, mining, and construction; and commerce, transport, communication, and other services. Three corresponding variables then give the total number of adults in the household employed in each sector. We also include a variable related to diversification of income sources within the household with a view to examining the hypothesis that multiple income sources contribute to lower risks and higher income for the household.[34]

Agriculture, Land, and Livestock

The total area of the landholding (*machamba*) is included as a determinant of living standards. In the MIAF, landholding size was not measured, but rather estimated by the

[32] We experimented with the number of members, by gender, with postprimary education as separate variables, but abandoned this because very few women have postprimary education, especially in the rural north.

[33] There is evidence that points to the existence of a gender differential to the returns to education for other countries. For a review of literature, see Schultz (1988).

[34] This variable gives a count of the distinct number of income sources for the household, and takes values up to four.

respondents.[35] We also include a dummy variable to indicate if the household irrigated their land or utilized inputs such as fertilizers, pesticides, ploughs, motor pumps, or fumigation equipment. We define a variable to indicate the type and relative security of land tenure. In the model, land tenure is considered relatively insecure if land was acquired through informal occupation, or a loan, or on a rental basis.

The households are also distinguished by the type of crops they cultivated; three binary variables are included to indicate the cultivation of basic food crops, horticultural crops, and commercial crops.[36] Similarly, variables are also included for the number of cashew, citrus or coconut,[37] and other fruit trees that a household had.

A variable to indicate the household's possession of livestock is also included. To construct measures of livestock ownership we focus on identifying those households that possessed at least some critical minimum number of livestock (of any type). After examining the data, we defined a binary variable that took the value of 1 if the number of a particular type of livestock possessed by the household was no less than the 75th percentile among households who owned at least one of that type of livestock.[38]

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[35] We also tried to include cultivated, as opposed to *cultivable* area, but the two variables were highly correlated (correlation coefficient of 0.93) as households tended to cultivate all the land they had. Of the two, total landholding is preferred, largely because the area cultivated variable is only reported as a proportion of the reported landholdings, with only four coding options: less than half, half, more than half, and all. Furthermore, endogeneity is less of a problem with the landholding variable than it is with the area cultivated variable.

[36] For these variables we followed the classification used by the MIAF survey protocol (see Cavero 1998), as follows. Basic food crops are maize, cassava, sorghum, millet, rice, groundnuts, potatoes, sweet potatoes, beans, sesame, and *xingoza*. Horticultural crops are onions, tomatoes, all leafy green vegetables, pumpkins, peas, okra, carrots, yams, melons, peppers, garlic, eggplant, and cucumber. Commercial crops are defined as cotton, coffee, sugarcane, tea, ginger, sunflower, sisal, soybeans, and tobacco.

[37] Coconut was included in the same variable as citrus because of its economic importance in the coastal zones of Zambézia and Inhambane Provinces. All other fruit crops were included in the "other" category.

[38] In practice, the 75th percentile was approximately equal to the mean for all types of livestock.

Community Characteristics and Access to Services

From the community module of the MIAF, a number of potential variables are available to reflect rural households' access to infrastructural services. For instance, there are variables to indicate if the village where the household lived had a bank, a market, an agriculture-livestock extension center, a post office, a public telephone, or if a paved or dirt road passes through that village.[39] Similarly, there are also variables to indicate the presence of health facilities in the village, including a doctor, nurse, midwife, health center, health post, or traditional healer. We initially tried to identify the separate effects of community facilities; however, with our data, these individual effects were imprecisely estimated. We therefore aggregate these variables into two indices of infrastructural development. The first is an economic infrastructure index, which is the simple average of six binary variables indicating the presence of the following six individual facilities in the village: bank, market, agriculture-livestock extension center, post office, public telephone, and paved or improved dirt road. The second is an index of health infrastructure, which is the simple average of four binary variables representing the presence in the village of a doctor, nurse, health center, or sanitary post.

To capture the effects of further health factors, a dummy variable to indicate if malaria was reported to be the principal health problem at the community level is also included.

Summary statistics on the model variables can be found in Table 10 and Table 11.

MODEL ESTIMATION

The first estimation issue has to do with missing values in the data set for a number of explanatory variables. Even though the number of missing observations for any single variable is not large, the set of households for whom there is missing data for at least one

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[39] The community questionnaire from which these variables are derived also provides the distances from the village to these services, but we consider this information unreliable and hence, limit our specification to binary variables indicating the presence of such services in the village.

variable increases with the number of explanatory variables. Since we are using a large set of variables to predict consumption, we opt to include observations with missing data, by constructing a set of dummy variables that take the value of one if the household is missing data for a particular variable. This way we reduce the potential of sample selection bias and we do not exclude useful information from households who have valid non-missing data for most explanatory variables.

There are also some concerns of potential bias in parameter estimates due to endogeneity or omitted variables. For instance, it could be argued that agroecological factors that determine the productivity of land are omitted from the regression, and hence implicitly included in the error term of the model. If these factors are a significant determinant of living standards, the error term will not converge to zero in probability limit, and the parameter estimates for the included explanatory variables will be inconsistent.

Another variant of this problem could be described by the argument that some of the determinants, for instance, whether there is a market in the village or whether a household cultivates horticultural or commercial crops, themselves depend on the omitted agroecological factors. Because the omitted factors are subsumed by the error term, these determinants are now correlated with the error term, and hence give rise to inconsistent parameter estimates.

One solution to the potential problem of omitted variables is the use of a fixed effects model. For instance, a set of village dummy variables will control for all observed and unobserved village-level determinants of living standards. For our data and model, we decided to introduce fixed effects at the district level, where each district contains several sample communities. Because we want to analyze community-level variables (in the rural model, where community-level data are available), we cannot introduce fixed effects at the village level. (This is because the village-level fixed effects estimator will absorb all community-level information, and preclude the analysis of the specific effects of any particular community variable.) There are 128 districts, and we argue that including district-level fixed effects controls for much of the potential omitted-variable bias.

A potential limitation of a model along the lines of equation (1) is that the marginal effect of a determinant on log per capita consumption is the same across all households within the domain of estimation. However, it could be argued that the marginal effect of a variable depends on other household characteristics. For instance, the marginal effect of a bank or market in the village itself could depend upon the education levels of household members. This suggests a generalization of model (1), where some determinants of living standards are interacted with each other (for an example of such an approach, see Datt and Jolliffe 1998).

However, such an augmentation of the model comes at a price. The interaction terms can be highly collinear with other variables in the model. This can often lead to highly imprecise, and volatile, parameter estimates, which can in turn produce misleading results in simulations where only a select subset of variables are altered at a time. Thus, we opt to introduce only a limited set of interaction terms. For the urban model, these are limited to the interaction of male and female literacy variables with the sector of employment. For the rural sector, in addition to these we also include interactions of the literacy variables with the community-level indices of infrastructural development.

Thus, our initial specification is model (1) with district fixed effects. This model is estimated separately for rural and urban sectors, with the rural model including community-level variables that were not collected in urban areas. For the rural model, the parameters are allowed to vary for the north, center, and south regions. The parameters for the urban model are also allowed to differ for two domains: the big cities and other urban areas. To permit the parameters to vary by domain, and facilitate hypothesis testing for the equality of parameters across domains, we estimate the rural model by interacting the explanatory variables with dummy variables for each of the three regions. An analogous procedure is followed for the two categories of urban areas. This approach also accommodates the few instances in which we choose not to allow a parameter to vary by domain, because the explanatory variable had extremely limited variation within one or more domains. For instance, there are only 14 households in the total rural north sample of 1,905 households that had an adult female with primary or higher (EP2 or above) level of education. For the rural areas as a whole, only 1.5 percent of the sample households had an adult female with primary or higher education. For variables such as this, it is not possible to identify precise domain-specific effects; in these cases, our preferred estimates allow for only a single domain-invariant effect.[40]

8. RESULTS

THE PREFERRED ESTIMATES

We subject the initial parameter estimates to a limited pruning, deleting interaction terms that are not significant at the 10 percent level. These terms are deleted conditional on the acceptance of a Wald test for their joint deletion (the test statistics for rural and urban models are reported at the bottoms of Table 12 and Table 13).[41] However, while this level of pruning is easily accepted, the test for the joint deletion of *all* interaction terms is rejected for both the rural and urban models at the 10 percent level of significance or better (for the rural model, the significance level is 0.097 and that for the urban model is 0.019).

We also test for the joint significance of district fixed effects. The null hypothesis of the joint insignificance of district fixed effects (i.e., that each of the coefficients for the district dummy variables is not significantly different from zero) is convincingly rejected for both rural and urban models (see Tables 12 and 13). The fixed effects specification is therefore retained in our preferred estimates of the models.

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[40] The variables controlling for missing data for particular explanatory variables were also not interacted with domain binary variables.

[41] In these and subsequent tests, we use a variance matrix corrected for sample design effects, allowing for both the stratified and clustered nature of our sample.

We investigate the possibility of regional heterogeneity in the effects of different determinants on living standards. Thus, for the rural model we test for equality of parameter estimates across the north, central, and southern regions, and find that this homogeneity hypothesis is strongly rejected (Table 12). Similarly, for the urban model, there is no support for the hypothesis of identical parameter estimates for the big-city and other urban domains (Table 13).

The preferred parameter estimates are also subjected to further diagnostics for collinearity. However, the variance inflation factors for the parameters do not suggest this to be a serious concern.[42] Diagnostic tests for influential observations (using *dfbeta* statistics) also confirm that the parameter estimates are not unduly influenced by a small subset of observations. The final estimates for the rural model are reported in Table 12, with the results for the urban model appearing in Table 13. A detailed discussion of the regression results follows, beginning with the rural model.

RURAL DETERMINANTS OF CONSUMPTION AND POVERTY

Table 12 presents the parameter estimates and t-ratios for the rural models for each of the three regions. The fit of the fixed effects model is good, with an R^2 of 0.538. The statistical significance of various parameter estimates varies widely, both across variables within a region and across regions for individual variables. With only a few exceptions, the signs on the parameters are as expected, and the relative magnitudes of the parameters are also reasonable. Note that as the dependent variable is in natural logarithm form, the estimated regression coefficients measure the percentage change in consumption per capita from a unit change in the independent variable. We now turn to a more in-depth discussion of the regression results, by category of explanatory variable, starting with the demographic variables.

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[42] The highest variance inflation factors for the rural and urban models were 21.73 and 18.97, respectively (with the exception of binary variables for the central and north regions in the rural model).

Demography

Given the strong negative relationship between household size and per capita consumption already noted in earlier work (see MPAR 1998), it is not entirely surprising that the estimated parameters are negative, and highly significant, for the six variables measuring the number of people in the household, disaggregated by age and sex. However, it is surprising that the coefficients are more negative for adults in the household than they are for children, a result that is consistent in all three regions. That is, according to the regression estimates, other things equal, an additional adult in the household will reduce consumption per capita more than an additional child in the household will. This is counterintuitive, especially in light of the descriptive information on poverty and dependency ratios presented earlier.

The estimated coefficient on the quadratic term for household size is positive and significant, suggesting a U-shaped relationship between household size and consumption per capita, with the bottom of the U-shape at approximately 10 to 12 persons. This implies that, on average and other things being equal, at household sizes of less than 10 to 12 persons, the addition of another person to the household reduces per capita consumption, but at a decreasing rate. As only 3 percent of the MIAF sample households have more than 10 members, and only 1 percent have more than 12 members, one need not (and should not) pay much attention to ascending part of the U-curve.

The above results are, however, contingent on the implicit assumption regarding economies of household size in consumption (see MPAR 1998, Chapter 2). The use of per capita consumption as the welfare metric carries the assumption of no economies of household size.

We explored the effects of economies of household size by calculating a modified consumption welfare metric $(c_j / h_j^{è})$, where è = 1.0 gives the per capita case, and 1 - è gives a measure of economies of household size. We experiment with values of 0, 0.2, 0.4, 0.6, 0.8, and 1.0 for è. The poverty headcount was then calculated for each household size category,[43] where the poverty line was normalized so that it pertains to a household of average size, i.e., a household of average size has the same poverty headcount for all values of è. The results are presented in Figure 3. The line corresponding to è = 1.0 shows the expected pattern: as household size increases, so does the poverty headcount. For the other polar case, è = 0, the poverty headcount declines as household size increases. The correlation between household size and poverty headcount almost disappears when è = 0.4, as indicated by the relatively flat line for that value.

To address the question of how sensitive our results are to this assumption, we also estimate the preferred model using consumption "per equivalent adult" using the size elasticity at which household size and poverty are almost orthogonal. That is, if c_j is household consumption and h_j household size, the dependent variable is $ln\ (c_j / h_j^{\text{è}})$, with è = 1.0 for the per capita case and è = 0 .4 for the alternative; the latter is the critical value of è, where the relationship between poverty and household size tends to vanish (see Figure 3). In the alternative model, the coefficients for the number of persons in the household became much smaller, ranging from -0.063 to only -0.147. Most of the other estimated parameters in the model did not change much in the alternative model. The principal exceptions were parameters for other demographic variables: those for age of household head became more negative, and the squared term for household size remained positive, but were much smaller.

The age of the household head does not have a significant effect on consumption per capita in any of the regions. However, the sex of the head of household does have a significant effect in all regions, with male-headed households having higher consumption per capita than female-headed households. The magnitude of the effect ranges from 4 percent in the southern region, to 9 percent in the central region and 13 percent in the northern region.

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[43] As few households (only 343) have more than 10 members, in the calculations the '10+' persons category includes all households with 10 or more members.

Recall that in the poverty profile it is reported that in rural areas, female-headed households are *less* likely to be poor (and ultra-poor) than male-headed households, for all three poverty measures. Although it might appear that the regression results are inconsistent with the poverty profile, such is not the case, and it is important to understand why and what its policy implications are. The principal reason is that the regression analysis controls for the levels of other variables, whereas the poverty profile does not; thus, the regression analysis is comparing male- and female-headed households that have the same number of household members, the same amount of arable land, the same educational levels, and so forth. However, the average male- and female-headed households do not have the same values for these covariates. For example, rural female-headed households tend to be smaller than male-headed households (3.7 members versus 4.9 members, on average), and smaller households tend to be less poor. There are, no doubt, other variables that confound the effect of the sex of the household head in the bivariate poverty profile analysis.

What does this contrast between the poverty profile and regression results imply for targeting female-headed households in Mozambique? The answer depends on the type of policy in question. If one is thinking of using female headship as a single targeting indicator for a transfer program directed to the poor, then the correct answer is given by the "unconditional" poverty profile, which suggests that female headship is *not* a good indicator of poverty. But, if, alternatively, the aim of policy intervention is to correct an underlying factor responsible for lower living standards, the factors identified by a multivariate analysis provide the correct answer, although in this case female headship is not particularly amenable to policy.

The number of disabled persons in the household does have the anticipated negative sign in all regions, but the impact is significant only in the south. The poverty profile results suggest an association between poverty and migration because of war. In the regression analysis of the determinants of poverty this effect is statistically significant only in the central region. The final demographic variable is the one for the number of young mothers (women currently between the ages of 12 and 49 who had their first child before the age of 16) in the household, which is also associated with higher poverty levels in the poverty profile. The regression coefficients for this variable are somewhat erratic, with the expected negative coefficient in the north (significant at the 10 percent level), a significant (also at the 10 percent level) positive coefficient of the same magnitude in the center, and an insignificant effect in the south.

Education

Among the adult education variables, most have the expected positive association with consumption per capita. For adult literacy, the results are strongest in the south—both in terms of the magnitude of the coefficients and statistical significance—and diminish as one moves northward. Female literacy, in particular, has a big impact on consumption per capita: the coefficient for female literacy in the south is three times that of male literacy, and in the central region the female coefficient is twice the size of the male literacy coefficient. The negative coefficient for female literacy in the north is not significantly different from zero, but even zero would be somewhat difficult to explain, given the number of studies that have shown the positive contributions of basic literacy.

Although both adult male and female primary education have the expected positive signs, neither are statistically significant at the 10 percent level. However, the variable for maximum level of education of any adult household member is positive and significant in all three regions. This indicates that additional education for *at least* one member of the household has a positive effect on consumption per capita independent of the effect of the number of literate and primary school-educated household members. The significant positive effect of the maximum level of education also subsumes the effect of primary education. To confirm this, we reestimate the model, dropping the maximum education variable. On doing this, both the male and female primary education variable become significant at the 5 percent level or better.[44]

Employment and Income Sources

The three variables for number of adults employed in different economic sectors show the expected pattern. Most are statistically significant, and all are positive, indicating that, other things equal, adult employment of any kind leads to higher consumption per capita than unemployment or unpaid housework.[45] The incremental gain in per capita consumption is smallest for those employed in agriculture and fisheries, and largest for those employed in "other" sectors, which principally consists of services. The magnitude of some coefficients, particularly for "other" sectors, should be treated with some caution, as only a small proportion of the rural labor force is employed outside of agriculture, implying that the estimates for other sectors are based on relatively few observations. The variable for diversification of income sources is statistically significant, with a positive sign only in the southern region.

