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DETERMINANTS OF POVERTY IN EGYPT: 1997

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ABSTRACT

Poverty profiles are a useful way of summarizing information on the levels of poverty and the characteristics of the poor in a society. They also provide us with important clues to the underlying determinants of poverty. However, important as they are, poverty profiles are limited by the bivariate nature of their informational content. The bivariate associations typical in a poverty profile can sometimes be misleading; they beg the obvious question of the effect of a particular variable conditional on the other potential determinants. While there may be certain contexts where unconditional poverty profiles are relevant to a policy decision (see Ravallion 1996), often one would be interested in the "conditional" poverty effects of proposed policy interventions. It is not surprising therefore that empirical poverty assessments in recent years have seen a number of attempts at going beyond the poverty profile tabulations to engage in a multivariate analysis of living standards and poverty. This study for Egypt has a similar motivation.

For Egypt, while there has been some work on a descriptive analysis of the characteristics of the poor, to our knowledge, there is no precursor to an empirical modeling of the determinants of poverty using nationally representative data. To a large extent, this has been due to the nonavailability of unit-record data from the Household Income, Expenditure and Consumption Survey (HIECS), the primary source of data on living standards in Egypt. However, this constraint has been recently alleviated with the

1997 Egypt Integrated Household Survey (EIHS). Using the EIHS data, it is now possible to conduct a household-level multivariate analysis of living standards. The EIHS, being an integrated, multimodule survey, also offers the potential of a richer analysis of this issue than may have been possible from other data sources.

In this paper, we have sought to extend the descriptive analysis of the Egypt poverty profile presented in Datt, Jolliffe, and Sharma (1998) by modeling the determinants of poverty, using data from the 1997 Egypt Integrated Household Survey. Our approach to modeling the determinants of poverty is to model the determinants of the individual welfare indicator, namely, consumption per person, used to define poverty measures. Model predictions for the individual welfare indicator have direct implications for predicted levels of poverty.

We estimate separate governorate-level fixed effect models for the urban and rural sectors. In our preferred model for the urban sector, we include interaction effects between schooling characteristics, measures of unemployment, and landownership. In our preferred rural model, we include interaction effects between schooling characteristics, measures of unemployment, landownership, and community characteristics including irrigation, distance to railroad, and indices of social and economic capital. We use both the urban and rural regression models to predict changes in consumption levels and hence poverty from simulated policy changes.

A key conclusion of our study has to do with the important instrumental role of education in alleviating poverty in Egypt. Increasing average years of schooling, as well as improving the level of parents education, is indicated to have large impacts on average living standards and poverty levels. Our simulation results suggest that a two-year increase in household average school attainment would result in an 18 percent decline in the number of individuals living in poverty. A two-year increase in school attainment would also result in a reduction in the depth of poverty (as measured by the poverty gap index) and the severity of poverty (as measured by the squared poverty gap index) of 22 and 25 percent, respectively. We find that the estimated beneficial effect of improved school attainment is robust whether we consider the rural or urban sector, Upper or Lower Egypt, and regardless of which poverty index we examine.

While the beneficial effects of improvements in school attainment are significantly larger than the predicted effects from any other policy changes, we do find fairly large and positive effects from improvements to irrigation and reducing the number of unemployed individuals. Improved irrigation is estimated to reduce the national incidence of poverty by 6 percent, while reducing unemployment levels is estimated to reduce the incidence of poverty by 2 to 3 percent.

It is in the nature of these poverty simulations that the results have a reduced form character. The observed effects are nevertheless important, even if the particular pathways are difficult to identify. In interpreting the importance of these results for poverty reduction, one should also not assume these effects to be instantaneous, even though they are estimated from static models. Educational investments, for instance, have inherently long gestation; what our results indicate is that they can be powerful instruments for long-term poverty reduction.

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1. INTRODUCTION

Poverty profiles are a useful way of summarizing information on the levels of poverty and the characteristics of the poor in a society. They also provide us with important clues to the underlying determinants of poverty. However, important as they are, poverty profiles are limited by the bivariate nature of their informational content. The bivariate associations typical in a poverty profile can sometimes be misleading because of their unconditional nature; they beg the obvious question of the effect of a particular variable conditional on the other potential determinants. While there may be certain contexts where unconditional poverty profiles are relevant to a policy decision (for instance, in the context of indicator targeting; see Ravallion 1996), often one is interested in the "conditional" poverty effects of proposed policy interventions. It is not surprising therefore that empirical poverty assessments in recent years have seen a number of attempts at going beyond the poverty profile tabulations to engage in a multivariate analysis of living standards and poverty.[1] This study for Egypt has a similar motivation.

For Egypt, while there has been some work on a descriptive analysis of the characteristics of the poor,[2] to our knowledge, there is no precursor to an empirical modeling of the determinants of poverty using nationally representative data. To a large extent, this has been due to the nonavailability of unit-record data from the Household

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[1] See, for instance, Glewwe (1991), World Bank (1994, 1995a, 1995b, 1995c, 1996), and Grootaert (1997).

[2] See, for instance, Ali et al. (1994), El-Laithy and Osman (1996), Korayem (1994), and Cardiff (1997).

Income, Expenditure, and Consumption Survey (HIECS), the primary source of data on living standards in Egypt. However, this constraint has been recently alleviated with the availability of data from the 1997 Egypt Integrated Household Survey (EIHS). Using the EIHS data, it is now possible to conduct a household-level multivariate analysis of living standards. The EIHS, being an integrated, multimodule survey, also offers the potential of a richer analysis of this issue than may have been possible from other data sources.[3]

This paper is organized as follows. The next section describes our approach to modeling the determinants of poverty. Section 3 introduces the EIHS data set, discusses our approach to consumption-based poverty measurement, and introduces the set of explanatory variables used in our analysis. Section 4 presents the regression results. Estimates for two versions of a model of living standards are presented, and based on these regression estimates, Section 5 presents results for a number of policy simulations of antipoverty interventions. Some concluding remarks are offered in the final section.

2. MODELING DETERMINANTS OF POVERTY

There can be a number of different approaches to modeling the determinants of poverty. In this section, we distinguish between two main approaches, and discuss our reasons for preferring one of them for the analysis undertaken in this study.

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[3] See Datt, Jolliffe, and Sharma (1998) and IFPRI (EIHS 1998) for a detailed description of the EIHS survey and data. Also see Assaad and Rouchdy (1998) for a review of the state of poverty research in Egypt.

POVERTY VERSUS CONSUMPTION MODELS

We begin with our preferred approach to modeling the determinants of poverty, which can be described as a two-step procedure. In the first step, we model determinants of consumption at the household level. The simplest form of such a model could be as follows:

$$\ln c_j \;=\; \text{â}' x_j \;+\; \text{ç}_j \,, \qquad \textbf{(1)}$$

where c_j is household *j*'s per capita consumption, x_j is a set of household characteristics, and ç_j is a random error term. In the second step, a household's poverty measure is defined in terms of its consumption level. The poverty measure for household *j* can be written as

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

where c_j is household *j*'s per capita consumption (as before), *z* denotes the poverty line, and á is a nonnegative parameter.[4] The household equivalents of the headcount index, the poverty gap index, and the squared poverty gap index are obtained when á = 0, 1, and 2, respectively.

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[4] 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

$$P_{\text{á}} \;=\; \left(\sum_{j=1}^{n} h_j \, p_{\text{á},j} \right) \;\div\; \left(\sum_{j=1}^{n} h_j \right) .$$

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

$$p_{\acute{a} j} = \hat{a}'_{\acute{a}} x_j + ç_{\acute{a} j} . \qquad \textbf{(3)}$$

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

First, given household consumption, c_j, the household's poverty level, $p_{\acute{a}j}$, is completely determined, but not vice versa.

Second, using data on only $p_{\acute{a}j}$ 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.

Third, there is an element of inherent arbitrariness about the exact level of the absolute poverty line, even if the cost of living relativities established by the regional poverty lines are considered robust. However, different poverty lines would imply that household consumption data would be censored at different levels. The estimated parameter of the poverty model would therefore change with the level of poverty line used. While this variation 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 step.

Fourth, estimation of the consumption model avoids strong distributional assumptions that are typically necessary for estimating nonlinear limited dependent variable models (Powell 1994).[5]

Hence, the approach we use in this study will be modeling consumption as in equation (1), and then using equation (2) to infer implications about levels of poverty. In estimating models such as equation (1), we will express consumption in *real* terms, i.e., nominal per capita consumption normalized by a spatial cost of living index, where this index itself can be derived as the ratio of a region's poverty line to a reference region's line. This is justified because the class of poverty measures we use is homogeneous of degree zero in mean consumption and the poverty line; in other words, the poverty measure $p_{áj}$ depends on the *ratio* of c_j to z. Thus, instead of defining poverty measures in terms of nominal per capita consumption and nominal poverty lines for different regions, we can express them directly in terms of real per capita consumption.

BASIC AND AUGMENTED MODELS

What we have discussed above could be called the *basic* model. It has the feature that the marginal effects of determinants of consumption are constant across households.

[5] 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 means that the number of nonlimit observations for estimation is very small.

It is, however, arguable that there is heterogeneity across households, and the marginal effects themselves depend on household characteristics.[6] This consideration leads to an augmented version of the model that allows for a range of interaction effects. The augmented model can be motivated as follows. The consumption model allows for individual-specific marginal effects (β_j):

$$\ln c_j = \beta_j' x_j + \eta_j , \qquad \textbf{(4)}$$

where

$$\beta_j = \beta + \gamma' x_j + \varepsilon_j \qquad \textbf{(5)}$$

and hence,

$$\ln c_j = \beta' x_j + x_j' \gamma x_j + \eta_j^* . \qquad \textbf{(6)}$$

This delivers a model with heteroscedastic errors, $\eta_j^* = \eta_j + \varepsilon_j' x_j$. This error structure is easily allowed for in estimating the variance matrix of the model parameters. Model (6) can also be motivated as a flexible functional form generalization of model (1). The model has a generalized quadratic form, which is a numerically equivalent second-order approximation to any arbitrary twice-differentiable function.[7]

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[6] Alternatively, it could be argued that the marginal effects differ for the poor and the nonpoor, or more generally, depend on the level of consumption itself. However, since the poverty or consumption level for the household is in turn a function of household characteristics, this also gets us to the same place.

[7] Such forms have been widely used in the estimation of production and profit functions (see Lau 1974).

While model (6) appears to offer a fairly general approach to modeling living standards, and model (4) is clearly a special case of (6) for ã = 0, this apparent generality comes at a price. The main issue has to do with potential over-parameterization of the model. With the full set of interaction terms, there is a veritable explosion of parameters. Beginning with a k-parameter basic model, there are $2k + k(k\text{-}1)/2$ parameters in the augmented model (6); thus, for instance, if the original model had 20 parameters, the extended model would have 230 parameters. The problem with a large number of estimable parameters is twofold. First, it exposes the specification to the problem of multicollinearity. Thus, individual parameters can be highly imprecisely estimated even as the model as a whole gives a better fit to the data. The second and related problem has to do with the use of such a model for simulations purposes. As simulations involve a change in only a limited set of variables at a time, if the parameters for some of those variables happen to be quite imprecisely estimated, then the simulated effects could also be highly imprecise, even if the fitted values from the model track the actual data quite well.

In view of these difficulties, we use below a more selective approach to the introduction of interaction terms into the basic model (4). Aiming for a more parsimonious specification, one general principle we use is that interactions *across* groups of variables are more important to the specification than interactions *within* groups. Thus, for instance, there may be several variables representing the educational attainment of the household. But it is arguably more important to interact a household educational attainment variable with, say, the level of infrastructural development in the community than interact different educational attainment variables with each other.

3. DATA AND EMPIRICAL IMPLEMENTATION

EGYPT INTEGRATED HOUSEHOLD SURVEY 1997

The primary data used in this paper are from the Egypt Integrated Household Survey, a nationwide, multiple-topic household survey carried out by IFPRI in coordination with the Ministry of Agriculture and Land Reclamation (MALR) and the Ministry of Trade and Supply (MOTS). Fieldwork began during the first week of March 1997 and concluded in the third week of May 1997. The questionnaire consists of 18 sections on a series of topics that integrate monetary and nonmonetary measures of household welfare and a variety of household behavioral characteristics.

The questionnaire was administered to 2,500 households from 20 governorates using a two-stage, stratified selection process. The first-stage of the selection process randomly selected 125 primary sampling units (PSU) with probability proportional to estimated size. In the second stage, 20 households were randomly selected from each PSU. The design also stratified selection on the following five regions of Egypt: Metropolitan, Lower urban, Lower rural, Upper urban, and Upper rural.[8]

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[8] This regional classification for Egypt has often been used in the tabulation of data from the Household Income and Expenditure Surveys conducted by the Central Agency for Public Mobilization and Statistics (CAPMAS). It has also been commonly deployed in the Egypt poverty literature; see, for instance, El-Laithy and Osman (1996), Korayem (1994), and Ali, El-Laithy, Hamza, and others (1994).

The advantage of a two-stage process relative to a pure random selection process is that it dramatically reduces the scope of fieldwork and therefore reduces the cost of the survey. The disadvantage is that standard errors resulting from two-stage samples tend to be significantly larger than those resulting from pure random samples. See Howes and Lanjouw (1998) for a discussion of how sample design affects poverty estimation. For more information on the EIHS, including more details on the sample design, strata weights, and fieldwork, see Datt, Jolliffe, and Sharma (1998). We incorporate the information on survey design effects in our estimation strategy.

CONSUMPTION-BASED POVERTY MEASUREMENT

Throughout this paper, per capita consumption is used as the basic measure of individual welfare. While this measure fails to incorporate some important aspects of individual welfare, such as consumption of public goods (for example, schools, health services, public sewage facilities), it is a useful aggregate money metric of welfare that reflects individual preferences conditional on prices and incomes.[9]

The measure of total consumption used in this paper is quite extensive and draws upon responses to several sections of the household survey. In brief, consumption is measured as the sum of total food consumption, total nonfood nondurable good expenses, estimated use value of durable goods, and an actual or imputed rental value of housing.

[9] For further discussion of this point, see Datt, Jolliffe, and Sharma (1998). On the relative merits of alternative indicators of welfare, see Atkinson (1993), Ravallion (1994) and Deaton (1997).

Below is a brief description of each of these components, which are documented in more detail in Datt, Jolliffe, and Sharma (1998).

Food consumption includes food that the household has purchased, grown, and received from other sources for 123 food items. Nonfood (nondurable) consumption is the sum of expenditures on 45 nonfood items, including expenditures on fuel, clothing, schooling, health, cleaning items, tobacco, and several miscellaneous items.

The use value of durable goods is constructed for 22 items by estimating rates of depreciation for items and using estimated interest rates from the EIHS data. These two estimates are then used to estimate what the rental price of the item would be if the household did not own the item and this is considered as the appropriate prorated expense the household incurs for the use of the durable good.

Most of the households in the survey reported how much they pay in rent or, if they own their houses, for how much they could rent the house out. These responses are used as the housing rental expenses. For those respondents who could not answer this question, an imputed rental value of their housing is assigned to them. This imputed value is derived by regressing the rental information on housing characteristics of those who do report a rental value. From this regression and with information on the housing characteristics of those who do not report, it is possible to impute a rental value for the nonreporters.

POVERTY LINES AND REAL CONSUMPTION

This paper follows the cost of basic needs methodology to construct region-specific poverty lines (Ravallion 1994). Using this approach, the total poverty line (z) is constructed as the sum of a food (z^F) and a nonfood poverty line (z^N). The reference poverty line varies for each of the five regions: Metropolitan, Lower urban, Lower rural, Upper urban, and Upper rural. Differences in the poverty lines reflect variations in the food and nonfood prices across the five regions. They also incorporate regional differences in the size and age composition of the relatively poor households, and their food and nonfood consumption preferences. See Datt, Jolliffe, and Sharma (1998) for details of the region-specific poverty line.

The food poverty line is based on the estimated cost of obtaining minimum caloric requirements. The caloric requirements are from the World Health Organization (1985), and the cost of these calories is derived by estimating the average cost per calorie of the food items consumed by *relatively poor* households.[10] The food poverty lines (in per capita monthly figures) for each of the five regions are as follows: LE 50.18 for Metropolitan, LE 45.94 for Lower urban, LE 44.29 for Lower rural, LE 45.19 for Upper urban, and LE 40.36 for Upper rural. These food poverty lines reflect average differences in prices, household composition, and consumption preferences across the five regions.