Agriculture and Livestock

Among the agriculture- and livestock-related variables, area of landholdings (in natural log form) is only statistically significant in the north. Even there, the effect is small, with a 1.00 percent increase in cultivable area is associated with a 0.05 percent increase in per capita consumption. Recent studies by the Ministry of Agriculture and Fisheries and Michigan State University, using data collected from northern Mozambique, have argued that landholding size is an important determinant of per capita incomes (see,

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[44] The estimated parameter on male primary education is 0.10 with a t-ratio of 3.5, and that on female primary education is 0.15 with a t-ratio of 2.1.

[45] The MIAF survey protocol treated unpaid workers differently, depending upon the type of work they did. If the work was in agriculture, they were considered to be employed in the agricultural sector. However, if they reported doing housework (including fetching water or wood, food preparation, etc.) for their own family, they were not considered part of the labor force, and not employed in any sector.

for example, Marrule et al. 1998; Tschirley and Weber 1994; Ministry of Agriculture and Michigan State University 1994). Our findings suggest that although there does appear to be a relationship between landholding size and consumption levels in the north, the impact of increased landholding size is weak. Moreover, the results suggest that the association between landholding and consumption might not be generalizable to the rest of the country.[46]

The use of some equipment or irrigation, production of crops that are strictly commercial (cotton, tobacco, etc.), and number of cashew trees (in logarithmic form) have the expected positive coefficients, but none are statistically significant at the 10 percent level. Cultivation of horticultural crops has a negative coefficient, and it, too, is statistically insignificant; the same is true of the variable for security of land tenure.

The variable for citrus and coconut trees has a statistically significant coefficient only in the southern region, where it is likely to be capturing the importance of oranges, tangerines, and coconuts in Inhambane Province. The coefficients for "other fruit and nut trees" are also positive and significant in the central and southern regions.

The dummy variable representing possession of a critical number of livestock has positive and significant coefficients in all three regions. The coefficients are also large, indicating that possessing a critical number of livestock is associated with per capita consumption that is higher by 9 to 13 percent.[47]

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[46] Note that this result should be tempered by the reminder that land area in the MIAF was not measured, but rather reported by sample households, who have little reason to know the size of their land, particularly given the low level of input use.

[47] It is worth noting that this variable is likely to be somewhat endogenous, and the causality may run both ways: livestock ownership may increase a household's income and consumption through the sale or consumption of animals and animal products, but better-off households may also purchase livestock as a form of investment.

Infrastructure and Other Community Characteristics

The estimated coefficients for the two infrastructure index variables constructed from the community-level data (one for general economic infrastructure and the other for health services) both have the expected positive signs, but neither are statistically significant in any region. When the economic infrastructure variable is interacted with adult female literacy, the coefficient is positive and significant, suggesting that at least some basic educational background is necessary to realize the benefits of improved economic infrastructure. The other community-level variable, a dummy variable indicating whether malaria was cited as the most important health problem in the community, has an estimated coefficient not significantly different from zero in any region.

URBAN DETERMINANTS OF CONSUMPTION AND POVERTY

Table 13 presents the results from the estimation of the urban models of the determinants of real consumption per capita, estimated separately for large cities (Maputo, Matola, Beira, and Nampula) and small urban areas. The fit of the model is good, with an R^2 of 0.502. Results for specific coefficients are discussed below.

Demographic

As in the rural models, all of the coefficients on the variables for household size and age composition are large, negative, and statistically significant; the quadratic term for household size is positive and significant. Once again we see the counterintuitive result that the coefficients for adults are more negative than the coefficients for those under the age of 18. As in the rural case, when the model is respecified allowing for economies of household size, the coefficients for age and sex composition of the household remained negative, but are much smaller. Also, in the urban model that allowed for economies of household size, most of the parameters were unchanged from the model specified in per capita terms, with the exception of the age of the household head and the quadratic term for household size, as was true in the rural reestimation.

In large cities, households with older heads tend to be slightly less poor, with consumption per capita increasing 0.4 percent for each additional year of age; in small urban areas there is no significant relationship between the age of the household head and per capita consumption. In all urban areas, female-headed households are significantly poorer than male-headed households. Other things equal, the consumption per capita of an urban male-headed household is 15 to 18 percent higher than that of its female-headed counterpart. For urban areas, this result may be seen as reinforcing the results seen in the poverty profile (in Chapter 2 of MPAR), which showed in a bivariate analysis that in urban areas, female-headed households are more likely to be poor than male-headed households.

The variables for number of persons with disabilities and number of war migrants in the family do not appear to be significant determinants of per capita consumption. The variable for number of women who had their first child before the age of 16 is significant, and negative, only in large cities.

Education

While all estimated coefficients for the education variables have the expected positive signs, they are not always significant. For example, adult male literacy in large cities is not a significant explanatory variable, nor is female literacy in small urban areas. Conversely, in small urban areas, holding other variables constant, an additional literate adult male increases consumption per capita by 10 percent.[48] The coefficient for adult female literacy in big cities is extremely large, suggesting an increase in per capita consumption of 25 percent associated with making a previously illiterate adult female literate.

The estimated coefficients for completion of primary education are as expected in three out of four cases. The adult female primary education coefficients are positive and significant in both models. The corresponding variable for males is positive in both

[48] Note that, because the model also controls for household size, the variable really measures the effect on per capita consumption of an adult literate male in the household relative to that adult male being illiterate.

models, but significant only in the small urban areas model. In each setting the adult female primary education coefficient is larger than the coefficient for males. As in the case of the rural models, the variable for the maximum educational level of anyone in the household is large and significant in both urban models. Also, as in the case of the rural model, the lack of significance of some of the education variables is partly on account of their effect being picked up by the significant effect of the maximum education variable.

Employment and Income Sources

In urban areas, the coefficients for employment in the agricultural, industrial, or construction sectors are statistically insignificant, which is a surprising result. On the other hand, employment in the services sector ("other") is significant, positive, and reasonably large in both large and small urban areas. Diversification of income sources does not add any independent explanatory power to the model, with estimated coefficients that are essentially zero.

Agriculture and Livestock

Among the agriculture and livestock variables, area cultivated is not a significant determinant of per capita in consumption in large cities, but it is in small urban areas. The use of agricultural equipment or irrigation has the expected positive sign and a reasonably large coefficient, but the coefficient is not significant at the 10 percent level. The land tenure variables did not work as expected: the coefficient is insignificant in the large city model, and has a perverse negative sign in the small urban areas model.

Because of the relative scarcity of tree crops in urban areas, we used a more aggregated variable for tree crops in the urban model. The log of the total number of fruit and nut trees is negative but insignificant in the large cities model, and positive and significant in the small urban areas model. Finally, as in the rural areas, ownership of a "critical mass" of livestock appears to be associated with significantly higher consumption per capita.

9. POVERTY SIMULATIONS

THE METHODOLOGY

Having estimated the consumption models above, we now move to the task of generating predictions of poverty. The formal details of the methodology of generating these predictions can be found in Datt et al. (1998), but we can illustrate the key steps of the procedure for the headcount index as follows.

Using the estimated parameters ($\hat{\beta}$) of the preferred model, we first generate predictions of consumption per capita ($\hat{c}_j$) for every household *j* as

$$\hat{c}_j = e^{\hat{\beta}' x_j}. \qquad (4)$$

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

$$\hat{p}_{0j} = prob(\ln \hat{c}_j < \ln z) = prob(\eta_j < \ln z - \hat{\beta}' x_j) = \Phi\left((\ln z - \hat{\beta}' x_j)/\hat{\sigma} \right), \qquad (5)$$

where Φ is the standard normal distribution function, σ is the standard error of the regression, and ^ indicates estimated values.

Based on predicted consumption, one could of course construct a binary variable to classify a household as poor or nonpoor. But predicted consumption is only a point estimate, which comes with its own prediction or forecast error. Thus, for example, even if predicted consumption were above the poverty line for a given household, there is a nonzero (estimable) probability that the true value of that household's predicted consumption is below the poverty line. It is therefore not correct to treat predicted consumption as a nonstochastic variable, and hence, we go on to compute the probability of being poor associated with any given level of predicted consumption.

Finally, a weighted average of the household probabilities of being poor gives the predicted national headcount index. Predicted measures of the depth and severity of poverty can be derived similarly (see Datt et al. 1998).

The poverty simulations we consider below are based on the parameter estimates of the preferred model. The usual caveat applies to the results of this simulation analysis. The simulations assume that the considered changes in the determinant variables do not affect the model parameters or other exogenous variables. While this is a plausible assumption for incremental changes, it warrants a more cautious interpretation for simulations that involve "large" policy changes.

THE SIMULATIONS

We now consider a set of policy simulations. The purpose of these simulations is two-fold. The first is to illustrate the impact that changes in the levels of the determinants of poverty have on poverty levels. Where explanatory variables are intrinsically related to one another, it is sometimes difficult to trace the relationship between a determinant and the outcome variable by examination of the regression coefficients alone. For example, for households that do not have an adult who has completed primary school (the majority of households in the MIAF sample), increasing the number of adult females with EP2 will also increase the maximum educational level attained by any adult in the household; these are two separate variables in the determinants models, and the effect on consumption per capita in these households will be the sum of the two effects. There might be implications for the number of literate persons in the household too.[49] The interpretation of regression results is also made less transparent by the presence of interacted variables.

[49] One could avoid these complications by assuming that a change in a given variable does not lead to changes in other variables. In the example used here, one could assume that there is already someone in the household with primary education, and that there is someone who is literate and would go on to complete primary education. However, these assumptions often diverge a great deal from reality, and the simulations provide a simple way to avoid making unnecessary, and unrealistic, simplifying assumptions.

The second purpose of the simulations is to demonstrate, in a relatively nontechnical presentation, the effects that various policies can have on consumption and poverty. For this reason, we focus on altering variables that are amenable to change, to at least some degree, through public policy.

Before running the simulations, it is necessary to establish a reference point, or base simulation. This is because the empirical models of the determinants of poverty are not perfect predictors of consumption per capita, or poverty; as such, it would be incorrect to compare the actual consumption and poverty levels (reported in section 6) with the simulated levels. Instead, the correct reference point for consumption levels is the mean of the predicted per capita consumption values ([illegible]) from the determinants regressions, using the original values for x_j, as per equation (4). For poverty levels, similarly, the correct reference point is the mean values calculated using equation (5) and the original x_j. Table 14 compares the actual consumption and poverty levels with the results of the base simulations, or reference points. From the table, we see that the predicted mean consumption and poverty measures are close to the actual values calculated from the MIAF data.

The simulation results are presented in Tables 15 and 16. Table 15 has results for the rural, urban, and national populations, showing the change in mean real consumption per capita resulting from the simulated change in the independent variables, and the changes in the three poverty measures corresponding to that change in consumption. The poverty measures capture the distributional effects of the change in consumption from the simulation. Table 16 has analogous information, but focuses only on the subset of households who are affected by a particular simulation.

One result that is common to almost all of the simulations is that the percentage change in the poverty indices is greater for higher orders of $P_{\acute{a}}$. That is, the percentage reduction in the poverty gap is generally larger than the reduction in the headcount index, and the reduction in the squared poverty gap is generally larger than the reduction in the poverty gap. This is, at least in part, because many of these simulations raise the consumption levels of the poor, but they do not always move the poor from below the poverty line to above the poverty line. This, in turn, may be because the increase in consumption is small, or because the household is far below the poverty to begin with, or both. Nevertheless, improving the well-being of those remaining below the poverty line is still an important consideration, especially in a country such as Mozambique, where two-thirds of the population is below the poverty line.

When examining the simulation results, it is useful to keep the following in mind. The magnitude of change in mean consumption and poverty in each of the simulations is attributable to three factors: the quantitative relationship between the determinant of poverty and per capita consumption (i.e., the sign and magnitude of the regression coefficients); the proportion of the population affected by the simulation; and the size of the considered change in the determinant of poverty.

Education

In Simulations 1 - 5, we present the effects of increased educational levels on per capita consumption and poverty. Simulations 1 and 2 focus on basic literacy, whereas Simulations 3 - 5 explore the effects of higher rates of primary school completion (EP2). For Simulation 1 we increased, by one, the number of adult males in the household who could read and write; this change only applies to households where there is an adult male who cannot read and write. Eighteen percent of the urban population live in such households, compared to 46 percent of the rural population (see Table 16). Based on the MIAF data, this simulation would have the effect of increasing the urban adult male literacy rate from 83 percent to 99 percent, while in rural areas the adult male literacy rate would almost double, from 50 percent to 95 percent. For the entire population, mean consumption per capita increases by 5 percent in rural areas and 1 percent in urban areas (Table 15). The increase in consumption per capita is distributed such that it reduces the poverty headcount by 4 percent in rural areas and 1 percent in urban areas. The percentage changes in the poverty gap (PG) and squared poverty gap (SPG) are greater than the changes in the headcount. For instance, the rural PG and SPG indices decline by 6 and 8 percent, respectively.

From Table 16 we see that among the affected households, the corresponding changes for the simulation are larger, as expected. Rural and urban mean consumption increase 10 percent and 8 percent, respectively, while the rural and urban headcount indices decline by 7 and 5 percent, respectively.

Simulation 2 is the corresponding simulation for adult females. Because there are greater numbers of households with adult females who are not literate, this simulation affects a much larger population than does the simulation for male literacy: an estimated 87 percent of the rural population and 50 percent of the urban population live in households where there is a least one adult female who cannot read and write (see Table 16). Simulation 2 would increase the female literacy rate from its present levels of 15 percent in rural areas and 57 percent in urban areas, to 86 and 95 percent, respectively. This large change, combined with regression coefficients that are typically higher for female literacy than male literacy (see Table 12 and Table 13), leads to a much greater impact on consumption and poverty than occurs in Simulation 1, especially in urban areas. As shown in Table 15, mean per capita consumption increases by 8 percent in rural areas and 10 percent in urban areas, the poverty headcounts in the two zones decline by 7 and 10 percent, respectively, with even greater percentage reductions in the higher-order poverty indices. Note that the percentage reduction in poverty is somewhat greater in urban areas, despite the fact that the simulation affects a smaller proportion of the urban population than it does the rural population.

Simulations 3 and 4 are similar to Simulations 1 and 2, except that they model the effects of increasing educational attainment of adult males and females at a higher, and necessarily formal, level: completion of primary school. As seen in Table 16, these simulations affect the large majority of the population, meaning that a high proportion of the population lives in households where there is at least one adult male (Simulation 3) or adult female (Simulation 4) who has not completed primary school. Note that the changes implied by Simulations 3 and 4 are enormous. According to the MIAF data, only 4 percent of rural adult males and 20 percent of urban adult males have completed full primary education. Under Simulation 3 those rates would change to 86 and 81 percent, respectively. The changes implied by Simulation 4 are even more dramatic, with the percentage of rural adult women who have completed primary school increasing from 1 percent to 80 percent, and an increase from 11 to 80 percent among adult urban women. Because the change is so large, these results should be treated with extra caution.

As one would expect, primary schooling has a larger impact on per capita consumption than literacy alone does.[50] For Simulation 3, simulating an extra adult male in the household with completed primary schooling, the effects are roughly equal in rural and urban areas, with increases in mean consumption per capita of about 15 percent, a reduction in the poverty headcount of approximately 13 percent, and declines in the poverty gap and squared poverty gap in the neighborhood of 20 and 25 percent, respectively.

As with literacy, the effects of increased female primary school completion (Simulation 4) are greater than those for males, because a (marginally) greater proportion of the population is affected, and more important, because the rate of return to female primary education is higher than that for male primary education (see estimated regression coefficients in Table 12 and Table 13). Overall, the impact of Simulation 4 is about twice as large as Simulation 3 for all measures shown in Table 15.

Simulation 5 uses a different approach to simulating the effects of a change in educational levels on consumption and poverty. In this case, we simulate the effect of guaranteeing that at least one adult in the household, male or female, completes primary

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[50] Note that for the simulations, in households where there was a person of the appropriate sex who was literate but had not completed primary school, we simply increased the value of the primary school completion variable and, if necessary, the value of the variable for the maximum level of education in the family. However, if none of those who had not completed primary school were literate, we also increased the literacy variable by one, as one cannot be illiterate and complete primary school successfully. Thus, the effect of primary school completion on per capita consumption is often the sum of several regression coefficients, rather than the coefficient for primary school completion alone.

school. According to the MIAF data, in 1996-97, 38 percent of urban households, and only 6 percent of rural households, had a member who had completed full primary education. As might be expected, the effect of this simulation on poverty and consumption falls somewhere between that for Simulations 3 and 4. In percentage terms, the poverty-reducing effects of such a policy are approximately equal in rural and urban areas.

Agriculture

We examine the agricultural determinants of poverty by altering several different variables, and representing different approaches to agriculture-based policies to reduce poverty. These may be categorized as expanding the area cultivated per household, increasing the use of productivity-enhancing agricultural inputs, increasing the productivity (or number) of fruit and nut trees, increasing the production of crops that are exclusively commercial (e.g., cotton or tea), and increasing the proportion of households that have a significant number of livestock.