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[10] The term *relatively poor* here indicates all households whose per capita nominal expenditure is less than the median level of nominal per capita expenditure for the entire sample.

The nonfood poverty line is a weighted average of the expenditure levels on nonfood items by those households whose food expenditure is equal to the food poverty line. The motivation for these methods is that the households who can just purchase the minimum food requirements are likely to also be consuming a minimum bundle of nonfood items.

While the cost of the minimum food bundle is derived from estimated physiological needs, there is no equivalent methodology for determining the minimum nonfood bundle. In this paper, the cost of basic nonfood consumption is defined as the amount of nonfood spending by the typical household whose per capita expenditure on *food* is just equal to the food poverty line. Thus, if x^N is per capita expenditure on nonfood, x^F is per capita expenditure on food, and x is total per capita expenditure, then the nonfood poverty line can be considered as

$$z^N = E\{\, x^N \mid x^F = z^F \,\} \ . \qquad \textbf{(7)}$$

Of course, there may well be no individual household whose per capita food expenditure is exactly equal to the food poverty line, and even if such a household were to exist, it is not obvious that the nonfood poverty line should be based solely on a single household's preferences for nonfood consumption. Thus, instead of searching for a household whose food expenditure just equals z^F, we examine the expenditure patterns of all households whose food expenditures are in the neighborhood of the food poverty line.[11] 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 average, observations closer to z^F are given a higher weight. The weighting scheme follows a kernel with triangular weights (Hardle 1990).

Table 1 lists by region the food and reference (total) poverty lines as well as the implicit spatial price indices. By definition, the differences observed in the poverty lines reflect different costs of obtaining minimum consumption bundles in the five regions, and thus the ratio of poverty lines reflects spatial price differences. In this paper, the poverty line for the Metropolitan region is treated as a baseline and the spatial price index is the ratio of each region's poverty line to the poverty line for the Metropolitan region.

DATA ON DETERMINANTS OF LIVING STANDARDS

Before discussing what sort of variables should be included among the set of explanatory variables, it is useful to consider the issue of potential heterogeneity of the model of living standards, i.e., whether we expect the model to be different across sectors or regions. While there can be different levels of heterogeneity, an argument can be made that, in particular, the rural and urban sectors in the Egyptian context are sufficiently different from each other so as to warrant different models. For instance, it could be argued that human capital has different returns in rural and urban areas, and hence has

[11] In the case of the reference poverty line, the neighborhood of z^F is defined to ensure that there are more than 20 observations supporting the estimate of z^N. In effect, though, significantly more than 20 observations were realized for the reference poverty line.

different implications for living standards in the two sectors. Another practical reason for distinguishing separate models for the two sectors is that while we can make use of a number of community-level variables available for the rural sector, such variables are unavailable for the urban sector because the complete community module was not canvassed in urban areas. Thus, in the following, we will estimate separate models for the rural and urban sectors.

In selecting among potential determinants of living standards, a key consideration for us has been selecting variables that are arguably exogenous to current consumption. Thus, for instance, we do not include value or possession of durable goods among the set of explanatory variables because the imputed value of the use of durable goods is already defined as a component of consumption (see Datt, Jolliffe, and Sharma 1998). Similarly, we do not include dwelling characteristics as these are likely to be determined by household living standards; these characteristics also determine the actual and imputed rents that directly enter into aggregate consumption for the household.

Our selection of potential determinants has also been guided by the results of the Egypt poverty profile, which suggested some significant correlates of poverty in Egypt, albeit based on bivariate associations (Datt, Jolliffe, and Sharma 1998). The selected determinants can be grouped broadly into household- and community-level variables.

Among the household-level variables, we started by considering the following categories of variables: a set of demographic variables, variables relating to education attainment, and variables relating to health, employment, and household assets.

The demographic variables included are a linear and quadratic term in household size, the number of children (below age 15), and the number of elderly (above age 60) household members. Linear and quadratic terms in the age of the head of the household head are also included to capture possible life-cycle effects. A binary variable for female-headed households is also included.

The education variables include the household average of completed school years for those household members over the age of 15. For a measure of parent's education, a dummy variable is created that takes the value of unity if either parent has at least an educational attainment of primary school or higher, and zero otherwise. In the initial specifications of the model, we also considered the highest grade completed in the household (again for those over 15 years of age) as a separate regressor.[12] However, this variable failed to augment the explanatory power of the estimated models. There was also some concern about this variable being significantly correlated with the other education variables. Hence, this variable was excluded from later runs of the model.

Initially, we also considered two measures of health for the household: mother's height (if there is a mother in the household with a child five years of age or younger) and the facility of birth for the most recent child (if the child is under three years of age). In view of their nonsignificance, these health-related variables were later dropped from the model.

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[12] For similar specification of the educational variables in household income functions, with attention to intrahousehold distribution of educational attainments, see Jolliffe (1996, 1997).

The assets that are included are the area of cultivated land that is owned by the household, and the total value of livestock owned.

In the employment category, we have variables related to unemployment and the sector of employment. For unemployment, we have a variable for the number of male and another for the number of female household members who were unemployed last week. For sector of employment, we construct dummy variables for whether the primary earner in the household (most typically the person described as the head of the household) is employed in manufacturing, construction, agriculture, trade and service, community and recreation, or other.

At the community level, we began with a set of dummy variables relating to the availability of a range of public facilities or services, including secondary school, hospital, market center, agricultural extension office, village bank, police station, and veterinary service. However, we found that with our data and specification, it was not possible to precisely identify the effects of each one of these services. This led us to aggregate them into two indices of economic and social capital. The economic capital index is defined to be a simple average of four dummy variables relating to whether the village has a market center, an agricultural extension office, a village bank, or a veterinary service. Thus, the index takes a value of one if all four facilities are available in the village, 0.75 if three of the four are available, and so on, and finally a value of zero if none of them are present. Similarly, the social capital index is constructed as a simple average of three dummy variables indicating the presence in the village of a secondary school, a hospital, or a police station. This index has an interpretation similar to the economic capital index.

At the community level, we also include variables relating to the provision of subsidized food products in the area, in particular, the number of *baladi* bread bakeries in the community and the number of subsidized flour warehouses normalized by the estimated population of the primary sampling unit (PSU). These variables are of special policy interest in the context of the food subsidy program. Also included as community-level variables is the distance in kilometers to the nearest railway station, a dummy variable that takes the value of one if the community described the level of irrigation as being sufficient. As mentioned before, with the EIHS data the community-level variables can only be defined for the rural sector.

Finally, we include in both the rural and urban models a dummy variable for whether the household lives in Upper Egypt. Descriptive statistics for the model variables for the rural and urban sectors are shown in Tables 2 and 3, respectively.

FURTHER SPECIFICATION AND ESTIMATION ISSUES

For most of the household- and community-level variables, there are some missing observations. The intersecting set of households with no missing data for any of the selected exogenous variables decreases in size as the number of explanatory variables increases. Since we are using a large set of variables to predict consumption, we opt to include observations with missing data. This way we reduce the potential of sample selection bias and we do not exclude useful information from those households with some valid and some missing data points. To control for the inclusion of missing data, we have constructed dummy variables that take the value of one if the household is missing data for that particular variable.

There may also be 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 themselves depend on some omitted variables. For instance, whether there is a market in the village may 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. However, while fixed effects at the village or primary sampling unit (PSU) level are appealing for dealing with the problem of omitted variables for our data, which has only 20 households per PSU, the introduction of village or PSU fixed effects would sweep out most of the variation in living standards. PSU fixed effects would also make it impossible to identify the effects of any community-level variables.[13] Thus, we decided to introduce fixed effects only at the level of the governorates. There are 20 governorates in Egypt.[14] A case can be made for governorate fixed effects in view of the governorates being distinct administrative entities, and also in view of differences in prices, agroclimatic conditions, and institutions across governorates. It is arguable that governorate fixed effects control for much of the potential omitted-variable bias. We will also experiment with PSU fixed effects to see if our estimates for the household-level variables are sensitive to this "extra" correction for potentially omitted variables.

4. THE ESTIMATED MODELS

The preferred parameter estimates for the rural and urban models are presented in Tables 4 and 5, respectively. Before discussing specific results, it is worth making a few general remarks. Both the rural and urban models are estimated with governorate fixed effects, which are jointly highly significant. In Tables 6 and 7, rural and urban models with PSU fixed effects are presented. The PSU fixed effects (FE) models, of course, only include household-level variables among the set of determinants. It is, however, notable

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[13] 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.

[14] As opposed to 68 rural and 57 urban PSUs in the sample.

that the parameter estimates for these variables are strikingly similar across the governorate and PSU FE specifications. Thus, relative to the PSU effects, governorate-specific effects appear to be reasonably adequate for controlling for potentially omitted variables. Since the governorate fixed effects model also allows us to identify the effects of community-level variables for rural areas, we consider the estimates from this model to be our preferred estimates.

Our preferred specification allows for several interaction variables. The null hypothesis that the interaction terms are jointly equal to zero is convincingly rejected for both rural and urban areas.[15]

PREFERRED ESTIMATES

Based on the preferred parameter estimates shown in Tables 4 and 5, the following points about the determinants of household living standards are notable.

Demographic Factors

In both rural and urban areas, household size has a significant negative effect on its living standards, as measured by household consumption per person. The quadratic term is significant and positive in either sector. However, the implied turning points, where the relationship between household size and living standards turns positive, are about 15

[15] The F-statistic for the joint significance of the interaction terms is F(10, 112) = 3.10, significant at the probability value of 0.001 for the rural model, and F(6, 116) = 8.83, significant at the probability value of 0.000 for the urban model.

and 10 for rural and urban areas, respectively, both being about the 98th percentiles of their respective samples. This inverse relation between household size and per capita consumption, and by implication the positive relation between household size and poverty, while a common finding in the literature (see, for instance, Lipton and Ravallion 1995, and Lanjouw and Ravallion 1995), is critically linked to the issue of economies of household size in consumption. Per capita normalization presumes no size economies. On the other hand, using total household consumption as a measure of household welfare assumes many can live as cheaply as one, and hence implies perfect size economies.[16] Treating size economies in consumption as a parameter within the [0,1] interval, there is typically a critical value at which the negative relation between living standards and household size tends to vanish.[17] Given its obvious dependence on the assumption regarding economies of size, not too much should be read into this result.

Household composition also matters. For a given household size, the number of children under 15 has a significant negative effect on household living standards in rural areas; ceteris paribus, an extra child reduces per capita consumption of a rural household by about 4 percent.

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[16] In a previous specification of the model, upon redefining the dependent variable as the log of total household consumption, we found that household size has a significant positive coefficient, with an elasticity at sample mean of about 0.55. This is comparable with the elasticities reported for other data sets; for instance, Lanjouw and Ravallion (1995) report elasticities between 0.5 and 0.62 for Pakistan.

[17] Lanjouw and Ravallion (1995) estimate this to be about 0.6 for Pakistan. A similar value for Mozambique is also estimated by Datt et al. (1999).

The age of the head of the household shows the expected life cycle effect in both rural and urban areas. Household living standards increase with the age of the head up to 62 years in rural areas (82nd percentile) and 74 years (96th percentile) and decline thereafter, although the quadratic term is not significant in urban areas. In part, these results reflect life cycle phenomena such as higher earning capacity with greater experience and smoothing of consumption over the life cycle.

We also find that controlling for other determinants, female headship has a significant negative effect on household living standards in both rural (significant at 5 percent level) and urban (significant at 9 percent level) areas.

Education

Educational variables emerge as a strong determinant of living standards in the results for both the rural and urban models. We find that in either model, average years of schooling entering on its own has a significant positive effect on consumption per capita. However, several interaction terms in schooling are also found to be significant in the rural model. For instance, the marginal return on average years of schooling is found to be decreasing in the value of livestock and the distance to railway station, but increasing in the number of unemployed male household members. This suggests that better infrastructure represented by the proximity to a railway station is complementary to household education, while greater male employment and ownership of livestock operate as substitutes for education. Given the diverse interaction effects, it is difficult to infer the rate of return of an extra year of schooling implied by these parameter estimates. These implied rates of return will be discussed further in the context of policy simulations discussed below; indeed, one of the key motivations for the simulation analysis is precisely to resolve the implicit rates of return on different policy instruments.

We also exploited the information on the educational attainment of parents of household members available in our data set. We find that either of the parents having completed primary schooling had a significant effect on household living standards, increasing per capita consumption by 13 and 10 percent, respectively, in rural and urban areas. However, the parental education variables need to be interpreted with some care because some of the parents are also included among household members. For these members, the parental education variables are supplementary in nature, and capture additional educational effects not already captured by the years of schooling variables discussed above. But, perhaps more significantly, the parental education variables are indicative of the importance of intergenerational human capital effects on living standards.

Assets

The household's asset base turns out to be an important determinant of its living standard. Thus, we find that owned land and the value of livestock have a significant positive effect on per capita consumption of the household in rural areas. Not surprisingly, owned cultivated land is not important in urban areas (less than 3 percent of the urban sample are owner-cultivator households), although livestock ownership still has a significant positive effect on living standards (about 15 percent of the urban households own livestock). The interaction terms in household assets are only occasionally significant. For the rural sector, while the negative interaction between value of livestock and education has already been referred to above, the interaction terms in owned land and other variables are all insignificant. In the urban sector, the only interaction that turns out to be significant is that between land owned and the number of female unemployed members with a positive sign, potentially indicating some substitutability between female employment and land owned. However, since less than 3 percent of all urban households have any owned cultivated land, this result should be interpreted with caution.

Employment

As may be expected, unemployment significantly lowers household living standards in both rural and urban areas. At the mean value of land owned and years of schooling, the marginal effects of male unemployment on per capita consumption is –2 percent in rural areas, increasing up to –7 percent for households with no schooling. The corresponding effects for urban areas are –6 percent and –8 percent. The negative effects of female unemployment are even larger: –9 percent and –14 percent, respectively, for rural areas, and –11 percent and –19 percent, respectively, for urban areas.

With regards to the sector of employment, we find significant effects in rural areas, but it does not appear to be important to household welfare in urban areas. For rural areas, we find that relative to the omitted agricultural sector, employment in Trade and Services increases household per capita consumption by 7 percent, while employment in the Community and Recreation sector augments it by about 13 percent. This largely reflects the underlying wage and productivity differentials between agricultural and other sectors.

Community Characteristics

As mentioned above, given our data, these effects are relevant only for the rural sector. In general, we fail to find significant welfare effects for the indices of economic and social capital. The economic capital index, in fact, has a negative parameter estimate significant at about the 8 percent level, though this is partially countered by its positive interaction with years of schooling. The distance to railways and the supply of irrigation by themselves are insignificant, but are significant in interacted form. Thus, when interacted with the years of schooling, greater distance to the railway station has a negative effect on living standards (significant at the 5 percent level), while better supply of irrigation has a positive effect (significant at the 8 percent level).

Among the food subsidy-related variables, we find that the number of bakeries and the number of subsidized flour warehouses per unit of population turn out to be insignificant. While they fail to provide any supportive evidence for significant beneficial effects of subsidized bread or flour, these results should be qualified for potential endogenous placement of the bakeries or flour warehouses, to the extent that this is not controlled for by the use of governorate fixed effects in estimation. Also, it must be admitted that the number of bakeries and warehouses per capita are relatively crude measures of the actual provision of subsidized bread or wheat flour.

5. POVERTY SIMULATIONS

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

$$\hat{c}_j = e^{\hat{\beta}' x_j} . \tag{8}$$

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

$$\hat{p}_{0j} = prob(\ln \hat{c}_j < \ln z) = prob(\eta_j < \ln z - \hat{\beta}' x_j) = \Phi\{(\ln z - \hat{\beta}' x_j)/\hat{\sigma}\} , \tag{9}$$

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 that 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.

RESULTS

Our first three simulations involve increasing the level of school attainment in the households. First we increase by one year the average level of schooling in every household, then we consider a two-year increase in average schooling, and finally we estimate the effect of improving school attainment of the parents of the individuals in our sample to ensure that they all at least complete primary schooling. The simulated impact of all three experiments on the stock of human capital generate the largest changes in the predicted levels of all three measures of poverty and across all regions of Egypt.