Simulation 7 estimates the effect of increasing the *machamba* area, by 0.5 hectares, operated by those households who already have at least some agricultural land. As may be seen in Table 16, this change would affect one-half of the urban population and nearly all of the rural population. Even though the proportion of the population affected is extremely large, the impact on consumption and poverty is small, with Table 15 showing only a one percent increase in mean consumption per capita, a one percent reduction in the poverty headcount, and similarly meager reductions in the other poverty measures. As an addition of one-half hectare of land per household is not a small change—recall that the average land size reported by landholders is 2.4 hectares, then clearly the small magnitude of the change is attributable to a small coefficient on the land variable, which has already been noted earlier in the discussion of the regression results.

Simulation 7 takes a more targeted approach to increasing area cultivated. The increase in total land cultivated is approximately the same as in Simulation 6, but in this case it is an increase of one hectare per household, targeted to those households who presently have two hectares or less. Even though this simulation affects fewer households, the results are essentially the same as those for Simulation 7.

Simulations 8 - 10 examine the effects of increasing the use of productivity-enhancing agricultural inputs, including one or more of fertilizers, pesticides, heavy equipment, and irrigation. The three simulations consider the same change in the independent variable: changing the dummy variable for use of modern agricultural inputs from zero to one, and limited to those who were cultivating at least some land at the time of the survey. The difference is in the group selected for the change. In Simulation 8 the change is limited to those households that have some land, but no more than one hectare; 29 percent of the rural population and 24 percent of the urban population are affected by this simulation (Table 16). In Simulation 9 this upper limit on landholding size is relaxed to include all households with no more than two hectares; this simulation affects 59 and 35 percent of the rural and urban populations, respectively. Finally, Simulation 10 includes all households that cultivated some land at the time of the survey, which is 89 percent of the rural sample and 43 percent of the urban sample.

As shown in Table 16, in each of Simulations 8 - 10, the mean per capita consumption of the affected population is approximately 6 percent in rural areas and 8.5 percent in urban areas, which is considerably higher than the results for the land expansion simulations (Simulations 6 and 7). This suggests that productivity-enhancing inputs are likely to have a bigger impact on consumption and poverty than land expansion will. However, even in the most ambitious case (Simulation 10), in which all farming households adopt at least some modern agricultural technology, the gains in consumption per capita are modest, at about 5 percent, and reductions in the poverty headcount are similarly modest at 4 percent.

Simulations 11 and 12 explore the effects of expanded production of cashew, Mozambique’s third largest export earner after prawns and cotton, and a subject of considerable policy interest in recent years. One area of focus has been to increase the productivity of existing cashew trees by rehabilitating the existing stock of trees, which is the primary avenue for increasing cashew production in the short term (World Bank and Ministry of Agriculture and Fisheries 1998). Another approach is to increase the number of trees that each cashew producer has in production, although that approach is inherently medium- to long-term, as cashew trees do not start producing nuts in any significant quantity until five to six years after planting. Simulation 11 captures either of these approaches to expanding cashew production, by simulating a 20 percent increase in cashew production among existing cashew producers—the simulation is general enough that it could be interpreted as increased production of existing trees or the planting of new trees by current cashew growers. The simulation is limited to rural areas because urban cashew production is negligible. From Table 15 we see that there is almost no impact whatsoever on mean consumption levels or on poverty. In part, this is because of the relatively small population affected by the simulation, i.e., the small proportion of the population living in households that currently grow cashew (see Table 16). It is also due to the small estimated coefficients in the relationship between the number of cashew trees and per capita consumption; the impact is almost zero even among those affected by the simulation.

Yet another approach to expanding cashew production that is currently being promoted is to encourage households to begin producing cashew, which is modeled in Simulation 12. In Simulation 12 we selected a 50 percent random sample of households in the main cashew-producing provinces (Nampula, Zambézia, Gaza, and Inhambane) who were not growing cashew at the time of the survey, and “gave” them cashew trees. Each of these new cashew-producing households was “given” 46 cashew trees; this number is twice the median number of cashew trees calculated from the sample of cashew producers in those provinces.[51] The large number of trees, and high proportion of new growers, were chosen because earlier simulations (not shown) with more conservative growth in new cashew producers had a small impact. As shown in Table 16, even this large increase had a small impact on affected households, and a much smaller impact on mean consumption and poverty at the national level (Table 15).

Simulation 13 examines the potential poverty-reducing impact of expanded production of citrus fruit or coconut; coconut was included because it is economically important for both income and auto-consumption in the coastal zones of Zambézia and Inhambane Provinces. As with the first cashew simulation (Simulation 11), we model a 20 percent increase in citrus and coconut production, and also limit the simulation to rural areas. Here, too, the impact on consumption and poverty is negligible, for those affected by the simulation as well as the country at large.

Simulation 14 examines crop selection, modeling the effects of households that are currently producing any type of crop, adopting crops that may be considered strictly commercial, as already defined in footnote 36.[52] Note that the simulation specifies adoption of commercial crops *in addition to* the crops the household was already producing. Most (although not all) of these crops are not suitable for production in urban environments, so the simulation is limited to rural areas, where it affects 91 percent of the population (i.e., 9 percent of the rural population was in households that were already

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[51] In the MIAF data there are 2,629 rural households in those four provinces, of which 1,006 had cashew trees, at the time of the survey, with a median number of 23 trees per cashew-producing household. There were 1,623 households without cashew trees, from which 812 households were randomly selected. As the simulation results depend in part upon which 812 households are randomly selected (for example, because the estimated parameters vary by region, and the regional composition of the new growers in the simulation can change with each random draw), we repeated the simulation several times and compared results. As none of those showed a large impact on consumption or poverty, we did not employ a full bootstrapping procedure for this simulation.

[52] It is possible that some output from some of these crops might be consumed at home, but the processing requirements indicate that such use would most likely be minor. It is also recognized that some of the most important "commercial" crops in Mozambique are basic food crops such as maize. These crops are deliberately excluded from the simulation because of the difficulty in analyzing the dual roles of these crops in the MIAF data.

growing one or more of these crops). In this simulation, mean consumption increases by 3 percent and the poverty headcount in rural areas declines by 2 percent. Reductions in the other poverty measures are greater, with the poverty gap declining by 4 percent and the squared poverty gap dropping by 5 percent.

The final agriculture simulation looks at the relationship between poverty and owning a substantial number of livestock (of any species). Recall from Section 7 that a dummy variable for livestock ownership was defined, taking the value one if the household owned at least some minimal critical number of livestock of any type, and taking the value zero otherwise. The households that have a zero value for that dummy variable may be divided into two groups: those with no livestock at all, and those with some livestock, but less than the minimum threshold. In Simulation 15, for this latter group of households, we changed the value of the livestock dummy variable from zero to one. That is, we are modeling the effect of current owners of livestock increasing their livestock numbers so that they achieve some critical mass necessary for the livestock to begin contributing to improve the household's well-being. From Table 15 we see that the total impact on consumption and poverty is small in both urban and rural areas, with mean consumption per capita increasing by only one percent, and the poverty headcount dropping by only 1 percent.

Table 16 provides an explanation for these results: Simulation 15 affects only 15 percent of the rural population and 5 percent of the urban population. In other words, the simulation does not affect the large majority of the population, which either (1) already had a substantial number of livestock (20 percent of the rural population and 6 percent of the urban population), or (2) had no livestock at all (65 percent of the rural population and 89 percent of the urban population). Among that small proportion of the population affected by Simulation 15, the impact on mean consumption and all measures of poverty is large, with an increase in mean consumption of 12 percent in rural areas and 20 percent in urban areas. The poverty headcount among the affected population declines by 8 percent in rural areas and 14 percent in urban areas, with larger reductions in the poverty gap and squared poverty gap.

Employment

In Simulations 16 and 17 we examine the effects of sectoral shifts in the distribution of the labor force, in particular, movements of workers from the agricultural sector to other sectors of the economy. Simulation 16 models moving an adult working in the agricultural sector to the industry and construction sector, whereas Simulation 17 considers the movement of an adult worker from the agricultural sector to the service sector. As it is unusual for households, particularly in rural areas, to abandon agriculture completely, we limited these simulations to urban households that had at least two adults working in the agricultural and rural households that had at least three adults working in agriculture. In this manner, there is still an adult (or two adults in rural areas) to tend the *machamba* and preserve land rights; this is a common household labor allocation strategy in southern Africa (for example, see Low 1986). Because of this restriction, these simulations affect less than one-quarter of the rural population, and less than one-fifth of the urban population (Table 16).[53]

As shown in Table 16, Simulation 17 has a large impact upon the affected population, increasing mean consumption per capita by 18 percent in rural areas and 12 percent in urban areas. The impact of Simulation 16 is smaller, at 5 and 10 percent, respectively. However, because of the relatively small proportion of the population affected, the impact is much smaller when the entire population is considered (see Table 15). When all households are considered, shifting workers from agriculture to industry and construction (Simulation 16) shows only a marginal increase in consumption per

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[53] One motivation for requiring that a rural household have three adults working in the agricultural sector is that it keeps the magnitude of the sectoral shift in the labor force within plausible bounds. If only two adults working in the agricultural sector were required, the simulation would imply moving more than half of the adult agricultural work force into other sectors, which is plainly unrealistic.

capita and a marginal reduction in poverty. In contrast, a shift from agriculture to the services sector (Simulation 17) generates a 4 percent increase in rural consumption per capita and a 4 percent reduction in the rural poverty headcount; in urban areas there is a 2 percent increase in consumption per capita and a 2 percent reduction in the incidence of poverty.

Related to sector of employment, Simulation 18 examines the role of income diversification in the determination of consumption and poverty. From the MIAF questionnaire, each income-earning member of a household indicated whether he or she received income from any of five sources: wages, self-employment (including own-account agricultural production), proceeds from capital assets (house rental, land rental, bank interest), formal or informal transfers, and “other” sources. These individual-level data were then aggregated to the household level and coded using integers from zero to five, as a crude measure of the household’s income diversification. In Simulation 18, we modified this variable so that all households with only one source of income would have two sources of income. Even though this simulation affects two-thirds of the population, it has essentially no impact on either mean consumption per capita or poverty.

Demographic Change

In the poverty profile in (MPAR 1988, Chapter 2) and in the discussion of the results of the regression models in Section 8, a negative relationship between household size and consumption per capita was noted. In the next set of simulations, we examine the effects of increasing the household size by one member, with that member being a child under the age of 18 (Simulation 19), or a working-age male (Simulation 20), or a working-age female (Simulation 21). As the determinants model also includes information about the educational level and sector of employment of adult household members, in Simulations 20 and 21 we assumed that the additional household member would have educational characteristics that matched those of adults of that sex already in the household, and employment characteristics of all adults in the household (as the employment variables in the model are not disaggregated by sex). For example, if a household had one adult female, who had a primary school education, and all adults were employed in the agricultural sector, in Simulation 21 it was assumed that the additional adult female also had a primary education and was employed in the agricultural sector. If there is more than one adult female in the household, the additional adult female would be assigned the average educational characteristics of all the adult females in the household. By design, these three simulations affected all households in the sample; therefore, the entries in Table 15 and Table 16 are identical for these three simulations.

In Table 15, we see that for the most part, increasing household size had a negative impact on consumption per capita, and led to increased poverty. In rural areas, the age or sex of the additional person changed only the magnitude of the impact, and not the direction. In urban areas the negative impact of an additional child was similar to that in rural areas, with mean consumption per capita declining by about 15 percent and the poverty headcount increasing by approximately 12 percent in both rural and urban areas. An additional adult female had a smaller negative impact than an additional child, reducing mean consumption per capita by 14 percent and increasing the poverty headcount by 12 percent in rural areas; in urban areas the corresponding numbers are a 9 percent drop in mean consumption per capita and a 9 percent increase in the poverty headcount.

The one exception to this overall negative relationship is the addition of an adult male to urban households. In Simulation 20, an additional male in urban areas leads to an estimated five percent increase in mean consumption per capita, and a one percent reduction in the poverty headcount. Yet even this positive note is dampened by the observation that the other poverty measures increase in this simulation (see Table 15). There are two inferences that one can make from the results of Simulation 20 in urban areas. First, the large increase in mean consumption per capita relative to the changes in poverty measures indicates that most of the benefits accrue to households who are nonpoor. Second, the increases in consumption per capita among the poor are concentrated in those households who are relatively close to the poverty line; under this simulation these households are moved out of poverty and the headcount is reduced. However, for the poverty gap and squared poverty gap to increase, consumption per capita must actually decline in poorer households.

In view of this critical dependence of the relationship between poverty and household size on the assumption about economies of size, we ran simulations that were similar to Simulations 19 - 21, but that incorporate the notion of economies of household size. In practice, we reestimated the model, changing the dependent variable from consumption per capita (which assumes zero economies of household size) to consumption per "equivalent adult," using the elasticity of household size at which household size is more or less orthogonal to poverty (è = 0.4).[54]

These results are presented as Simulations 19a, 20a, and 21a in Table 17, and are more consistent with intuition than the results in Simulations 19 - 21 that ignore economies of household size. In Simulations 19 - 21, an additional household member reduced consumption per capita and increased poverty in almost all cases, even if the additional person was of working age (and thus, the addition of the member reduced the dependency ratio). When economies of household size are taken into account, the impact on well-being of an additional household member is still negative if the additional member is a child (i.e., the dependency ratio is increased) as in Simulation 19a, although this adverse impact is less than that seen when economies of size are not considered. However, when the additional member is an adult (Simulations 20a and 21a), there is a small increase in consumption per equivalent adult, and essentially no change in the poverty headcount, a result quite different from those of Simulations 20 and 21. Note that the poverty and squared poverty gap still tend to increase in Simulations 20a and 21a, indicating that most of the benefits from this simulation are going to households above or

[54] Note also from previous discussion that economies of household size in Mozambique are unlikely to be as great as that implied by è = 0.4. However, we use this value because the "true" elasticity of household size is unknown, and because this value eliminates the effect of any relationship between household size and poverty, allowing us to focus on aspects of household composition.

just below the poverty line, and that consumption per adult equivalent is actually declining for the poorest households.

Infrastructural Development

Our final simulations explore the potential contributions to poverty reduction of infrastructural development and improved physical access to health services. We do this using the two infrastructure index variables—one for general economic infrastructure and one for health services infrastructure—described in Section 7. The simulation is limited to rural areas, as these variables (derived from the rural community questionnaire) do not exist in the urban data set. In either of the two simulations, we increase the value of the infrastructure index variable to one (1) for all households who have a value of less than one for that variable. Because these variables include several measures of infrastructure, and because the current infrastructure is so poor, these simulations affect almost the entire rural population, although to varying degrees, as initial values of the indices take a range of values between zero and one, inclusively.

In Simulation 22, the economic infrastructure variable is set to unity for all households. This is equivalent to specifying that the household has each of the following in their village: a bank, a market, a paved or improved earthen road, an agricultural extension office, a post office, and a public telephone. Simulation 22 implies major changes: the simulated change in the independent variable is large (from a mean of 0.15 to 1.00), the magnitude of the regression coefficient is large (0.116), and almost 100 percent of the rural population is affected. Therefore, it is not surprising that the impact on rural mean consumption per capita and poverty rates is correspondingly large: mean consumption increases by 14 percent, the poverty headcount declines by 11 percent, the poverty gap drops by 16 percent, and the squared poverty gap by 19 percent.

Improvements in the health services infrastructure (Simulation 23) have a much smaller impact on poverty than the economic infrastructural improvements modeled in Simulation 22. This is mainly because the relationship between the health services infrastructure and consumption per capita is much weaker (with a regression coefficient of only 0.038).

10. ECONOMIC GROWTH AND POVERTY REDUCTION

Economic growth has been widely regarded as a key pillar of the strategy for poverty reduction. Many of the policy simulations that we have considered above clearly work through fostering economic growth, as, for instance, in the case of economic infrastructure development. Similarly, human capital development can also be considered an important ingredient of the process of economic growth. In this section, we abstract from the potential sources or determinants of growth, but pose the question how much potential does economic growth, whatever its source, hold for poverty reduction in Mozambique.

We first look at the recent historical experience. Based on national accounts data, it is estimated that real per capita GDP in Mozambique grew by 6.5 percent, a modest amount, over the decade 1987-1996.[55] Even though there is no household survey with national coverage prior to the MIAF 1996-97, it is possible to use the MIAF data to explore what sort of poverty impact this growth could have had. In particular, one can estimate what poverty levels would have been in 1987 had average living standards grown at the same rate as real GDP per capita, and assuming there was no change in relative inequalities. (This is equivalent to simulating a distribution-neutral growth scenario where every household's consumption is assumed to increase proportionately by the same growth factor.)

Table 18 summarizes the findings of this analysis. It shows that only modest gains in poverty reduction could have resulted from the modest growth in mean consumption.

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[55] These estimates are based on the official GDP figures published by the INE in various issues of the *Anuário Estatístico*, including up to the latest for 1996 (see INE 1997). In these calculations, the nominal per capita GDP was deflated by the Consumer Price Index for Maputo City.