Tables 8 through 13 demonstrate the consistency of this large effect on welfare across all analyzed dimensions. For example, increasing the average household level of schooling by two years reduces the predicted value of the squared poverty gap by about 20 percent in rural regions (both Upper and Lower) and by 32 percent in urban regions (both Upper and Lower). The results for a one-year increase in average schooling follow the same pattern and are about one-half the size in terms of the percentage change in the poverty indices. The simulation of increasing school attainment to having completed primary school for the parents of the individuals in our sample also follows a similar pattern of large effects. When we consider this change in rural areas, the squared poverty gap declines by approximately 31 percent, and when considering urban areas, it declines by approximately 24 percent.

In the first two experiments of increasing the average level of household schooling, the entire sample is affected by the simulation. In the third simulation, we improve school attainment to at least completing primary schooling for the parents of all sampled individuals. This means, though, that some individuals are unaffected by the simulation; namely those individuals whose parents had already completed at least primary schooling are unaffected by this change. The difference between the effect of the simulation on the entire population versus the effect on only the affected population can be seen by comparing the full results from Tables 8, 9, and 10 with the results for only the affected population in Tables 11, 12, and 13.

If we consider only those individuals whose parents did not complete primary schooling, we predict a reduction of the squared poverty gap by 33 percent for rural Egypt and 28 percent for urban Egypt. When comparing these estimates to the estimated change over all households, we note that the difference is larger for the urban population. (The predicted effect for all urban individuals is 24 percent, and when considering only those affected, the estimated decline is 28 percent. In the rural region, the full effect is 31 percent, and when considering the affected population only, the effect increases to 33 percent.) This difference in effects means that the proportion of the population affected by the change is larger in the rural areas than in urban areas. As the proportion of the affected population converges to one, the results for the affected population converge to the results for the full population.

Before proceeding further with the discussion of simulation results, it is also worth noting that over most of the simulations, the results do not vary much across Lower and Upper Egypt. This similarity across Lower and Upper Egypt primarily means that the regression model controls for the differences across these regions. It is also worth noting that we have estimated more simulations for rural Egypt than for urban Egypt. This is primarily because we had more community-level variables, which are potentially affected by government policy, for the rural region than for the urban region.

In simulations 4 and 5, we test the effect of improving measures of physical capital. First we increase the area of owned, cultivated land by 20 percent, and then we increase livestock holdings by 20 percent (in terms of the value of the livestock). When looking at all residents of rural and urban Egypt, the predicted results for both of these simulations are very modest. Table 8 shows that the proportion of the rural population living in poverty would decline by only 1.5 percent if landholdings were increased by 20 percent and a decline of 1 percent for the increase in livestock holdings. When considering only the affected population in rural Egypt, though, Table 11 shows a significant decline in the headcount index of 7 percent from increasing landholdings. Table 12 shows that for those urban households who are affected by the increase in landholdings, their predicted headcount index would decline by 3.5 percent.

Simulations 6 and 7 are intended to estimate the effect of improved employment opportunities. Households report the number of individuals in the household who were available for work during the past week, but unable to find employment. We simulate the impact of reducing by one the number of males and then females in the household who are unemployed by this definition. For the full sample, the effect of this change results in a predicted decline of the proportion of the population living in poverty by about 2 percent in rural areas and by about 3 percent in urban areas, whether males or females are considered. As with most of the other simulations, the predicted change in the incidence of poverty is matched by predicted declines in the depth and severity of poverty as well.

Simulations 8 through 12 consider the effect of improving community infrastructure. As this information is only available for the rural households, we estimate the changes only on this part of our sample. When we look at all rural households, we find that increasing the index of social capital to one-half for all communities where it is less than one-half results in a decline in the headcount index of 3 percent.[18] When we focus on only those rural communities affected by the simulation, the decline in the headcount index is 4 percent. In an attempt to model the importance of access to transportation, we simulate the effect of reducing the distance to the nearest railroad to 4 kilometers. Table 8 shows that this change would result in a decline of the headcount index by 3 percent, but when considered for the affected households (all those who are more than 4 kilometers away from railroad access), the decline in the headcount index is 8 percent.

In the community questionnaire, it is recorded whether or not the level of irrigation was sufficient during the previous agricultural year. Simulation 10 estimates the effect of improving irrigation to sufficient in all communities that reported it as insufficient in some way. After the three simulations improving school attainment levels, this simulation has the next largest effect on estimated consumption levels and improved

[18] See text for a description of the index of social capital.

poverty indices. Improved irrigation status reduces the rural headcount index by 10 percent, or 16 percent when considering only the affected communities.

For the irrigation simulation, though, it is informative to note that the effect of this change does not have the same level of relative improvement in the poverty gap and squared poverty gap indices, as say, the improvements in schooling. From Table 8, we see that increasing average schooling by two years reduces the rural headcount index by 14 percent and the squared poverty gap index by 21 percent. The impact of this simulation on the severity of poverty is deep relative to the impact on the incidence. The difference between these two effects is 49 percent. When considering the improved irrigation simulation, the table shows that the rural headcount index declines by 10 percent while the squared poverty gap declines by 13 percent. In this case, the change in the squared poverty gap is still larger than the change in the headcount index, but the relative impact is not as deep. The difference between the decline in the measure of the squared poverty gap and the headcount index is 27 percent.

Perhaps the most disappointing simulations are the two that increase the number of bakeries per capita and the number of flour warehouses per capita. We find that increasing the supply of either of these has virtually no effect on poverty. This result holds true whether we look at the entire sample or only the affected sample, whether we examine Upper or Lower Egypt, and regardless of which poverty index we consider.

6. CONCLUSION

In this paper, we have sought to extend the descriptive analysis of the Egypt poverty profile presented in Datt, Jolliffe, and Sharma (1998) by modeling the determinants of poverty, using data from the 1997 Egypt Integrated Household Survey. Our approach to modeling the determinants of poverty is to model the determinants of the individual welfare indicator, namely, consumption per person, used to define poverty measures. Model predictions for the individual welfare indicator have direct implications for predicted levels of poverty.

We estimate separate governorate-level fixed effect models for the urban and rural sectors. In our preferred model for the urban sector, we include interaction effects between schooling characteristics, measures of unemployment, and landownership. In our preferred rural model, we include interaction effects between schooling characteristics, measures of unemployment, landownership, and community characteristics including irrigation, distance to railroad, and indices of social and economic capital. We use both the urban and rural regression models to predict changes in consumption levels and hence poverty from simulated policy changes.

A key conclusion of our study has to do with the important instrumental role of education in alleviating poverty in Egypt. Increasing average years of schooling, as well as improving the level of parents education, are indicated to have large impacts on average living standards and poverty levels. Our simulation results suggest that a two-year increase in household average school attainment would result in a 18 percent decline in the number of individuals living in poverty. A two-year increase in school attainment would also result in a reduction in the depth of poverty (as measured by the poverty gap index) and the severity of poverty (as measured by the squared poverty gap index) of 22 and 25 percent, respectively. We find the estimated beneficial effect of improved school attainment is robust to whether we consider the rural or urban sector, Upper or Lower Egypt, and regardless of which poverty index we examine.

While the beneficial effects of improvements in school attainment are significantly larger than the predicted effects from any other policy changes, we do find fairly large and positive effects from improvements to irrigation and reducing the number of unemployed individuals. Improved irrigation is estimated to reduce the national incidence of poverty by 6 percent, while reducing unemployment levels is estimated to reduce the incidence of poverty by 2 to 3 percent.

It is in the nature of these poverty simulations that the results have a reduced form character. The observed effects are, nevertheless, important even if the particular pathways are difficult to identify. In interpreting the importance of these results for poverty reduction, one should also not assume these effects to be instantaneous, even though they are estimated from static models. Educational investments, for instance, have inherently long gestation; what our results indicate is that they can be powerful instruments for long-term poverty reduction.

TABLES

Table 1 Poverty lines and spatial price index by region

Regions	Food poverty line	Reference poverty line	Relative price index
Metropolitan	50.18	129.19	1.000
Lower Urban	45.94	101.72	0.787
Lower Rural	44.29	85.38	0.661
Upper Urban	45.19	101.36	0.785
Upper Rural	40.36	82.81	0.641

Notes: Poverty lines are monthly, per capita figures in Egyptian Pounds. The Metropolitan poverty line is used as a baseline to create the relative price index, which is simply the ratio of each region's reference poverty line to the baseline.

Table 2 Descriptive statistics, rural model

	Mean	N	Standard Deviation	Minimum	Maximum
Log: Monthly, real per capita expenditure	5.24	1,326	0.031	3.22	8.34
Upper Egypt	0.42	1,326	0.004	0	1
Household composition					
Household size	6.65	1,326	0.195	1	34
Household size, squared	57.50	1,326	3.885	1	1,156
Number below age 15	2.72	1,314	0.103	0	18
Number above age 60	0.40	1,314	0.020	0	4
Household head: Age in years	47.54	1,257	0.481	16	109.6
Household head: Age, squared	2,461.83	1,257	47.959	256	12,008
Dummy: Female-headed household = 1	0.16	1,326	0.011	0	1
Education					
Household average: Years of schooling	4.76	1,299	0.194	0	18
Mother or father: Primary schooling or more	0.16	1,107	0.015	0	1
Assets					
Log: Owned, cultivated land	1.08	1,326	0.109	0	7.9
Log: Livestock value	3.57	1,326	0.205	0	10.3
Employment					
Industry: Manufacturing	0.13	1,326	0.017	0	1
Industry: Construction	0.06	1,326	0.009	0	1
Industry: Trade and service	0.12	1,326	0.010	0	1
Industry: Community and recreation	0.20	1,326	0.019	0	1
Number of unemployed males, last week	0.37	1,326	0.041	0	6
Number of unemployed female, last week	0.14	1,326	0.014	0	4
Community characteristics					
Index of social capital	0.31	1,326	0.045	0	1
Index of economic capital	0.45	1,326	0.034	0	1
Kilometers to railway station	7.70	1,268	1.225	0	45
Irrigation supply	0.39	1,326	0.061	0	1
Bakeries/PSU population	0.10	1,306	0.012	0	0.44
Flour warehouses/PSU population	0.34	1,326	0.049	0	1.54
Other category and missing data					
Missing: Age	0.01	1,326	0.003	0	1
Missing: Age, household head	0.05	1,326	0.007	0	1
Missing: School, household average	0.02	1,326	0.004	0	1
Missing: Mother or father schooling	0.16	1,326	0.013	0	1
Zero: Cultivated, owned land	0.76	1,326	0.023	0	1
Zero: Livestock value	0.39	1,326	0.030	0	1
Industry: Other	0.15	1,326	0.013	0	1
Missing: Kilometers to railway	0.04	1,326	0.020	0	1
Missing: Number bakeries in PSU	0.01	1,326	0.013	0	1

Notes: Standard errors are corrected for sample design effects.

Table 3   Descriptive statistics, urban model

	Mean	N	Standard Deviation	Minimum	Maximum
Log: Monthly, real per capita expenditure	5.46	1,123	0.043	2.8	8
Upper Egypt	0.27	1,123	0.012	0	1
Household composition					
Household size	4.98	1,123	0.103	1	15
Household size, squared	29.55	1,123	1.246	1	225
Number below age 15	1.54	1,112	0.077	0	7
Number above age 60	0.35	1,112	0.024	0	7
Household head: Age in years	49.13	1,072	0.661	19	90
Household head: Age, squared	2,589.33	1,072	67.452	361	8,100
Dummy: Female-headed household = 1	0.14	1,123	0.012	0	1
Education					
Household average: Years of schooling	8.13	1,102	0.269	0	20
Mother or father: Primary school	0.37	1,057	0.026	0	1
Assets					
Log: Owned cultivated land	0.10	1,123	0.028	0	7.6
Log: Livestock value	0.67	1,123	0.101	0	9.7
Employment					
Industry: Manufacturing	0.25	1,123	0.020	0	1
Industry: Construction	0.08	1,123	0.009	0	1
Industry: Trade and service	0.19	1,123	0.019	0	1
Industry: Community and recreation	0.26	1,123	0.019	0	1
Number of unemployed male, last week	0.25	1,123	0.030	0	3
Number of unemployed female, last week	0.13	1,123	0.014	0	3
Other category and missing data					
Zero: Cultivated, owned land	0.98	1,123	0.007	0	1
Zero: Livestock value	0.85	1,123	0.021	0	1
Industry: Other	0.17	1,123	0.015	0	1
Missing: Age	0.01	1,123	0.004	0	1
Missing: Age, household head	0.05	1,123	0.008	0	1
Missing: School, household average	0.02	1,123	0.004	0	1
Missing: Mother or father school	0.06	1,123	0.007	0	1

Notes: Standard errors are corrected for sample design effects.

Table 4 Preferred rural model of the log of per capita real consumption, OLS estimates, governorate-level fixed effects

Variable name	Variable label	Coefficient	Standard error	t-Statistic
upper	Upper Egypt	0.040	(0.1246)	0.32
Household composition				
hhsize	Household size	-0.118	(0.0171)	-6.93
hhsize2	Household size, squared	0.004	(0.0007)	5.45
n_15	Number below age 15	-0.039	(0.0131)	-3.00
n_60	Number above age 60	0.000	(0.0290)	0.01
hhage	Household head: Age in years	0.014	(0.0052)	2.63
hhage2	Household head: Age, squared	0.000	(0.0001)	-2.16
femhead	Dummy: Female-headed household = 1	-0.083	(0.0426)	-1.96
Education, assets, and employment				
avgsch	Household average: Years of schooling	0.029	(0.0093)	3.08
class	Mother or father: Primary school	0.127	(0.0374)	3.39
lowned	Log: Owned cultivated land	0.157	(0.0264)	5.94
lvalstck	Log: Livestock value	0.048	(0.0111)	4.36
manuf	Industry: Manufacturing	0.052	(0.0425)	1.22
const	Industry: Construction	0.057	(0.0579)	0.99
trade	Industry: Trade and service	0.075	(0.0446)	1.68
public	Industry: Community and recreation	0.131	(0.0371)	3.54
Community characteristics				
s_cap	Index of social capital	0.000	(0.0942)	0.00
e_cap	Index of economic capital	-0.200	(0.1127)	-1.78
rail	Kilometers to railway station	0.000	(0.0028)	-0.14
irr	Irrigation supply	0.033	(0.0647)	0.51
pcbake	Bakeries/PSU population	-0.016	(0.2427)	-0.06
pcflour	Flour warehouses/PSU population	0.014	(0.0845)	0.17
unem_wm	Number of unemployed males, last week	-0.075	(0.0302)	-2.48
unem_wf	Number of unemployed females, last week	-0.145	(0.0473)	-3.06
Interaction Effects				
schIlown	Interaction: avgsch * lowned	-0.002	(0.0020)	-1.09
schIlval	Interaction: avgsch * lvalstck	-0.002	(0.0011)	-1.87
schIs_ca	Interaction: avgsch * s_cap	0.013	(0.0096)	1.34
schIe_ca	Interaction: avgsch * e_cap	0.024	(0.0163)	1.50
schIrail	Interaction: avgsch * rail	-0.001	(0.0004)	-1.99
schIirr	Interaction: avgsch * irr	0.013	(0.0074)	1.77
schIunem	Interaction: avgsch * unem_wm	0.011	(0.0040)	2.80
schIunef	Interaction: avgsch * unem_wf	0.009	(0.0073)	1.27
unemIown	Interaction: unem_wm * lowned	0.002	(0.0107)	0.16
unefIown	Interaction: unem_wf * lowned	0.009	(0.0177)	0.49
Intercept		4.861	(0.2350)	20.68
R^2 = 0.41				
Number of observations = 1,326				

Notes: Standard errors are Huber-corrected for sample design effects. The complete sample consists of 5 strata and 125 PSUs, and the rural sample consists of 2 strata and 68 PSUs. The parameter estimates for the governorate dummies for missing observations are suppressed from the output.