Over the ten-year period, such growth would have implied a decline in the incidence of poverty by about 4.4 percent, and a decline in the depth and severity of poverty by about 8 and 10 percent respectively.

Table 19 presents the potential implications of higher growth in the future, under various assumptions about the rate of economic growth and the distribution of that growth. In the first scenario, a modest real economic growth rate of two percent per capita per year is considered, with the gains of this growth distributed proportionately (implying no change in the Lorenz curve). This growth scenario generates significant gains in poverty reduction, especially as measured by the poverty gap and squared poverty gap indices.

Next, in each of scenarios 2-4 in Table 19, a much faster economic growth rate of 7.7 percent in real per capita terms is assumed, with three alternative distributional assumptions. This rate of economic growth is based upon the government's current five-year growth projections (personal communication, Gabinete de Estudos), assuming a population growth rate of 2.7 percent per year. In scenario 2, growth is assumed to be distributional-neutral (as in the first scenario). Faster growth relative to scenario 1, of course, leads to larger poverty reduction relative to scenario 1. Such growth, if sustained up to 2003, would lead to almost 40 percent reduction in the national headcount index. Even larger percentage declines are implied for the poverty gap and squared poverty gap indices, indicating that the remaining poor would be less poor than before.

Experience in other countries indicates that economic growth as rapid as that projected for Mozambique is typically not distributed equally. Thus, scenario 3 illustrates the effects on poverty of the same economic growth rate, with urban incomes growing twice as rapidly as rural incomes. In this scenario, poverty reduction is somewhat lower than that projected in the distribution-neutral scenario (Scenario 2), yet the reduction in all poverty measures is still substantial (Table 19). Finally, scenario 4 shows the effects of economic growth on poverty reduction if the incomes of the nonpoor grow twice as fast as the incomes of the poor. Under this skewed pattern of economic growth, the reduction in poverty is less than that in Scenarios 2 and 3, yet poverty reduction is still significant, with the headcount declining by 30 percent, leaving 48 percent of the population below the poverty line by year 2003.

These growth simulations demonstrate that economic growth can be a potent force for poverty reduction. That said, the pattern and distribution of that growth will also have an important bearing on the degree to which poverty is reduced.

11. CONCLUSIONS AND IMPLICATIONS FOR POLICY

The analysis presented in this report has sought to extend the understanding of poverty in Mozambique by going beyond the bivariate analysis of the poverty profile and examining the structural determinants of living standards and poverty. Before summarizing the key implications of our results for the formulation of poverty reduction policies in Mozambique, it is useful to mention some caveats to the analysis and the results presented here.

As the first nationally-representative household survey, the MIAF survey provides a wealth of useful information on household living conditions. However, the survey data also have some significant limitations that have influenced the analysis presented in this study. A significant omission among the potential determinants of poverty is some measure of agricultural yields. This omission is on account of the nonavailability of regionally disaggregated data on yields that could be integrated with data from the MIAF survey. It would be useful to collect such data in future surveys both to promote better analysis of the determinants of poverty and living standards, and also to facilitate monitoring of poverty over time.

There also seems to be a considerable degree of measurement error for a number of variables on which data were collected in the MIAF survey, including, for instance, the distance to facilities, area of *machamba*, the extent of irrigation, and the quantities of output produced and sold. While a considerable amount of effort was spent in cleaning the data (including corrections made by going back to the original questionnaires), the existence of measurement errors influenced the specification choices that were made in the analytical work (e.g., the need to form crude indices of infrastructural development for the poverty determinants models). Another limitation has to do with the lack of data on fisheries as a form of livelihood. We suspect that fisheries make a potentially important contribution to living standards of households, especially in the coastal region. However, the MIAF employment data report an extremely small proportion of the population engaged in fishing. While we partially control for this by way of district fixed effects, we are unable to isolate the individual effect.

These limitations suggest both the scope for improvement in future data collection efforts, and also the need for caution against a highly literal interpretation of the results presented in this study. It is more judicious to focus on broad regularities than on the exact numbers.

Drawing upon the analysis presented here, we may identify six principal elements of a prospective poverty alleviation strategy for Mozambique. These include (1) increased investment in education, (2) sustained economic growth, (3) a sectoral pattern of growth favoring faster growth in the industrial and services sectors, (4) measures to raise agricultural productivity, (5) improved rural infrastructure, and (6) reducing fertility and dependency load within households. Each of these elements is elaborated upon further in the paragraphs that follow.

One of the key messages of the analysis is that it is important to invest in education. As a basic non-income dimension of well-being, education is important in its own right. From this perspective, high priority should be given to addressing the gender, urban-rural, and regional disparities in educational attainment. The male-female and the urban-rural gaps in education are both large and significant. Similarly, provinces such as Niassa, Cabo Delgado, Nampula, Zambézia, and Sofala have lagged critically behind in building their human capital resource base. The process of raising the overall educational standards in the country can indeed take the form of addressing these imbalances.

Education also has instrumental value; the analysis shows that education is a key determinant of living standards and improvements in education are an important means of poverty reduction. Completing *primary education*, in particular, is associated with large gains in poverty reduction, although the poverty-reducing impact of higher literacy rates alone are also significant. Overall, it seems clear that investing in education should be a key element of the poverty alleviation strategy for Mozambique.

The analysis also points to the importance of economic growth for poverty reduction. Not much by way of poverty alleviation could have been expected over the preceding two decades of economic decline or stagnation at best. During 1987-96, real per capita GDP grew at only about 0.6 percent per annum. However, economic growth does hold the promise of significant poverty reduction in the future. For instance, a sustained annual economic growth rate of 7.7 percent in real per capita terms over the next five years has the potential of reducing the incidence of poverty by as much as 40 percent, although the actual poverty reduction will also depend critically upon the distribution of growth.

The sectoral pattern of growth is also important. At the current productivity levels, a pattern of growth favoring the industrial and services sectors will reduce poverty. But it is also important to raise agricultural productivity. The relatively high levels of poverty in the agricultural sector reflect currently low levels of productivity in that sector. The results indicate that increasing the size of operational holdings for small landholders will *not* reduce poverty unless productivity-improving investments are made in irrigation and the use of modern inputs (e.g., fertilizers). This is not surprising in a setting where the availability of land does not appear to be a binding constraint.

An important role is also identified for improved economic infrastructure in rural areas. Wider provision of roads, markets, banks, extension and communication services to Mozambican villages can go a long way to alleviate poverty in the country.

The results also suggest that measures to reduce the dependency load within households will help reduce poverty. Apart from the direct effect through reducing the number of children supported by an adult of working age, poverty alleviation effects could also be expected from the beneficial effects of reduced fertility on women's health, labor force participation, and productivity. Drawing upon the experience of other countries, the importance of women's education in this context cannot be overemphasized.

Finally, it should be reiterated that while this analysis has helped identify some key directions for a poverty reduction policy, there is a need to extend and refine this analysis, including more disaggregated analyses at the regional and provincial levels, as well as incorporating supplementary information from other recent data sources, such as the national agricultural survey, the demography and health survey, and the national census.

APPENDIX

CONSTRUCTING AGGREGATE HOUSEHOLD CONSUMPTION

This study uses a comprehensive measure of consumption, drawing from several modules of the household survey. It includes expenditures and auto-consumption of food and nonfood items, as well as imputed use-values for owner-occupied housing and household durable goods. The only significant omission from the consumption measure is consumption of public goods. For example, an all-weather road, or a public market, or a public water tap, presumably enhances the well-being of the people who use those facilities. However, the MIAF data do not permit quantification of those benefits, and they are therefore not included in the consumption measure.[56]

FOOD CONSUMPTION

In the MIAF, information on household food acquisition was recorded in the daily household expenses questionnaire. As noted in Section 4, households were visited three times over a seven-day period, and asked about what foods the household had acquired, through whatever means, including purchases, own production, and transfers received. On each visit the household was asked what food was acquired that day, as well as the preceding two days (on the second and third visits), so that food acquisition information was recorded separately for each of seven days. The most common food items were pre-coded on the questionnaire, but the questions were open-ended, so that the household could include any food items that were acquired.

For each food item recorded, the interviewer solicited information about the unit of measure for the item (for example, kilograms, liters, cans, cups, etc.), the number of those units acquired, and amount spent for the food. If the item was received in a noncash

[56] This is, however, not unique to the Mozambique survey. It is rarely possible to integrate the consumption of public goods into an aggregate measure of consumption.

transfer or was home-produced, then the respondent provided an estimate of the value of the food. The household was also asked how many days they expected the food would last in the household, and from where they acquired the food (shop, market, informal market, own-production, or other). For example, a household might respond that the previous day they had spent 60,000 MT on two *latas* of maize grain from a local market, and that they expected it to last for eight days.

The daily household expenses questionnaire was designed to collect food acquisition information for a seven-day period. However, consumption of individual products acquired and recorded on the questionnaire may span more or less than one week. All food consumption was normalized to reflect average consumption for a one-week period, calculated as follows. The expenditure (or, more generally, the value), physical quantity consumed, and number of days the food would last were summed for each product. If the total estimated number of days the food would last was less than or equal to seven, then it was assumed that the survey captured a typical week's worth of that food item for that household, and the sums of the item's value and physical quantity were divided by seven to arrive at estimated daily consumption values for that food item. If the estimated number of days the food would last exceeded seven days (e.g., a bulk purchase of maize grain or flour), the total quantity and expenditure recorded were divided by the estimated number of days the food would last to arrive at an estimate of the average daily consumption of that food item. The estimates of daily food consumption for each item were then aggregated to the household level to obtain an estimate of the total value of household food consumption per day.

NONFOOD CONSUMPTION

Nonfood consumption is the sum of several nonfood consumption components, including both direct expenditures and imputed use values. The details of the construction of these components are described below.

Monthly and Three-Month Nonfood Consumption

Two sections of the MIAF questionnaire were devoted exclusively to the collection of information about nonfood expenditures; the two sections differ only by recall period and the list of items covered. The monthly nonfood expenditure section of the questionnaire asked primarily about common consumable nonfood items acquired by the household during the preceding month, including items such as cooking fuel, medicines, soap, and other items. The three-month nonfood expenditures questionnaire had a three-month recall period, and was intended to capture less frequent purchases, such as clothing and footwear, household durables, and other items that are generally more expensive than those recorded in the monthly nonfood expenditures questionnaire. Each of these sections of the questionnaire also asked about the quantity of the item purchased, the value of the item, and the location where the item was purchased. For most items, converting to household daily consumption values was simply a matter of dividing the values from the monthly questionnaire by 30.417 (365 days/12 months), and those in the three-month questionnaire by 91.25 (365 days/4 quarters). However, for certain expensive, infrequently purchased durable goods a different approach was used. In these cases a use value for the item was imputed for all households possessing that item, as recorded in the household assets section of the MIAF questionnaire, whether it had been purchased during the survey recall period or not. This is described in detail below.

Housing and Imputed Rent

A comprehensive measure of consumption as a metric of welfare should include a value for the use of housing. When a household pays rent for its dwelling, this is measured by the actual rent paid. For owner-occupied houses, too, data on self-imputed rents are available for some households in the form of responses to the question, “If you had to rent your house, how much would you charge per month?” These data on actual or self-imputed rents are used whenever available. However, for 6,986 households, no such information is available. For these households, we estimate an imputed rent, or the use-value of the housing, as a function of a number of dwelling characteristics. A hedonic rental model is estimated using the 1,264 households who reported actual or self-estimated rents. Rents are then imputed for the remaining 6,986 households, using their dwelling characteristics and the estimated parameters from the rental model. Operational details of the methodology are described below.

In the dwellings section of the MIAF survey, there are two questions pertaining to rentals. The first question is intended for tenants who are asked about actual monthly rental payments. The second question is addressed to the owners who are asked, "If you had to rent your residence, how much would you charge per month?" Thus, we have a measure of actual rent for tenants and a measure of self-estimated rental value for owners. However, either of these two measures of rent are available for only 1,264 households out of a total sample of 8,274. Fortunately, there is complete information on dwelling characteristics even when no rental information is available. Thus, for the remaining households, we use this information to estimate imputed rents derived from a hedonic model of dwelling rentals as a function of dwelling characteristics. This model is described as follows.

We use data on both actual and self-imputed rents in our rent determination model. The following model was estimated.

$$\ln R_i = \text{á} + \text{â}'(Province * Urban)_i + \text{ã}(Tenant)_i + \text{ä}' X_i + \text{å}_i,$$

where

R_i	=	monthly rent (actual or self-imputed),
$Province*Urban_i$	=	a set of dummy variables for province-zone interactions,
$Tenant_i$	=	a dummy variable with a value of 1 if the rent observation is reported by a tenant, and 0 if self-imputed by the owner,

X_i = a vector of dwelling characteristics, including number of rooms, categorical variables identifying the type of dwelling (house, apartment, or hut), the type of walls, roof, floor, toilet, source of water, age of the dwelling, length of stay in the dwelling, mode of acquisition of dwelling, type of illumination, and the type of cooking fuel used.

The dummy variable for *Tenant* turned out to be collinear with the other model variables and was dropped. We also tried several alternative specifications, including interacting the *Tenant* dummy variable with dwelling characteristics; interaction terms are for dwelling type and the province/area set of dummy variables; and running separate regressions by type of dwelling (one for *vivendas* and flats and the other for *palhotas* and other dwellings. But these specifications failed to improve the model's fit significantly.

Our preferred estimates of the model parameters are reported in Table 20. The estimated parameters were used to predict rent for cases where actual or self-imputed rent was missing.

Use-Value of Durable Gods

The consumption of durable goods augments household welfare and hence should be included as a component of aggregate household consumption. However, the consumption of durable goods is distinct from their purchase or acquisition because, typically, durable goods are purchased or acquired infrequently and consumed over long periods. This is in contrast to nondurable or single-use goods whose consumption is usually realized over a relatively short period of time. The value of durable goods purchased over a certain time period can therefore be a poor measure of the value of their consumption over that period.

The use value of durable goods has two components: the depreciation of the durable good over the period of consumption considered, and the opportunity cost of resources locked in the durable good over that period of consumption. Thus, the value of consumption of durable good *j* for household *i* can be estimated as

$$Use\ value_{ij} = Current\ value_{ij} * (r + d_j) / (1 - d_j) ,$$

where *Current value*$_{ij}$ is the value of good *j* for household *i* at the time of the survey, *r* is the rate of interest, and d_j is rate of depreciation of good *j*. Operational details of the estimation of the use value of durable goods with the available data from the MIAF and other sources are given below.

The MIAF questionnaire asked households about their possession of 16 durable goods. Examples of durable goods include furniture, vehicles, bicycles, and other household articles such as electric irons, fans, radios, and televisions. The survey asked about the quantity and the condition of each good (whether they were in "good" condition) but not its value. It was therefore necessary to estimate the value of these durable goods at the time of the survey (February 1996 to April 1997). In order to derive this value, a modest market survey was conducted in Maputo City that collected information on the market prices of these goods prevailing in September 1996 (midpoint of the survey).

The primary source for the price data was the Maputo informal market for used goods. For cases where the price of a used good was not obtainable, the value of new goods in the formal market was used. For cases where the value of goods in September 1996 was difficult to find, the current value at the time of the Maputo market survey, i.e., October 1997, was used. Prices of new goods were converted to used goods equivalents, assuming that the value of a used good was two-thirds the value of a comparable new good.

Prices current at the time of the market survey, i.e., October 1997, were deflated to the midpoint of the survey period, i.e., September 1996, using the durable goods component of Consumer Price Index (CPI) compiled by the National Institute of Statistics

(INE 1996). A deflator of 0.89 was used to convert October 1997 prices to September 1996 prices. The resulting values are presented in Table 21.

Recall that the questionnaire identified the total quantity of a particular durable good that the household possessed and the quantity in good condition, with the rest presumably in "bad" condition. In computing the current value of durable goods, the value of goods in "bad" condition was assumed to be half the value of those in good condition.

The next step was the estimation of depreciation rates for durable goods based on their estimated remaining life span, keeping in mind that households report possession of durable goods they have been already using over a period of time. The estimated life spans were based on informal consultations with several members of the staff at the Department of Population and Social Development, and are shown in the last column of Table 21.[57] A straight line depreciation method was used to compute a monthly depreciation rate for each good.[58]

Finally, to estimate the opportunity cost component, we used the interest rate on bank deposits. For our purposes, we used the average interest rate over the duration of the household survey, as reported in the Central Bank Statistical Year Book (Boletim Estatístico do Banco de Moçambique).

Our estimation of the use value of durable goods involves several strong assumptions necessitated by the lack of appropriate data. However, we felt that even an approximate estimate was better than a complete omission of this component from our measure of household consumption.

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[57] In principle, we could use the depreciation rates established in the tax law and used in business. However, that was not pursued as these rates were not believed to be representative of used durable goods at the household level.

[58] The monthly depreciation rate is the inverse of the lifetime of the durable good in months.