Table 5 Preferred urban model of the log of per capita real consumption, OLS estimates, governorate-level fixed effects

Variable name	Variable label	Coefficient	Standard error	t-Statistic
upper	Upper Egypt	-0.189	(0.0726)	-2.61
Household composition				
hhsize	Household size	-0.290	(0.0262)	-11.07
hhsize2	Household size, squared	0.014	(0.0016)	9.14
n_15	Number below age 15	-0.019	(0.0162)	-1.16
n_60	Number above age 60	-0.002	(0.0340)	-0.07
hhage	Household head: Age in years	0.019	(0.0090)	2.09
hhage2	Household head: Age, squared	0.000	(0.0001)	-1.40
femhead	Dummy: Female-headed household = 1	-0.091	(0.0528)	-1.72
Education, assets, and employment				
avgsch	Household average: Years of schooling	0.057	(0.0056)	10.22
class	Mother or father: Primary school	0.103	(0.0433)	2.39
lowned	Log: Owned cultivated land	0.088	(0.1058)	0.84
lvalstck	Log: Livestock value	0.087	(0.0285)	3.04
manuf	Industry: Manufacturing	-0.044	(0.0575)	-0.77
const	Industry: Construction	0.036	(0.0654)	0.55
trade	Industry: Trade and service	0.023	(0.0563)	0.40
public	Industry: Community and recreation	-0.055	(0.0586)	-0.93
unem_wm	Number of unemployed males, last week	-0.081	(0.0621)	-1.31
unem_wf	Number of unemployed females, last week	-0.200	(0.0846)	-2.36
Interaction terms				
schIlown	Interaction: avgsch * lowned	0.002	(0.0058)	0.33
schIlval	Interaction: avgsch * lvalstck	-0.001	(0.0019)	-0.74
schIunem	Interaction: avgsch * unem_wm	0.003	(0.0075)	0.35
schIunef	Interaction: avgsch * unem_wf	0.009	(0.0091)	1.03
unemIown	Interaction: unem_wm * lowned	-0.037	(0.0286)	-1.29
unefIown	Interaction: unem_wf * lowned	0.104	(0.0163)	6.39
Intercept		4.829	(0.4562)	10.58

R^2 = 0.49
Number of observations = 1,122

Notes: Standard errors are Huber-corrected for sample design effects. The complete sample consists of 5 strata and 125 PSUs, and the rural sample consists of 3 strata and 57 PSUs. The parameter estimates for the governorate dummies and the dummies for missing observations are suppressed from the output.

Table 6 Supplementary rural model of the log of per capita real consumption, OLS estimates, PSU-level fixed effects

Variable name	Variable label	Coefficient	Standard error	t-Statistic
Household composition				
hhsize	Household size	-0.116	(0.0119)	-9.75
hhsize2	Household size, squared	0.004	(0.0004)	8.81
n_15	Number below age 15	-0.042	(0.0107)	-3.97
n_60	Number above age 60	-0.019	(0.0286)	-0.68
hhage	Household head: Age in years	0.010	(0.0058)	1.78
hhage2	Household head: Age, squared	0.000	(0.0001)	-1.30
femhead	Dummy: Female-headed household = 1	-0.104	(0.0398)	-2.61
Education, assets, and employment				
avgsch	Household average: Years of schooling	0.032	(0.0087)	3.70
class	Mother or father: Primary school	0.116	(0.0409)	2.84
lowned	Log: Owned cultivated land	0.161	(0.0279)	5.77
lvalstck	Log: Livestock value	0.045	(0.0102)	4.40
manuf	Industry: Manufacturing	0.055	(0.0470)	1.16
const	Industry: Construction	0.053	(0.0583)	0.91
trade	Industry: Trade and service	0.079	(0.0461)	1.72
public	Industry: Community and recreation	0.148	(0.0424)	3.48
unem_wm	Number of unemployed males, last week	-0.082	(0.0355)	-2.30
unem_wf	Number of unemployed females, last week	-0.165	(0.0595)	-2.77
Interaction terms				
schIlown	Interaction: avgsch * lowned	-0.003	(0.0019)	-1.49
schIlval	Interaction: avgsch * lvalstck	-0.002	(0.0012)	-1.67
schIs_ca	Interaction: avgsch * s_cap	0.014	(0.0106)	1.31
schIe_ca	Interaction: avgsch * e_cap	0.014	(0.0143)	0.95
schIrail	Interaction: avgsch * rail	-0.001	(0.0004)	-1.45
schIirr	Interaction: avgsch * irr	0.012	(0.0071)	1.63
schIunem	Interaction: avgsch * unem_wm	0.011	(0.0056)	1.93
schIunef	Interaction: avgsch * unem_wf	0.012	(0.0087)	1.37
unemIown	Interaction: unem_wm * lowned	0.000	(0.0088)	0.04
unefIown	Interaction: unem_wf * lowned	0.011	(0.0167)	0.67
Intercept		4.709	(0.1991)	23.65

$R^2 = 0.33$
Number of observations = 1,326

Notes: The parameter estimates for the 68 PSU dummies and the dummies for missing observations are suppressed from the output.

Table 7 Supplementary urban model of the log of per capita real consumption, OLS estimates, PSU-level fixed effects

Variable name	Variable label	Coefficient	Standard error	t-Statistic
Household composition				
hhsize	Household size	-0.286	(0.0250)	-11.41
hhsize2	Household size, squared	0.014	(0.0018)	7.87
n_15	Number below age 15	-0.019	(0.0156)	-1.22
n_60	Number above age 60	0.003	(0.0341)	0.08
hhage	Household head: Age in years	0.016	(0.0085)	1.91
hhage2	Household head: Age, squared	0.000	(0.0001)	-1.34
femhead	Dummy: Female-headed household = 1	-0.089	(0.0449)	-1.98
Education, assets, and employment				
avgsch	Household average: Years of schooling	0.056	(0.0045)	12.52
class	Mother or father: Primary school	0.099	(0.0365)	2.71
lowned	Log: Owned cultivated land	0.085	(0.1081)	0.79
lvalstck	Log: Livestock value	0.071	(0.0284)	2.51
manuf	Industry: Manufacturing	-0.040	(0.0712)	-0.56
const	Industry: Construction	0.031	(0.0820)	0.38
trade	Industry: Trade and service	0.022	(0.0713)	0.31
public	Industry: Community and recreation	-0.074	(0.0688)	-1.07
unem_wm	Number of unemployed males, last week	-0.041	(0.0585)	-0.71
unem_wf	Number of unemployed females, last week	-0.124	(0.1160)	-1.07
Interaction terms				
schIlown	Interaction: avgsch * lowned	0.002	(0.0052)	0.31
schIlval	Interaction: avgsch * lvalstck	-0.001	(0.0022)	-0.33
schIunem	Interaction: avgsch * unem_wm	0.000	(0.0071)	0.06
schIunef	Interaction: avgsch * unem_wf	0.002	(0.0118)	0.20
unemIown	Interaction: unem_wm * lowned	-0.046	(0.0404)	-1.13
unefIown	Interaction: unem_wf * lowned	0.116	(0.0477)	2.43
Intercept		5.058	(0.4649)	10.88

R^2 = 0.41
Number of observations = 1,123

Notes: The parameter estimates for the 57 PSU dummies and the dummies for missing observations are suppressed from the output.

Table 8 Rural poverty simulations (percent change over base simulation)

Number and description of simulation	All rural Percentage change in				Lower rural Percentage change in				Upper rural Percentage change in			
	Consumption	P0	P1	P2	Consumption	P0	P1	P2	Consumption	P0	P1	P2
1. Increase household average schooling by one year	3.67	-7.03	-9.24	-10.83	3.64	-7.36	-9.53	-11.11	3.70	-6.67	-8.93	-10.55
2. Increase household average schooling by two years	7.51	-13.81	-17.78	-20.59	7.47	-14.39	-18.26	-21.01	7.57	-13.17	-17.29	-20.18
3. Increase parents schooling to at least primary schooling	11.42	-21.86	-27.53	-31.33	11.42	-22.94	-28.70	-32.64	11.43	-20.69	-26.35	-30.08
4. Increase the area owned, cultivated land by 20 percent	0.95	-1.47	-1.61	-1.67	0.96	-1.50	-1.63	-1.68	0.93	-1.44	-1.59	-1.66
5. Increase the livestock holdings by 20 percent (in terms of value)	0.48	-0.97	-1.22	-1.39	0.46	-0.98	-1.23	-1.39	0.51	-0.96	-1.22	-1.39
6. Decrease by one the number of unemployed males in the household	0.24	-1.66	-2.93	-3.94	0.05	-1.46	-2.70	-3.69	0.50	-1.87	-3.17	-4.18
7. Decrease by one the number of unemployed females in the household	0.89	-2.18	-3.11	-3.82	1.15	-3.14	-4.38	-5.27	0.54	-1.14	-1.82	-2.41
8. Increase social capital index to at least one-half for all communities	1.89	-2.72	-3.15	-3.43	2.09	-3.16	-3.63	-3.92	1.62	-2.23	-2.66	-2.95
9. Decrease distance to railroad to no more than 4 kilometers	2.07	-3.33	-3.99	-4.40	2.33	-3.94	-4.58	-4.92	1.72	-2.67	-3.38	-3.90
10. Improve irrigation (see notes below)	6.61	-10.22	-11.92	-12.93	7.80	-12.02	-13.86	-14.96	5.01	-8.27	-9.96	-10.97
11. Increase the number of bakeries per capita to median value	-0.05	0.09	0.12	0.14	-0.05	0.10	0.13	0.15	-0.05	0.08	0.11	0.12
12. Increase the number of flour warehouses to median value	0.11	-0.21	-0.26	-0.31	0.12	-0.24	-0.29	-0.33	0.10	-0.17	-0.24	-0.29