Other Nonfood Consumption

Other nonfood consumption items were drawn from various parts of the MIAF questionnaire. Although the daily expenditure diary was mostly used to record food expenditures, it also included purchases of fuel (firewood, charcoal, kerosene), soap, water, and local transportation (mini-buses, or *chapas*). Additional observations on energy and water consumption appeared in the dwelling (*vivenda*) section of the questionnaire. In cases where expenses on a particular category appeared in more than one section of the questionnaire, the data were cross-checked to avoid double-counting of any consumption items. Expenditures on school fees and books were drawn from the education section of the questionnaire. Finally, there were a few types of transfers or financial transactions made by the household that were included in the measure of aggregate consumption, namely, payments made for life and health insurance and payments made to clubs or associations.

TEMPORAL DIFFERENCES IN FOOD PRICES

A potentially important issue for constructing region-specific poverty lines is seasonal (or more generally, temporal) variation in prices, especially food prices. It is commonly believed that food prices in Mozambique fluctuate substantially across seasons. Seasonal price variation need not bias the regional poverty profile if household interviews in each regional domain were uniformly spread through the survey period. However, Table 2, which lists the distribution of sample households by month of interview and region, shows that this was not the case, particularly for urban areas.

Even if the temporal distribution of interviews in each regional domain were uniform, the non-regional aspects of the poverty profile can be biased by the seasonal variation in prices. For the MIAF data, seasonal price variation has an additional bearing on the calculation of poverty lines because the quantities, and hence calories, consumed by households often have to be determined using data on food prices.

We examined the nature of seasonal variation in food prices using price data from the Agricultural Market Information System (*Sistema de Informação do Mercado Agrícola*, or SIMA) of the Ministry of Agriculture and Fisheries. We constructed a temporal food price index for the relatively poor (for this purpose, defined as households with nominal per capita consumption below the median). The price indices were constructed separately for three regions in the country, designated as North, Central, and South. Reporting markets for Niassa, Cabo Delgado, and Nampula Provinces were included in the Northern region; those for Sofala, Tete, Manica, and Zambézia Provinces were included in the Central region; and the South included markets for Gaza, Inhambane, and Maputo Provinces and Maputo City. The food price index was based on nine food products: maize grain, maize flour, cassava flour, rice, sugar, cowpeas, butter beans, small groundnuts, and large groundnuts. These nine products accounted for about half the total nominal food consumption of the relatively poor: 48 percent for the North, 54 percent for Central, and 46 percent for the South. Average product prices for each region were aggregated into an index, using as weights the region-specific expenditure share of each product in total food expenditure of the relatively poor.

The pattern of the food price index is illustrated in Figure 2. Food prices are highest in the beginning of the survey in February, 1996, drop significantly during the middle of the calendar year, and then rise somewhat during the last months of 1996 and the first months of 1997. It is notable that this pattern corresponds roughly to the harvest cycle. Food prices are highest in the beginning of the calendar year, when the stocks from the preceding harvest are depleted for most households. Early harvest of green maize and other crops eases the pressure on food prices, until they reach their lowest point following the harvest, which typically occurs during May, June, and July. Then prices rise again in December and January, although in this instance the prices in early 1997 were generally much lower than those for the corresponding period in 1996. Although the monthly data in Figure 2 illustrate the price cycles well, we chose to aggregate the price data, using four-month averages. The indices were constructed for four subperiods spanning the duration of the MIAF: subperiod 1 from February 1996 to April 1996, subperiod 2 from May 1996 to August 1996, subperiod 3 from September 1996 to December 1996, and subperiod 4 from January 1997 to April 1997. The estimated indices are not reported here, but can be found in the *MPAR* (Table 1.5).

Overall, the results indicate significant temporal variation in food prices in all regions, with higher prices during February to April 1996 (the lean months before the annual harvest), followed by a decline and leveling off in next two subperiods, and an increase again during January to April 1997. In view of this evidence, we decided to deflate nominal food consumption by the seasonal food price indices. Thus, food consumption aggregates are expressed at January-April 1997 prices. We assume that there is no temporal variation in nonfood prices. This may be an oversimplification, but given the available data, it was not possible to replace this with a better assumption. Furthermore, considering the low level of inflation in Mozambique during the survey period, and the lack of any compelling reason to expect seasonal (or any other systematic intra-year) fluctuations in prices, it is likely that any temporal adjustment to nonfood prices would be small even if sufficient data were available. Our temporally price-adjusted household total consumption (described later) is thus the sum of temporally price-adjusted food consumption plus the nominal nonfood consumption.

CONSUMPTION PATTERN

A typical analysis of household expenditure patterns, based upon expenditure shares for functional groupings of food and nonfood commodities, is presented in the poverty profile in Chapter 2 of the MPAR. However, from a methodological point of view, it is useful at this point to examine the relative magnitudes of the different components of the consumption measure used in this study. Reviewing the components of total household consumption, we note that, on average, food consumption is by far the largest component of total consumption, accounting for 62 percent of total consumption. A high food budget share such as this is typical for very low income countries such as Mozambique. The second largest component is the estimated use value of durable goods, which accounts for 12 percent of total consumption. This is followed by nonfood items from the daily expenditure questionnaire, which are predominantly energy items such as firewood and charcoal, which comprise 9 percent of total consumption. Housing, either in the form of rent paid or an imputed value for housing services, is next on the list, accounting for 6 percent of total consumption. The items appearing in the three-month and monthly nonfood expenditure questionnaires are the next largest components, at 6 percent and 4 percent, respectively. The remaining components of total expenditure account for less than 1 percent of total consumption individually, and only 1.5 percent collectively.

Finally it is worth noting that the estimate of average consumption from the MIAF data is 5,285.92 MT per person per day. This is considerably higher than the corresponding estimate of private consumption from the national accounts, which is 2,068.70 MT per person per day (INE 1996). Only a small part of this discrepancy can possibly be explained by the inclusion of consumption items that might not appear in the national accounts, such as valuation of housing services, and use value of household durables. This large differential suggests that the national accounts data may be underestimating personal consumption.[59]

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[59] This should be viewed in relation to the estimates of poverty for Mozambique (see Section 6), where we present an estimated headcount index of 69 percent using a poverty line anchored to a standard WHO caloric norm. With the national accounts' estimate of mean consumption, virtually the entire population would be below the poverty threshold, which suggests that it is more likely that the national accounts underestimate consumption than the alternative of the MIAF overestimating consumption.

TABLES

Table 1: Sample distribution, by sampling units and province

	Urban			Rural			Total
	Provincial capitals			Rest of province	Small urban		
Province	Number of *Bairros*	Number of *Quarteirões*	Number of Households	Number of *Localidades*	Number of *Aldeias*	Number of Households	Number of House-holds
Niassa	2	6	72	21	63	585	657
Cabo Delgado	2	6	72	25	75	675	747
Nampula	3	12	144	22	88	816	960
Zambézia	2	8	96	22	88	792	888
Tete	2	6	72	20	60	546	618
Manica	4	12	144	19	57	522	666
Sofala	7	21	252	19	57	513	765
Inhambane	2	6	72	24	72	657	729
Gaza	2	6	72	21	63	567	639
Maputo Province	8	24	288	16	48	432	720
Maputo City	37	75	900				900
National total	71	182	2,184	209	671	6,105	8,289

Table 2: Spatial distribution of the sample, by month of interview

	Niassa and Cabo Delgado		Nampula		Sofala and Zambézia		Manica and Tete		Gaza and Inhambane		Maputo Province		Maputo	Number	Percent of
	Rural	*Urban*	*Rural*	*Urban*	*Rural*	*Urban*	*Rural*	*Urban*	*Rural*	*Urban*	*Rural*	*Urban*	City	of AFs	sample
February 96	27	36		47	26	48	27	25	12	45			12	305	3.7
March 96		36		47	66	48	27	47	33	99		72	96	571	8.6
April 96	108		47	47	97	36	98	24	108			72	72	709	9.3
May 96	80	72	97		98	36	64	83	99			72	71	772	8.8
June 96	99	71	36	72	91		100		118			72	73	732	8.6
July 96	118		71	24	144		88		135		53		82	715	9.3
August 96	55				75				107		18		98	353	4.3
September 96	134		72		123		108		135		37		72	681	8.2
October 96	80		72		116		81		108		54		72	583	7.0
November 96	81		71		155		108		81		27		74	597	7.2
December 96	109		73		98		54	34	54		54		70	546	6.6
January 97	111		72		72	110	45	36	135		54		108	743	9.0
February 97	104		72		48	70	54		51	36	81			516	6.2
March 97	55		36		60		81	36	12		48			328	9.0
April 97	27				36		54				6			123	4.0
Total	1,188	215	719	237	1,305	348	989	285	1,188	180	432	288	900	8,274	100.0
Percent	14.4	2.6	8.7	2.9	15.8	4.2	12	3.4	14.4	2.2	5.2	3.5	10.9	100.0	

Table 3: Distribution of sample households, by poverty line domains

Spatial domain	Number of households	Percent of total sample
Niassa and Cabo Delgado — Rural	1,186	14.4
Niassa and Cabo Delgado — Urban	214	2.6
Nampula — Rural	719	8.7
Nampula — Urban	236	2.9
Sofala and Zambézia — Rural	1,301	15.8
Sofala and Zambézia — Urban	345	4.2
Manica and Tete — Rural	987	12.0
Manica and Tete — Urban	285	3.5
Gaza and Inhambane — Rural	1,187	14.4
Gaza and Inhambane — Urban	179	2.2
Maputo Province — Rural	431	5.2
Maputo Province — Urban	287	3.5
Maputo City	893	10.8
Total	8,250	100.0

Note: The *poverty line domains* are those regions used to construct separate poverty lines, thereby partially controlling for spatial differences in prices, preferences, and household composition.

Table 4: Calorie requirements per capita, mean price per calorie, and food poverty lines

Poverty line domain	Mean per capita daily calorie requirements	Mean price per calorie	Food poverty line
		(MT/calorie)	(MT/person/ day)
Niassa and Cabo Delgado — Rural	2,158.70	1.3950	3,011.47
Niassa and Cabo Delgado — Urban	2,121.89	1.7375	3,686.83
Nampula — Rural	2,162.53	1.2680	2,742.00
Nampula — Urban	2,140.38	1.7017	3,642.28
Sofala and Zambézia — Rural	2,173.63	1.7109	3,718.80
Sofala and Zambézia — Urban	2,173.73	2.4703	5,369.80
Manica and Tete — Rural	2,113.97	1.8190	3,845.31
Manica and Tete — Urban	2,166.51	2.5610	5,548.39
Gaza and Inhambane — Rural	2,142.28	2.3205	4,971.20
Gaza and Inhambane — Urban	2,167.12	2.6367	5,713.96
Maputo Province — Rural	2,122.04	2.5532	5,418.00
Maputo Province — Urban	2,165.39	2.7926	6,047.09
Maputo City	2,217.34	2.7926	6,192.15

Table 5: Food, nonfood, and total poverty lines, and spatial price index

Spatial domain	Food poverty line	Nonfood poverty line	Total poverty line	Spatial price index
Niassa and Cabo Delgado — Rural	3,011.47	1,011.24	4,022.71	0.74
Niassa and Cabo Delgado — Urban	3,686.83	1,747.53	5,434.36	1.00
Nampula — Rural	2,742.00	617.17	3,359.16	0.62
Nampula — Urban	3,642.28	1,306.57	4,948.86	0.91
Sofala and Zambézia — Rural	3,718.80	1,134.75	4,853.55	0.89
Sofala and Zambézia — Urban	5,369.80	2,230.26	7,600.06	1.40
Manica and Tete — Rural	3,845.31	868.07	4,713.38	0.87
Manica and Tete — Urban	5,548.39	1,865.99	7,414.38	1.36
Gaza and Inhambane — Rural	4,971.20	1,461.70	6,432.90	1.18
Gaza and Inhambane — Urban	5,713.96	2,112.79	7,826.75	1.44
Maputo Province — Rural	5,418.00	1,898.18	7,316.17	1.35
Maputo Province — Urban	6,047.09	2,666.80	8,713.89	1.60
Maputo City	6,192.15	2,349.33	8,541.48	1.57

Table 6: Mean consumption and poverty estimates, by zone and region

	Population share	Mean consumption	Headcount index	Poverty gap index	Squared poverty gap index
	(percent)	(MT/person/month)			
Rural	79.7	150,074	71.25	29.92	15.89
		(3,313.2)	(1.25)	(0.85)	(0.60)
Urban[b]	20.3	202,685	62.01	26.67	14.60
		(10,628.7)	(2.67)	(1.81)	(1.39)
North[c]	32.5	167,834	66.28	26.62	13.85
		(6,275.2)	(2.28)	(1.49)	(1.07)
Center[c]	42.6	141,990	73.81	32.71	18.01
		(4,470.5)	(1.60)	(1.18)	(0.89)
South[c] (including	24.9	183,718	65.80	26.80	13.88
Maputo City)		(7,291.9)	(1.96)	(1.24)	(0.87)
South[c] (excluding	18.8	161,036	71.67	30.17	15.89
Maputo City)		(8,381.6)	(2.38)	(1.61)	(1.14)
National	100	160,780	69.37	29.26	15.63
		(3,460.8)	(1.14)	(0.77)	(0.55)

Source: Mozambique National Household Survey on Living Conditions, 1996-97.
Notes: Standard errors in parentheses, corrected for sample design effects.
[a] Mean total consumption, temporally and spatially deflated, using national average prices as the base. (See Section 5 and Appendix for details.)
[b] Urban areas include Maputo City, provincial capitals, and small urban centers.
[c] North: Cabo Delgado, Nampula, and Niassa Provinces; Center: Manica, Sofala, Tete, and Zambézia Provinces; South: Gaza, Inhambane, and Maputo Provinces, plus Maputo City.

Table 7: Estimates of ultra-poverty, using alternative ultra-poverty lines

	Using food poverty line			Using 60 percent of total poverty line		
	Headcount index	Poverty gap index	Distribution of the ultra-poor	Headcount index	Poverty gap index	Distribution of the ultra-poor
Rural	55.70	20.26	83.1	38.78	12.05	81.8
	(1.53)	(0.77)	(1.72)	(1.49)	(0.62)	(2.03)
Urban[a]	44.50	15.99	16.9	33.77	11.31	18.2
	(2.89)	(1.69)	(1.72)	(2.98)	(1.54)	(2.03)
North[b]	49.98	17.40	30.4	34.09	10.31	29.3
	(2.62)	(1.31)	(2.06)	(2.38)	(1.13)	(2.30)
Central[b]	59.43	22.59	47.4	42.92	14.06	48.4
	(2.06)	(1.12)	(2.27)	(2.15)	(0.97)	(2.54)
South[b] (including	47.72	16.52	22.2	33.73	10.27	22.3
Maputo City)	(2.02)	(1.10)	(1.40)	(2.08)	(0.87)	(1.56)
South[b] (excluding	54.14	19.31	19.02	39.19	12.04	19.48
Maputo City)	(2.58)	(1.47)	(1.25)	(2.74)	(1.17)	(1.43)
National	53.44	19.39	100.0	37.76	11.90	100.0
	(1.36)	(0.70)		(1.34)	(0.58)	

Source: Mozambique National Household Survey of Living Conditions (MIAF), 1996-97.
Notes: Standard errors in parentheses, corrected for sample design effects.
[a] Urban areas include the city of Maputo, provincial capitals, and small urban centers.
[b] North: Cabo Delgado, Nampula, and Niassa Provinces; Central: Manica, Sofala, Tete, and Zambézia Provinces; South: Gaza, Inhambane, and Maputo Provinces and the city of Maputo.

Table 8: mean consumption and poverty estimates, by province

Province	Population share	Mean consumption	Headcount index	Poverty gap index	Squared poverty gap index
	(percent)	(MT/person/month)[a]			
Niassa	4.85	147,841	70.64	30.06	16.1
		(10,787.9)	(3.78)	(3.10)	(2.21)
Cabo Delgado	8.16	194,448	57.40	19.82	9.11
		(12,653.3)	(4.19)	(2.32)	(1.35)
Nampula	19.47	161,668	68.92	28.62	15.28
		(8,743.9)	(3.29)	(2.17)	(1.61)
Zambézia	20.34	154,832	68.10	25.96	12.28
		(6,321.1)	(2.60)	(1.80)	(1.19)
Tete	7.3	117,049	82.27	38.97	22.48
		(8,109.6)	(3.22)	(2.88)	(2.14)
Manica	6.19	191,608	62.60	24.16	11.68
		(22,527.9)	(5.95)	(3.12)	(1.71)
Sofala	8.77	97,906	87.92	49.21	32.05
		(5,807.8)	(1.46)	(2.70)	(2.73)
Inhambane	7.06	128,219	82.60	38.61	21.41
		(10,909.1)	(2.45)	(2.15)	(1.74)
Gaza	6.57	183,233	64.66	22.99	10.91
		(10,828.2)	(3.26)	(2.50)	(1.86)
Maputo Province	5.14	177,774	65.60	27.75	14.66
		(18,642.3)	(5.41)	(3.20)	(2.01)
Maputo City	6.14	253,102	47.84	16.48	7.72
		(21,335.7)	(4.06)	(2.00)	(1.19)

Source: Mozambique National Household Survey on Living Conditions, 1996/97.
Notes: Standard errors in parentheses, corrected for sample design effects.
[a] Mean total consumption, temporally and spatially deflated, using national average prices as the base.

Table 9: Mean consumption and ultra-poverty estimates, by province

Province	Population share	Mean consumption	Headcount index	Poverty gap index	Squared poverty gap index
	(percent)	(MT/person/month)[a]			
Niassa	4.85	147,841	40.48	12.37	5.31
		(10,787.9)	(5.29)	(2.17)	(1.23)
Cabo Delgado	8.16	194,448	23.10	5.96	2.12
		(12,653.3)	(3.82)	(1.19)	(0.41)
Nampula	19.47	161,668	37.11	11.62	5.25
		(8,743.9)	(3.42)	(1.75)	(1.07)
Zambézia	20.34	154,832	34.35	7.84	2.59
		(6,321.1)	(3.92)	(1.17)	(0.53)
Tete	7.30	117,049	53.60	18.69	8.82
		(6,740.0)	(4.00)	(1.98)	(1.13)
Manica	6.19	191,608	26.96	7.52	2.99
		(22,527.9)	(3.78)	(1.56)	(0.84)
Sofala	8.77	97,906	65.19	29.27	16.50
		(5,807.8)	(3.87)	(3.14)	(2.35)
Inhambane	7.06	128,219	53.73	17.17	7.25
		(10,909.1)	(3.77)	(1.96)	(1.13)
Gaza	6.57	183,233	26.54	7.29	3.00
		(10,828.2)	(4.16)	(1.86)	(1.11)
Maputo Province	5.14	177,774	35.37	11.07	4.74
		(18,642.3)	(5.49)	(1.93)	(0.80)
Maputo City	6.14	253,102	17.03	4.85	2.14
		(21,335.7)	(2.20)	(0.96)	(0.70)

Source: Mozambique National Household Survey on Living Conditions, 1996/97.

Notes: The ultra-poverty line is set at 60 percent of the reference poverty line. Standard errors in parentheses, corrected for sample design effects.

[a] Mean total consumption, temporally and spatially deflated, using national average prices as the base.

Table 10: Means and standard errors of variables in rural determinants of poverty models

Variable	North (N=1,905)	Center (N=2,288)	South (N=1,618)	All rural (N=5,811)
Ln of real consumption per person per day	8.42	8.19	8.24	8.28
	(0.03)	(0.03)	(0.04)	(0.02)
Persons 0-9 years old	1.92	2.07	2.24	2.05
	(0.06)	(0.06)	(0.06)	(0.04)
Persons 10-17 years old	1.04	1.41	1.64	1.33
	(0.05)	(0.05)	(0.06)	(0.03)
Females 18-59 years old	1.12	1.25	1.71	1.29
	(0.03)	(0.03)	(0.05)	(0.02)
Males 18-59 years old	0.98	1.03	1.06	1.02
	(0.03)	(0.02)	(0.04)	(0.01)
Persons 60 years or older	0.19	0.16	0.41	0.22
	(0.02)	(0.01)	(0.02)	(0.01)
Persons of unclassified age	0.000	0.001	0.002	0.001
	(0.000)	(0.000)	(0.001)	(0.000)
Household size squared	33.00	41.47	61.64	42.46
	(1.73)	(1.66)	(2.69)	(1.11)
Age of head of household	41.81	42.24	47.83	43.16
	(0.63)	(0.50)	(0.57)	(0.35)
Male head of household (0/1)	0.89	0.81	0.78	0.83
	(0.01)	(0.01)	(0.01)	(0.01)
Number of disabled persons in household	0.11	0.10	0.12	0.11
	(0.01)	(0.01)	(0.01)	(0.01)
Number of war migrants in household	0.08	0.33	0.19	0.22
	(0.03)	(0.06)	(0.10)	(0.04)
Number of women who had first child	0.29	0.14	0.07	0.18
before age 16	(0.02)	(0.01)	(0.01)	(0.01)
Number of literate adult males	0.54	0.59	0.76	0.61
	(0.03)	(0.03)	(0.05)	(0.02)
Number of literate adult females	0.12	0.19	0.59	0.24
	(0.02)	(0.02)	(0.04)	(0.02)
Number of adult males who completed	0.05	0.06	0.07	0.06
primary education	(0.01)	(0.01)	(0.01)	(0.01)
Number of adult females who completed	0.01	0.01	0.05	0.02
primary education	(0.006)	(0.002)	(0.009)	(0.003)
Number of adults in agricultural sector	1.93	2.10	2.52	2.12
	(0.05)	(0.05)	(0.09)	(0.03)

(continued)

Table 10 (continued)

Variable	North (N=1,905)	Center (N=2,288)	South (N=1,618)	All rural (N=5,811)
Number of adults in industrial or construction sectors	0.04 (0.01)	0.04 (0.01)	0.14 (0.02)	0.06 (0.01)
Number of adults employed in other sectors	0.07 (0.01)	0.07 (0.01)	0.11 (0.02)	0.08 (0.01)
Number of income sources	1.21 (0.03)	1.77 (0.08)	1.12 (0.02)	1.46 (0.04)
Male literacy * Employed in industrial/ construction sector	0.03 (0.01)	0.00 (0.00)	0.00 (0.00)	0.01 (0.004)
Female literacy * Employed in agricultural sector	0.00 (0.00)	0.00 (0.00)	1.87 (0.19)	0.36 (0.04)
Ln of arable land (hectares)	0.54 (0.04)	0.44 (0.03)	1.06 (0.05)	0.59 (0.02)
Use any equipment or irrigation (0/1)	0.07 (0.02)	0.03 (0.01)	0.14 (0.02)	0.06 (0.01)
Secure land tenure (0/1)	0.33 (0.02)	0.50 (0.03)	0.74 (0.03)	0.49 (0.02)
Cultivate horticultural crops (0/1)	0.07 (0.02)	0.29 (0.04)	0.46 (0.03)	0.25 (0.02)
Cultivate commercial crops (0/1)	0.12 (0.04)	0.05 (0.02)	0.01 0.00	0.07 (0.02)
Ln of number of cashew trees	0.50 (0.10)	0.42 (0.07)	1.64 (0.16)	0.68 (0.06)
Ln of number of citrus trees plus coconut trees	0.27 (0.07)	0.43 (0.07)	1.30 (0.19)	0.54 (0.06)
Ln of number of other trees	0.48 (0.05)	0.90 (0.06)	1.43 (0.12)	0.86 (0.04)
Has “significant” livestock holdings (0/1)	0.12 (0.01)	0.23 (0.03)	0.29 (0.02)	0.21 (0.02)
Economic infrastructure index	0.17 (0.02)	0.12 (0.01)	0.17 (0.03)	0.15 (0.01)
Economic infrastructure index * Adult female literacy	0.02 (0.01)	0.02 0.00	0.12 (0.03)	0.04 (0.01)
Health infrastructure index	0.11 (0.02)	0.07 (0.01)	0.19 (0.03)	0.11 (0.01)
Malaria identified as the major health problem (0/1)	0.40 (0.05)	0.41 (0.05)	0.66 (0.05)	0.46 (0.03)

Note: Standard errors in parentheses, corrected for sample design effects.

Table 11: Means and standard errors of variables in urban determinants of poverty models

Variable	Large cities (N=1,570)	Small urban areas (N=869)	All urban (N=2,439)
Ln of real consumption per person per day	8.46 (0.08)	8.38 (0.07)	8.43 (0.05)
Persons 0-9 years old	2.20 (0.05)	2.31 (0.08)	2.24 (0.04)
Persons 10-17 years old	1.83 (0.04)	1.55 (0.14)	1.72 (0.06)
Females 18-59 years old	1.50 (0.05)	1.24 (0.05)	1.40 (0.04)
Males 18-59 years old	1.43 (0.05)	1.17 (0.07)	1.33 (0.04)
Persons 60 years or older	0.17 (0.03)	0.23 (0.03)	0.20 (0.02)
Persons of unclassified age	0.001 (0.001)	0.009 (0.006)	0.004 (0.002)
Household size squared	60.65 (2.86)	51.62 (4.23)	57.26 (2.20)
Age of head of household	42.91 (0.69)	41.69 (0.73)	42.45 (0.50)
Male head of household (0/1)	0.81 (0.01)	0.80 (0.02)	0.81 (0.01)
Number of disabled persons in household	0.08 (0.01)	0.12 (0.02)	0.09 (0.01)
Number of war migrants in household	0.17 (0.04)	0.05 (0.03)	0.12 (0.03)
Number of women who had first child before age 16	0.13 (0.02)	0.15 (0.02)	0.14 (0.01)
Number of literate adult males	1.37 (0.06)	0.97 (0.09)	1.22 (0.05)
Number of literate adult females	1.09 (0.06)	0.60 (0.07)	0.91 (0.04)
Number of adult males who completed primary education	0.49 (0.04)	0.35 (0.06)	0.44 (0.03)
Number of adult females who completed primary education	0.28 (0.03)	0.14 (0.04)	0.23 (0.02)
Highest educational level of any adult in the household	3.31 (0.07)	2.64 (0.26)	3.06 (0.11)
Number of adults in agricultural sector	0.45 (0.08)	1.00 (0.12)	0.66 (0.07)

(continued)

Table 11 (continued)

Variable	Large cities (N=1,570)	Small urban areas (N=869)	All urban (N=2,439)
Number of adults in industrial or construction sectors	0.34	0.18	0.28
	(0.04)	(0.02)	(0.03)
Number of adults in other sectors	0.88	0.47	0.73
	(0.06)	(0.08)	(0.04)
Number of income sources	1.26	1.29	1.27
	(0.03)	(0.06)	(0.02)
Female literacy * employment in "other" sector	1.26	0.000	0.79
	(0.14)	(0.00)	(0.07)
Male literacy * employment in agricultural sector	0.00	0.91	0.34
	(0.00)	(0.12)	(0.06)
Female literacy * employment in agricultural sector	0.000	0.53	0.20
	(0.00)	(0.09)	(0.04)
Female literacy * employment in industrial/construction sector	0.000	0.13	0.05
	(0.00)	(0.03)	(0.01)
Ln of arable land (hectares)	0.11	0.21	0.15
	(0.03)	(0.04)	(0.02)
Use any equipment or irrigation? (0/1)	0.07	0.12	0.09
	(0.01)	(0.02)	(0.01)
Secure land tenure? (0/1)	0.22	0.42	0.29
	(0.02)	(0.04)	(0.02)
Ln of total number of fruit and nut trees	0.35	0.89	0.56
	(0.07)	(0.12)	(0.07)
Has "significant" livestock holdings (0/1)	0.04	0.09	0.06
	(0.01)	(0.01)	(0.01)

Note: Standard errors in parentheses, corrected for sample design effects.

Table 12: Determinants of rural poverty in Mozambique

	North		Center		South	
	Parameter estimate	t-statistic	Parameter estimate	t-statistic	Parameter estimate	t-statistic
Constant (North)	1.043	6.76				
Constant (Center)			0.570	3.91		
Constant (South)					(dropped)	
Persons 0-9 years old	-0.402	-14.72	-0.355	-20.89	-0.313	-12.10
Persons 10-17 years old	-0.358	-13.64	-0.319	-19.95	-0.292	-12.20
Females 18-59 years old	-0.451	-10.56	-0.417	-12.31	-0.312	-7.97
Males 18-59 years old	-0.431	-9.19	-0.378	-14.15	-0.337	-8.03
Persons 60 years or older	-0.464	-9.36	-0.397	-10.70	-0.366	-9.58
Persons of unclassified age	-0.509	-7.01	-0.159	-0.69	0.340	0.77
Household size squared	0.021	8.19	0.016	13.97	0.014	7.27
Age of head of household	-0.000	-0.42	-0.001	-0.82	-0.002	-1.61
Male head of household (0/1)	0.135	3.57	0.091	2.85	0.043	1.47
Number of disabled persons in household	-0.019	-0.48	-0.002	-0.06	-0.080	-2.17
Number of war migrants in household	-0.011	-0.80	-0.037	-2.15	0.008	0.52
Number of women who had first child before age 16	-0.052	-1.85	0.055	1.68	0.021	0.39
Number of literate adult males	0.042	1.56	0.039	1.72	0.061	2.30
Number of literate adult females	-0.041	-0.84	0.075	2.65	0.201	4.68
Number of adult males who completed primary education	0.031	0.97	0.031	0.97	0.031	0.97
Number of adult females who completed primary education	0.103	1.52	0.103	1.52	0.103	1.52
Highest educational level of any adult in the household	0.048	3.08	0.054	4.19	0.049	2.86
Number of adults in agricultural sector	0.033	1.10	0.037	1.68	0.041	1.82
Number of adults in industrial or construction sectors	0.193	1.90	0.053	1.00	0.109	2.12
Number of adults in other sectors	0.342	6.63	0.265	5.02	0.105	2.01
Number of income sources	0.010	0.33	-0.032	-1.12	0.084	2.31
Male literacy * Industrial/construction sector	-0.107	-1.01				
Female literacy * Agricultural sector					-0.044	-3.857
Ln of arable land (hectare)	0.048	1.98	0.018	0.87	0.042	1.31
Use any equipment or irrigation? (0/1)	0.057	1.50	0.057	1.50	0.057	1.50
Secure land tenure (0/1)	-0.047	-1.63	0.007	0.25	-0.042	-1.20
Cultivate horticultural crops (0/1)	-0.003	-0.12	-0.003	-0.12	-0.003	-0.12
Cultivate commercial crops (0/1)	0.032	0.86	0.032	0.86	0.032	0.86
ln of number of cashew trees	0.015	1.12	0.008	0.43	0.004	0.38
ln of number of citrus trees plus coconut trees[a]	0.006	0.29	0.014	1.07	0.040	3.16

(continued)

Table 12 (continued)

	North		Center		South	
	Parameter estimate	t-statistic	Parameter estimate	t-statistic	Parameter estimate	t-statistic
ln of number of other trees	0.008	0.61	0.028	2.61	0.044	3.63
Has “significant” livestock holdings (0/1)	0.135	3.68	0.089	3.03	0.109	3.42
Economic infrastructure index	0.122	1.27	0.122	1.27	0.122	1.27
Econ infrastructure index * Adult female literacy	0.116	2.23	0.116	2.23	0.116	2.23
Health infrastructure index	0.038	0.59	0.038	0.59	0.038	0.59
Malaria a major problem (0/1)	-0.017	-0.48	-0.017	-0.48	-0.017	-0.48
Constant, district fixed effects, and controls for missing data						
Number of observations	5,811		F(153, 34)	154.45		
Number of strata	10		Prob > F	0.000		
Number of PSUs	196		R^2	0.538		
Tests of hypotheses:						
Joint deletion of all interaction terms			F(18,169) = 1.50		prob > F = 0.097	
Joint deletion of interaction terms with p-values	> 0.1		F(17,170) = 1.03		prob > F = 0.432	
Identical parameters for north, center and south			F(62,125) = 1.92		prob > F = 0.001	
No district fixed effects			F(109,78) = 304.90		prob > F = 0.000	

Notes: (dropped) indicates that variable was perfectly collinear with another variable, and therefore omitted from the regression. The F-statistic for the regression is $F(k, d-k + 1)$, where k = number of estimated parameters, d = total number of sampled PSUs minus the total number of strata. The F-statistics for the tests of hypotheses are $F(r, d-r + 1)$ where r = number of restrictions tested. The regression and the tests are implemented using Stata's *svyreg* and *svytest* commands. See Korn and Graubard (1990) for detailed explanation of degrees of freedom (cited in *Stata Reference Manual*, Release 5, Volume 3).

Table 13: Determinants of urban poverty in Mozambique

	Large cities		Small urban areas	
	Parameter estimate	t-statistic	Parameter estimate	t-statistic
Constant - Large cities	(dropped)			
Constant - Small cities			(dropped)	
Persons 0-9 years old	-0.303	-14.58	-0.360	-12.44
Persons 10-17 years old	-0.246	-12.82	-0.274	-6.06
Females 18-59 years old	-0.449	-12.40	-0.439	-5.92
Males 18-59 years old	-0.349	-5.82	-0.309	-4.51
Persons 60 years or older	-0.410	-7.57	-0.297	-4.57
Persons of unclassified age	-0.539	-0.99	-0.509	-0.88
Household size squared	0.010	9.14	0.015	7.24
Age of head of household	0.004	1.72	-0.001	-0.43
Male head of household (0/1)	0.183	3.99	0.153	2.58
Number of disabled persons in household	0.036	0.61	-0.084	-1.28
Number of war migrants in household	0.008	0.41	-0.093	-1.37
Number of women who had first child before age 16	-0.100	-1.87	-0.013	-0.24
Number of literate adult males	0.021	0.35	0.097	1.71
Number of literate adult females	0.253	7.28	0.097	1.18
Number of adult males who completed primary education	0.037	1.01	0.110	1.80
Number of adult females who completed primary education	0.112	2.66	0.145	1.94
Highest educational level of any adult in the household	0.178	7.00	0.086	2.60
Number of adults in agricultural sector	-0.031	-0.74	-0.010	-0.16
Number of adults in industrial or construction sectors	0.013	0.41	-0.035	-0.78
Number of adults in other sectors	0.135	3.63	0.146	4.39
Number of income sources	-0.001	-0.03	0.012	0.22
Female literacy * employment in "other" sector	-0.055	-3.93		
Male literacy * employment in agricultural sector			-0.079	-2.72
Female literacy * employment in agricultural sector			0.068	1.60
Female literacy * employment in industrial/construction sector			0.170	1.80
Ln of arable land (hectares)	0.032	0.68	0.130	3.63
Use any equipment or irrigation? (0/1)	0.105	1.62	0.105	1.62

(continued)

Table 13 (continued)

	Large cities		Small urban areas	
	Parameter estimate	t-statistic	Parameter estimate	t-statistic
Secure land tenure (0/1)	-0.011	-0.17	-0.098	-2.39
Ln of total number of fruit and nut trees	-0.054	-1.57	0.038	1.95
Has “significant” livestock holdings (0/1)	0.231	2.19	0.166	2.47
Constant, district fixed effects, and controls for missing data				
Number of observations	2,439		F(62, 5)	50.81
Number of strata	11		Prob > F	0.000
Number of PSUs	77		R^2	0.502
Tests of hypotheses:				
Joint deletion of all interaction terms	F(12,55) =	2.3	prob > F = 0.019	
Joint deletion of interaction terms with p-values > 0.1	F(9,58) =	1.15	prob > F = 0.344	
Identical parameters for large and small urban areas	F(31,36) =	3.54	prob > F = 0.000	
No district fixed effects	F(19,48) =	12.09	prob > F = 0.000	

Note: (dropped) indicates that variable was perfectly collinear with another variable, and therefore omitted from the regression. The F-statistic for the regression is $F(k, d\text{-}k + 1)$, where k = number of estimated parameters, d = total number of sampled PSUs minus the total number of strata. The F-statistics for the tests of hypotheses are $F(r, d\text{-}r + 1)$ where r = number of restrictions tested. The regression and the tests are implemented using Stata's *svyreg* and *svytest* commands. See Korn and Graubard (1990) for detailed explanation of degrees of freedom (cited in *Stata Reference Manual*, Release 5, Volume 3).

Table 14: Comparison of actual measures of well-being with base simulation

	Rural		Urban	
Statistic	Actual	Base simulation	Actual	Base simulation
Mean daily consumption per capita[a]	4,933.95	4,442.25	6,663.62	5,463.68
Poverty headcount	71.25	67.79	62.01	58.00
Poverty gap	29.92	29.43	26.67	26.27
Squared poverty gap	15.89	16.22	14.60	15.15

[a] Expressed in MT at temporally and spatially adjusted 1996-97 prices.

Table 15: Total changes in consumption and poverty levels (simulation results)

Simulation		Percent change in real consumption per capita			Percent change in poverty headcount			Percent change in poverty gap			Percent change in squared poverty gap		
No.	Description	Rural	Urban	National	Rural	Urban	National	Rural	Urban	National	Rural	Urban	National
1	Increase by 1 the number of adult males who are literate	4.5	1.1	3.7	–3.5	–1.1	–3.1	–6.0	–2.0	–5.3	–7.8	–2.7	–6.8
2	Increase by 1 the number of adult females who are literate	8.1	10.3	8.7	–6.5	–10.4	–7.2	–11.0	–17.7	–12.3	–14.0	–22.5	–15.7
3	Increase by 1 the number of adult males who have completed primary school	16.3	15.0	16.0	–12.5	–13.8	–12.7	–19.6	–21.1	–19.9	–24.1	–25.8	–24.4
4	Increase by 1 the number of adult females who have completed primary school	28.9	31.6	29.6	–22.1	–28.1	–23.2	–32.8	–40.1	–34.2	–39.3	–47.2	–40.8
5	Ensure that at least one adult completes primary school	24.3	21.2	23.6	–18.4	–19.7	–18.6	–27.6	–29.8	–28.0	–33.3	–36.2	–33.8
6	Increase landholdings by 0.5 hectare (all landholders)	0.9	1.4	1.0	–0.7	–1.3	–0.8	–1.1	–2.1	–1.3	–1.3	–2.6	–1.5
7	Increase landholdings by 1 hectare (those with ≤ 2 hectares)	0.8	1.7	1.0	–0.6	–1.6	–0.8	–0.9	–2.5	–1.2	–1.0	–3.1	–1.4
8	Households with ≤ 1 hectare adopt modern agricultural inputs	1.8	2.0	1.9	–1.4	–2.0	–1.5	–2.0	–3.4	–2.3	–2.4	–4.3	–2.7
9	Households with ≤ 2 hectares adopt modern agricultural inputs	3.6	3.0	3.5	–2.8	–2.9	–2.8	–4.3	–5.0	–4.4	–5.2	–6.4	–5.4
10	Households with any land adopt modern agricultural inputs	5.2	3.8	4.8	–4.1	–3.6	–4.0	–6.6	–6.0	–6.5	–8.2	–7.6	–8.1
11	Increase number of cashew trees (or cashew productivity) by 20 percent	0.04	n/a	0.03	–0.03	n/a	–0.02	–0.04	n/a	–0.03	–0.05	n/a	–0.04
12	Increase number of households producing cashew (see text)	0.8	n/a	0.7	–0.7	n/a	–0.5	–1.0	n/a	–0.8	–1.1	n/a	–0.9
13	Increase number of citrus and coconut trees by 20 percent	0.1	n/a	0.1	–0.1	n/a	–0.1	–0.1	n/a	–0.1	–0.1	n/a	–0.1
14	Crop-producing households also start growing commercial crops	2.9	n/a	2.3	–2.3	n/a	–1.8	–3.8	n/a	–3.0	–4.7	n/a	–3.8
15	Households with livestock increase quantity to a "substantial" number	1.7	0.8	1.5	–1.3	–0.7	–1.2	–2.1	–1.1	–1.9	–2.6	–1.4	–2.4

(continued)

Table 15 (continued)

Simulation		Percent change in real consumption per capita			Percent change in poverty headcount			Percent change in poverty gap			Percent change in squared poverty gap		
No.	Description	Rural	Urban	National	Rural	Urban	National	Rural	Urban	National	Rural	Urban	National
16	Move one adult from agricultural sector to industrial and construction sector (see text)	1.3	1.2	1.3	–1.1	–1.1	–1.1	–2.0	–1.7	–2.0	–2.6	–2.1	–2.5
17	Move one adult from agricultural sector to service sector (see text)	4.3	2.2	3.8	–3.7	–2.3	–3.4	–6.6	–4.2	–6.2	–8.6	–5.4	–8.0
18	Increase number of sources of income to two	1.1	0.2	0.9	–0.9	–0.2	–0.8	–1.3	–0.4	–1.2	–1.5	–0.5	–1.3
19	Add one child to the household	–15.3	–14.7	–15.2	12.5	12.9	12.4	19.2	17.9	18.9	23.0	21.7	22.8
20	Add one adult male to the household	–12.1	5.1	–8.6	10.0	–0.6	7.8	14.7	2.4	12.2	17.3	5.0	14.8
21	Add one adult female to the household	–14.5	–9.4	–13.5	12.1	9.0	11.4	19.1	17.3	18.8	23.4	23.7	23.5
22	Improve economic infrastructure (see text)	13.9	n/a	11.0	–10.5	n/a	–8.4	–16.0	n/a	–12.7	–19.2	n/a	–15.3
23	Improve health services infrastructure (see text)	3.4	n/a	2.7	–2.7	n/a	–2.1	–4.4	n/a	–3.5	–5.6	n/a	–4.4

Note: N/A indicates that the simulation does not apply to urban areas. For purposes of calculating the national impact, nonapplicable simulations are treated as having zero impact on consumption and poverty in urban areas.

[a] See text for complete description of simulations.

Table 16: Changes in consumption and poverty levels among those affected (simulation results)

Simulation		Percent of population affected			Percent change in real consumption per capita			Percent change in poverty headcount			Percent change in poverty gap			Percent change in squared poverty gap		
No.	Description	Rural	Urban	National	Rural	Urban	National	Rural	Urban	National	Rural	Urban	National	Rural	Urban	National
1	Male literacy	46.4	18.4	40.7	10.6	8.4	10.2	– 7.1	– 4.6	– 6.6	– 11.7	– 7.8	– 10.9	– 14.5	– 9.9	– 13.6
2	Female literacy	86.7	50.0	79.2	9.9	29.2	13.8	– 7.3	– 16.7	– 9.2	– 12.1	– 26.1	– 14.9	– 15.2	– 31.7	– 18.6
3	Male primary education	87.3	71.9	84.1	19.2	23.5	20.1	– 14.0	– 17.9	– 14.8	– 21.8	– 26.9	– 22.9	– 26.6	– 32.6	– 27.8
4	Female primary education	97.2	88.2	95.3	30.5	39.9	32.4	– 22.4	– 29.9	– 23.9	– 33.2	– 42.2	– 35.0	– 39.6	– 49.5	– 41.6
5	Guarantee primary education for one adult	92.6	56.3	85.2	26.8	49.8	31.5	– 19.5	– 29.3	– 21.5	– 29.2	– 41.7	– 31.7	– 35.0	– 48.7	– 37.8
6	Increase landholdings by 0.5 hectare (all landholders)	95.4	52.1	86.6	1.0	3.2	1.4	– 0.7	– 2.2	– 1.0	– 1.1	– 3.4	– 1.6	– 1.3	– 4.0	– 1.9
7	Increase landholdings by 1 hectare (those with ≤ 2 ha)	61.2	40.0	56.9	1.3	5.4	2.1	– 1.0	– 3.5	– 1.5	– 1.5	– 5.2	– 2.3	– 1.8	– 6.2	– 2.7
8	Households with ≤ 1 hectare adopt modern agric. inputs	28.6	24.0	27.6	5.9	11.1	6.9	– 5.2	– 7.0	– 5.6	– 7.9	– 11.2	– 8.6	– 9.6	– 13.9	– 10.5
9	Households with ≤ 2 hectares adopt modern agric. inputs	59.4	35.3	54.5	5.9	11.1	6.9	– 4.9	– 6.9	– 5.4	– 7.7	– 11.0	– 8.4	– 9.5	– 13.6	– 10.4
10	Households with any land adopt modern agric. inputs	89.3	43.3	79.9	5.9	11.1	6.9	– 4.5	– 7.1	– 5.0	– 7.3	– 11.1	– 8.0	– 9.0	– 13.7	– 9.9
11	Increase cashew trees (or productivity) by 20 percent	23.6	n.a.	18.8	0.2	n.a.	0.1	– 0.1	n.a.	– 0.1	– 0.2	n.a.	– 0.2	– 0.3	n.a.	– 0.2
12	Increase no. of households growing cashew (see text)	19.4	n.a.	15.5	4.1	n.a.	3.2	– 3.6	n.a.	– 2.8	– 5.6	n.a.	– 4.5	– 7.0	n.a.	– 5.6
13	Increase no. of citrus and coconut trees by 20 percent	22.5	n.a.	17.9	0.4	n.a.	0.3	– 0.3	n.a.	– 0.2	– 0.6	n.a.	– 0.4	– 0.7	n.a.	– 0.6
14	Agric. households also start growing commercial crops	90.5	n.a.	72.1	3.2	n.a.	2.6	– 2.5	n.a.	– 2.0	– 4.1	n.a.	– 3.3	– 5.1	n.a.	– 4.1
15	Households with livestock increase quantity to a "substantial" number	15.2	4.6	13.0	11.6	20.5	13.4	– 8.5	– 13.6	– 9.5	– 13.2	– 20.6	– 14.7	– 16.0	– 25.0	– 17.8

(continued)

Table 16 (continued)

Simulation		Percent of population affected			Percent change in real consumption per capita			Percent change in poverty headcount			Percent change in poverty gap			Percent change in squared poverty gap		
No.	Description	Rural	Urban	National	Rural	Urban	National	Rural	Urban	National	Rural	Urban	National	Rural	Urban	National
16	Move adult labor from agric. sector to industrial/ construction sector (see text)	23.9	18.1	22.7	6.7	10.0	7.4	– 3.8	– 4.6	– 4.0	– 6.5	– 6.4	– 6.5	– 8.0	– 7.4	– 7.9
17	Move 1 adult from agric. sector to service sector (see text)	23.9	18.1	22.7	23.2	18.3	22.2	– 13.0	– 9.9	– 12.4	– 21.3	– 15.8	– 20.2	– 26.0	– 19.4	– 24.7
18	Increase number of sources of income to two	66.4	73.3	67.8	1.7	0.3	1.4	– 1.4	– 0.3	– 1.1	– 1.9	– 0.5	– 1.6	– 2.0	– 0.7	– 1.7
19	Add 1 child to the household	100.0	100.0	100.0	– 15.3	– 14.7	– 15.2	12.6	12.0	12.4	19.2	17.9	18.9	23.1	21.7	22.8
20	Add 1 adult to the household	100.0	100.0	100.0	– 12.1	5.1	– 8.6	10.0	– 0.6	7.8	14.7	2.4	12.2	17.3	5.0	14.8
21	Add 1 adult female to the household	100.0	100.0	100.0	– 14.5	– 9.4	– 13.5	12.1	9.0	11.4	19.1	17.3	18.8	23.4	23.7	23.5
22	Improve economic infra- structure (see text)	99.2	n.a.	79.0	14.0	n.a.	11.2	– 10.6	n.a.	– 8.4	– 16.1	n.a.	– 12.8	– 19.3	n.a.	– 15.4
23	Improve health services infrastructure (see text)	98.6	n.a.	78.5	3.5	n.a.	2.8	– 2.7	n.a.	– 2.2	– 4.5	n.a.	– 3.6	– 5.6	n.a.	– 4.5

Note: n.a. indicates that the situation does not apply to urban areas. For purposes of calculating the national impact, nonapplicable simulations are treated as having zero impact on consumption and poverty in urban areas.

[a] See text and first column of Table 15 for more complete explanation of the simulation used. The simulation numbers refer to the same situation in both tables.

Table 17: Simulated effects of demographic changes, assuming economies of household size

Simulation		Percent change in consumption per "equivalent adult"			Percent change in poverty headcount			Percent change in poverty gap			Percent change in squared poverty gap		
No.	Description	Rural	Urban	National	Rural	Urban	National	Rural	Urban	National	Rural	Urban	National
19a	Add one child	-3.01	-9.30	-4.29	3.23	9.74	4.55	5.48	14.37	7.29	6.87	17.53	9.04
20a	Add one adult male	1.28	1.11	1.25	-0.34	0.80	-0.11	-0.04	3.24	0.63	0.13	5.21	1.16
21a	Add one adult female	0.51	3.67	1.15	0.66	0.31	0.59	1.99	5.26	2.66	2.86	9.40	4.19

Note: The determinants of poverty models were reestimated, taking economies of household size into account. The dependent variable was changed to $x_j / h^{è}_{j}$, where x_j is total consumption of household *j*, h_j is the number of persons in household *j*, and è is the elasticity of household size parameter, which was set to 0.4 (the level at which household size and poverty are almost orthogonal). The poverty line was normalized, using the average household size in the sample. For more details, see the text, and Lanjouw and Ravallion (1995).

Table 18: Implications of economic growth over the past decade for poverty reduction

	1987 simulated	1996-97	Percent change over the decade
Mean consumption (MT per person per day at 1996-97 prices)	4963	5286	6.5
Headcount index (percent)	72.60	69.37	-4.4
Poverty gap index (percent)	31.82	29.26	-8.0
Squared poverty gap index (percent)	17.39	15.63	-10.1

Table 19: Implications of future economic growth for poverty reduction

Hypothetical economic growth rate	1996-97	2003 simulated	Percent change over 5 years
Scenario 1: 2% p.a. growth in real consumption per capita, distribution-neutral			
Mean consumption (MT per person per day at 1996-97 prices)	5,286	5,836	10.4
Headcount index	69.37	64.17	–7.5
Poverty gap index	29.26	25.35	–13.4
Squared poverty gap index	15.63	13.06	–16.4
Scenario 2: 7.7% p.a. growth in real consumption per capita, distribution-neutral			
Mean consumption (MT per person per day at 1996-97 prices)	5,286	8,240	55.9
Headcount index	69.37	41.95	-39.5
Poverty gap index	29.26	13.72	–53.1
Squared poverty gap index	15.63	6.28	–59.9
Scenario 3: 7.7% p.a. growth in real consumption per capita, with growth in urban areas twice as fast as rural growth			
Mean consumption (MT per person per day at 1996-97 prices)	5,286	8,240	55.9
Headcount index	69.37	43.42	–37.4
Poverty gap index	29.26	14.70	–49.8
Squared poverty gap index	15.63	6.83	–56.3
Scenario 4: 7.7% p.a. growth in real consumption per capita, with growth for nonpoor households twice as fast as for poor households			
Mean consumption (MT per person per day at 1996-97 prices)	5,286	8,240	55.9
Headcount index	69.37	48.44	–30.2
Poverty gap index	29.26	16.85	–42.4
Squared poverty gap index	15.63	8.01	–48.8

Table 20: A hedonic model for dwelling rentals (dependent variable: log monthly rental)

Variable	Parameter estimate	T-ratio
Province-zone dummy variables		
Niassa rural	0.2177	0.219
Cabo Delgado urban	-0.8069	-0.961
Cabo Delgado rural	-0.6334	-0.744
Nampula urban	-0.6364	-0.777
Nampula rural	-1.6189	-1.744
Zambézia urban	-0.6126	-0.738
Zambézia rural	0.2602	0.255
Tete urban	-0.6668	-0.809
Tete rural	-0.9496	-1.039
Manica urban	-0.3465	-0.425
Manica rural	-0.5468	-0.644
Sofala urban	-0.0734	-0.09
Sofala rural	-0.0592	-0.066
Inhambane urban	-0.0330	-0.04
Inhambane rural	-0.3272	-0.403
Gaza urban	0.0315	0.034
Gaza rural	-0.6533	-0.79
Maputo Province urban	-0.2042	-0.252
Maputo Province rural	-0.3884	-0.475
Maputo City urban	0.0058	0.007
Number of rooms		
Number of rooms in dwelling	0.1405	5.502
Missing data (dummy)	1.7456	1.381
Type of habitation dummy variables		
Flat or apartment	-0.1355	-0.937
Hut (*palhota*) or cabana	-0.0415	-0.14
Other	-0.4036	-2.113
Type of walls dummy variables		
Wood or metal	-0.4419	-2.297
Adobe	-0.4227	-1.337
Reeds or sticks	-0.3173	-1.141
Reeds or sticks with mud plaster	-0.5155	-1.738
Other	-0.3803	-0.914
Type of roof dummy variables		
Tile	-0.0744	-0.352
Composite	-0.2778	-1.73
Zinc	-0.1266	-0.954

(continued)

Table 20 (continued)

Variable	Parameter estimate	T-ratio
Thatch	-0.3766	-1.542
Other	-0.0964	-0.437
Type of floor dummy variables		
Marble	-0.2061	-0.773
Granulite	-0.1976	-0.322
Cement or concrete	0.1043	0.699
Brick	0.5395	1.118
Adobe	-0.2763	-1.138
None (earthen)	-0.0740	-0.323
Other	0.7626	2.324
If any room used exclusively for work (dummy variables)		
No	0.0906	0.605
Missing data	-0.0717	-0.198
Age of dwelling dummy variables		
1 to 3 years	0.2541	0.888
4 - 5 years	0.0929	0.324
5 - 10 years	0.2908	1.052
More than 10 years	0.2660	1.005
Missing data	0.3093	0.483
Length of stay dummy variables		
1 to 3 years	-0.3417	-1.528
4 - 5 years	-0.1328	-0.578
5 - 10 years	-0.4622	-2.116
More than 10 years	-0.2913	-1.436
Missing data	-0.8119	-0.714
Mode of acquisition dummy variables		
Rented (not from APIE/Coop)	2.1516	12.352
Own home, fully paid	3.0307	25.326
Own home, still paying for it	2.4742	12.509
Squatting	2.6088	10.706
Ceded by the state or others	1.2370	4.609
Other	0.6142	0.863
Source of water dummy variables		
Piped water in yard	-0.1991	-1.645
Public tap	-0.3903	-2.595
Private well	-0.3534	-1.964
Public well	-0.3623	-2.194
River or lake	-0.3010	-1.232

(continued)

Table 20 (continued)

Variable	Parameter estimate	T-ratio
Other	-0.3587	-2.285
If dwelling has a toilet dummy variables		
No	0.0614	0.086
Missing data	0.0532	0.069
If dwelling has a latrine dummy variables		
No	0.1435	1.333
Missing data	0.3132	0.442
Type of illumination dummy variables		
Oil lamp	-0.3010	-3.083
Candle	-0.3320	-1.467
Wood	-0.6080	-2.943
Other	-0.5968	-2.2
No lighting	-0.0705	-0.131
Type of cooking fuel dummy variables		
Gas	-0.1769	-1.128
Charcoal	-0.1510	-1.211
Wood	-0.3248	-2.178
Other	-0.0972	-0.293
Do not cook	-0.5376	-0.478
Constant	9.3043	10.833
R^2	0.5947	
Adjusted R^2	0.5673	
Standard error of regression	1.1006	
Signif F = .0000 F(80,1183)	21.6987	

Note: The regression uses observations on actual or owner-estimated rent reported by 1,264 households.

Table 21: Estimated market values and life spans of durable goods

Durable good	Estimated market value of a used durable good at the time of the MIAF survey	Assumed remaining life span
	('000 MT)	(in years)
Table with four chairs	2,352	15
Medium bed	358	15
Refrigerator	6,638	10
Fan	149	5
Sewing machine	3,876	25
Electrical iron	224	5
Charcoal iron	30	5
Radio	251	5
Black and white television	1,700	5
Color television	3,506	5
Air conditioner	5,665	10
Clock	72	5
Telephone	519	10
Vehicle (car or truck)	125,029	15
Motorcycle	13,892	10
Bicycle	795	10

Note: The expected market values are for a used durable good in "good" condition. See text for further discussion of data sources and assumptions used in the calculations.

Table 22: Estimated caloric requirements by age and sex

Age category	Females	Males
Up to 1 year old	820	820
1 - 2 years old	1,150	1,150
2 - 3 years old	1,350	1,350
3 - 5 years old	1,550	1,550
5 - 7 years old	1,750	1,850
7 - 10 years old	1,800	2,100
10 - 12 years old	1,950	2,200
12 - 14 years old	2,100	2,400
14 - 16 years old	2,150	2,650
16 - 18 years old	2,150	2,850
18 - 30 years old	2,100	3,000
30 - 60 years old	2,150	2,900
60 years and older	1,950	2,450

Source: World Health Organization (1985).
Notes: An additional 285 calories per day are required for women in the last trimester of pregnancy. An additional 500 calories per day are required by women who are in the first six months of lactation. Adult caloric requirements assume a moderate amount of physical activity.

FIGURES

Figure 1: Sample design for Mozambique Household Survey (MIAF)

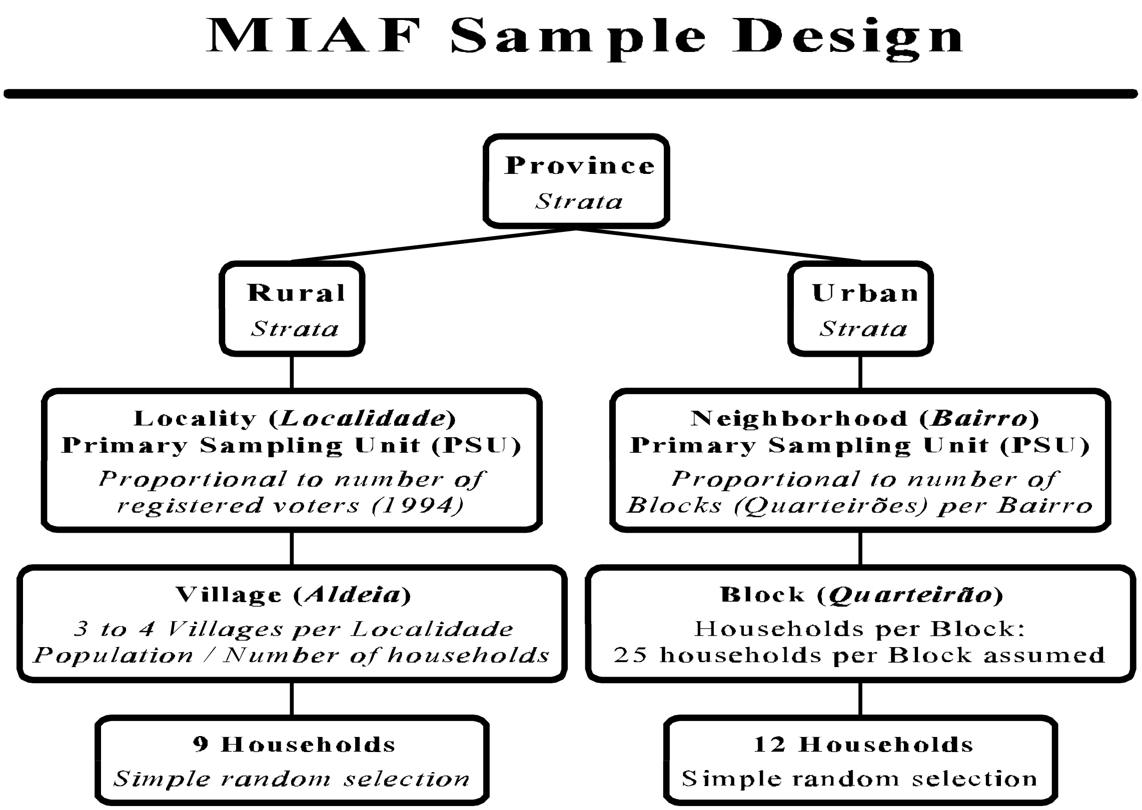


Figure 2: Temporal food price variation, by region

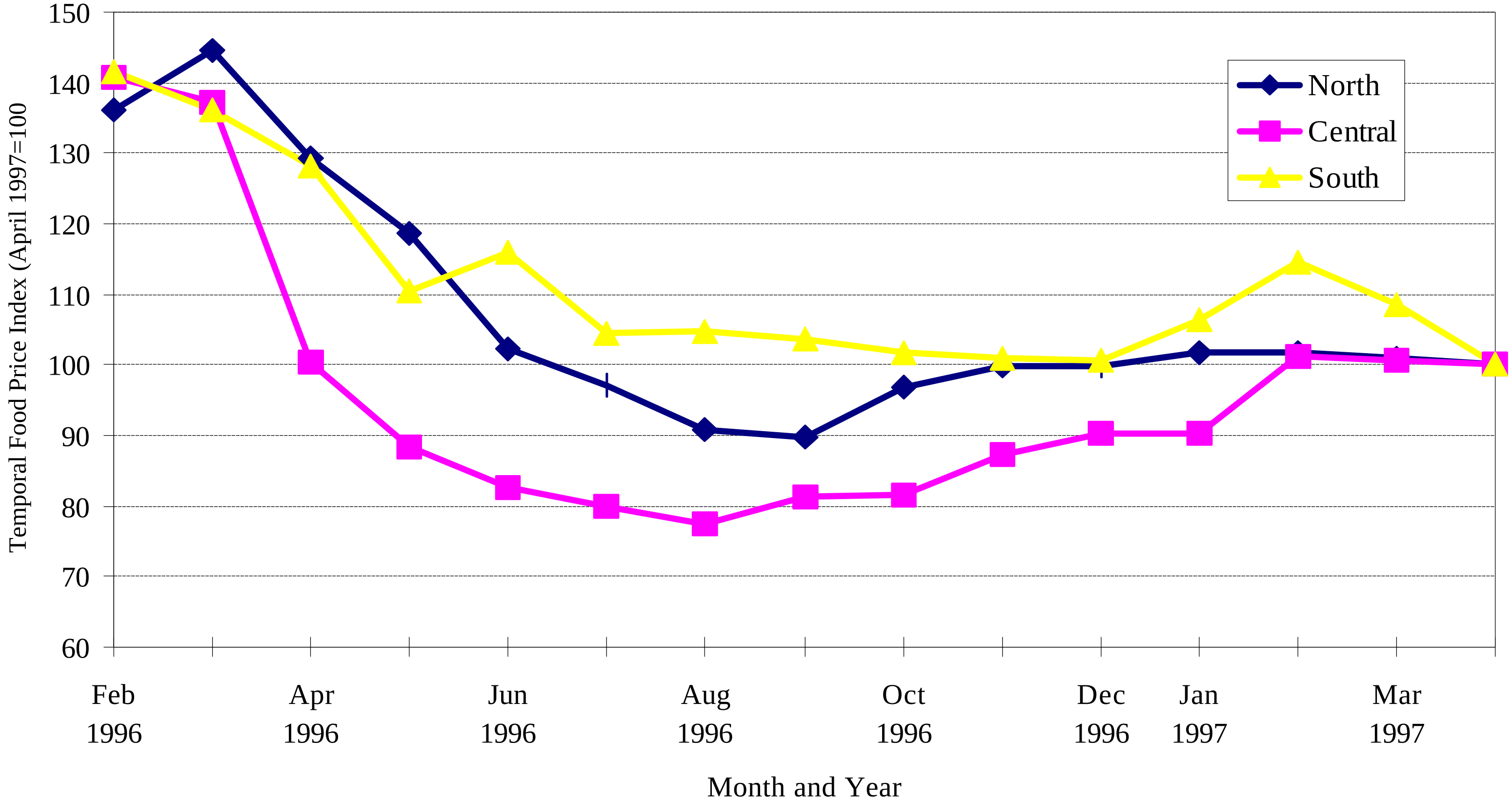
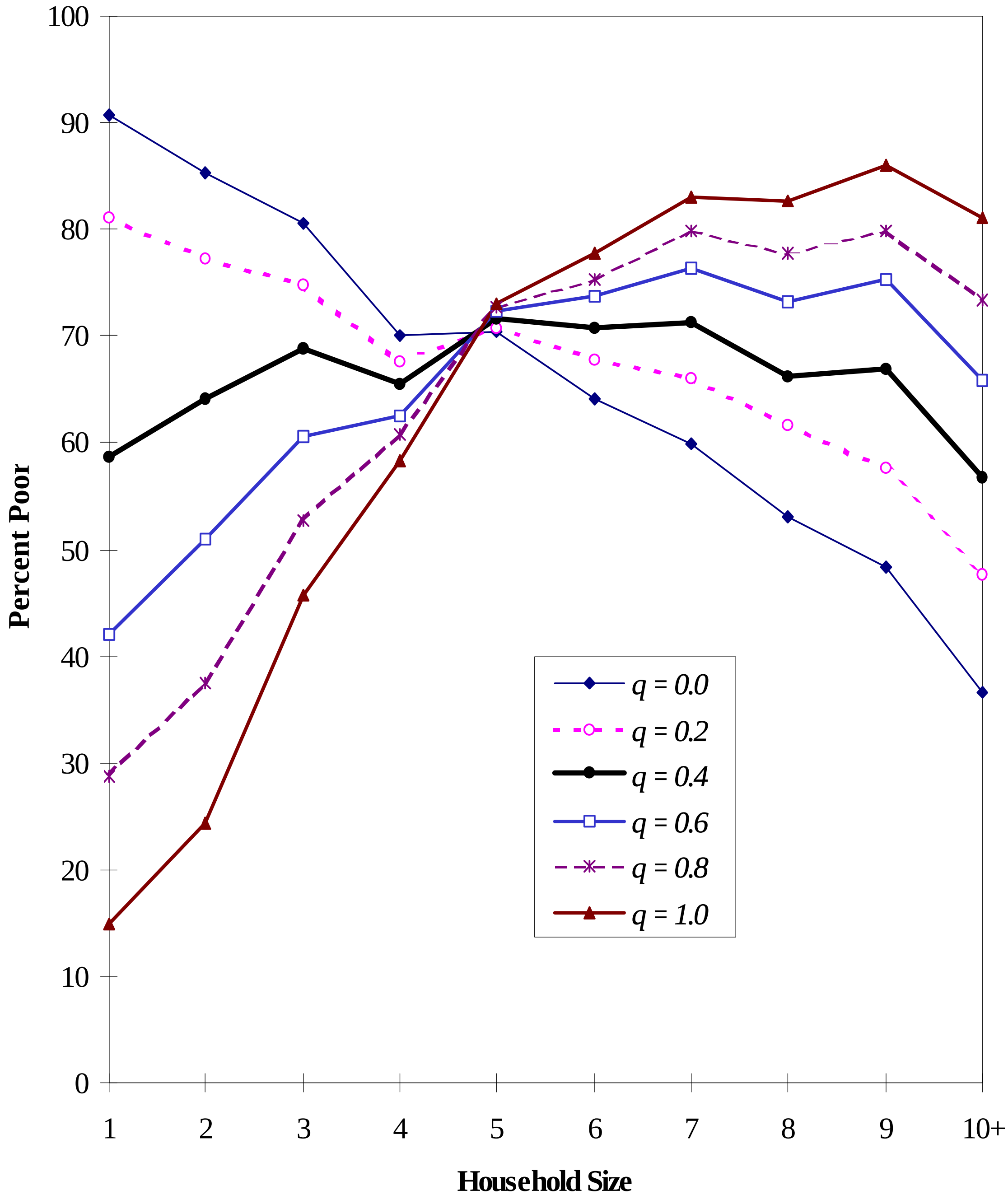


Figure 3: Poverty and household size, under alternative assumptions about economies of household size



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