Notes: The figures provide an estimate of the percentage change in real per capita consumption, P0, P1, and P2 resulting from the change described in the first column. P0 is the headcount index, P1 is the poverty-gap index, and P2 is the squared poverty-gap index. Change is measured as the difference between predicted values from the simulation less predicted values from the base model (described in Table 4). The irrigation simulation is the effect of improving the irrigation level to sufficient for all communities where it was reported not to be sufficient.

Table 9 Urban poverty simulations (percent change over base simulation)

Number and description of simulation	All urban Percentage change in Consumption	All urban P0	All urban P1	All urban P2	Lower urban Percentage change in Consumption	Lower urban P0	Lower urban P1	Lower urban P2	Upper urban Percentage change in Consumption	Upper urban P0	Upper urban P1	Upper urban P2
1. Increase household average schooling by one year	6.03	-11.94	-14.90	-16.98	6.05	-11.76	-14.74	-16.83	6.00	-12.62	-15.51	-17.56
2. Increase household average schooling by two years	12.43	-23.08	-28.16	-31.63	12.47	-22.76	-27.89	-31.39	12.36	-24.27	-29.22	-32.63
3. Increase parents schooling to at least primary schooling	6.30	-16.42	-21.11	-24.39	6.77	-16.03	-20.71	-24.00	5.38	-17.86	-22.66	-26.01
4. Increase the area owned, cultivated land by 20 percent	0.10	-0.10	-0.13	-0.14	0.04	-0.09	-0.10	-0.10	0.21	-0.14	-0.25	-0.31
5. Increase the livestock holdings by 20 percent (in terms of value)	0.23	-0.60	-0.74	-0.82	0.19	-0.44	-0.52	-0.56	0.32	-1.22	-1.62	-1.89
6. Decrease by one the number of unemployed males in the household	1.24	-3.47	-4.38	-4.99	1.28	-3.00	-3.85	-4.45	1.14	-5.23	-6.46	-7.19
7. Decrease by one the number of unemployed females in the household	1.28	-3.80	-4.61	-5.10	1.39	-3.24	-3.87	-4.24	1.07	-5.90	-7.51	-8.62

Notes: The figures provide an estimate of the percentage change in real per capita consumption, P0, P1, and P2, resulting from the change described in the first column. P0 is the headcount index, P1 is the poverty-gap index, and P2 is the squared poverty-gap index. Change is measured as the difference between predicted values from the simulation less predicted values from the base model (described in Table 4). The irrigation simulation is the effect of improving the irrigation level to sufficient for all communities where it was reported not to be sufficient.

Table 10 National poverty simulations (percent change over base simulation)

Number and description of simulation	Egypt Percentage change in				Lower Egypt Percentage change in				Upper Egypt Percentage change in			
	Consumption	P0	P1	P2	Consumption	P0	P1	P2	Consumption	P0	P1	P2
1. Increase household average schooling by one year	4.68	-9.13	-11.66	-13.45	4.67	-9.24	-11.76	-13.56	4.68	-9.21	-11.75	-13.55
2. Increase household average schooling by two years	9.61	-17.77	-22.22	-25.31	9.60	-17.97	-22.37	-25.44	9.61	-17.91	-22.39	-25.50
3. Increase parents schooling to at least primary schooling	9.24	-19.54	-24.79	-28.37	9.43	-19.99	-25.29	-28.95	8.85	-19.48	-24.77	-28.34
4. Increase the area owned, cultivated land by 20 percent	0.58	-0.88	-0.98	-1.02	0.57	-0.90	-0.97	-1.01	0.62	-0.88	-1.02	-1.09
5. Increase the livestock holdings by 20 percent (in terms of value)	0.37	-0.81	-1.02	-1.15	0.34	-0.75	-0.92	-1.03	0.43	-1.07	-1.39	-1.61
6. Decrease by one the number of unemployed males in the household	0.67	-2.43	-3.55	-4.39	0.58	-2.12	-3.19	-4.02	0.77	-3.31	-4.57	-5.47
7. Decrease by one the number of unemployed females in the household	1.05	-2.87	-3.75	-4.37	1.25	-3.18	-4.16	-4.83	0.77	-3.17	-4.25	-5.06
8. Increase social capital index to at least one-half for all communities	1.08	-1.56	-1.80	-1.96	1.20	-1.81	-2.08	-2.25	0.93	-1.28	-1.53	-1.69
9. Decrease distance to railroad to no more than 4 kilometers	1.19	-1.91	-2.28	-2.52	1.34	-2.26	-2.62	-2.82	0.99	-1.53	-1.94	-2.23
10. Improve irrigation (see notes below)	3.78	-5.85	-6.83	-7.41	4.47	-6.88	-7.94	-8.57	2.87	-4.73	-5.70	-6.28
11. Increase the number of bakeries per capita to median value	-0.03	0.05	0.07	0.08	-0.03	0.06	0.08	0.09	-0.03	0.05	0.06	0.07
12. Increase the number of flour warehouses to median value	0.06	-0.12	-0.15	-0.18	0.07	-0.14	-0.17	-0.19	0.06	-0.10	-0.13	-0.16

Notes: The figures provide an estimate of the percentage change in real per capita consumption, P0, P1, and P2, resulting from the change described in the first column. P0 is the headcount index, P1 is the poverty-gap index, and P2 is the squared poverty-gap index. Change is measured as the difference between predicted values from the simulation less predicted values from the base model (described in Table 4). The irrigation simulation is the effect of improving the irrigation level to sufficient for all communities where it was reported not to be sufficient.

Table 11 Rural poverty simulations Affected population only (percent change over base simulation)

Number and description of simulation	All rural Percentage change in Consumption	P0	P1	P2	Lower rural Percentage change in Consumption	P0	P1	P2	Upper rural Percentage change in Consumption	P0	P1	P2
1. Increase household average schooling by one year	3.67	-7.03	-9.24	-10.83	3.64	-7.36	-9.53	-11.11	3.70	-6.67	-8.93	-10.55
2. Increase household average schooling by two years	7.51	-13.81	-17.78	-20.59	7.47	-14.39	-18.26	-21.01	7.57	-13.17	-17.29	-20.18
3. Increase parents schooling to at least primary schooling	13.49	-23.28	-29.17	-33.13	13.49	-24.34	-30.18	-34.13	13.49	-22.12	-28.12	-32.14
4. Increase the area owned, cultivated land by 20 percent	2.74	-6.65	-8.26	-9.42	2.73	-7.06	-8.74	-9.97	2.76	-6.24	-7.82	-8.94
5. Increase the livestock holdings by 20 percent (in terms of value)	0.69	-1.55	-2.03	-2.38	0.67	-1.59	-2.08	-2.44	0.72	-1.50	-1.98	-2.31
6. Decrease by one the number of unemployed males in the household	0.84	-4.71	-7.87	-10.16	0.18	-4.19	-7.41	-9.82	1.86	-5.27	-8.32	-10.48
7. Decrease by one the number of unemployed females in the household	6.24	-14.46	-19.91	-23.73	6.08	-15.08	-20.66	-24.59	6.76	-12.88	-18.28	-22.09
8. Increase social capital index to at least one-half for all communities	2.85	-4.00	-4.61	-5.00	3.32	-4.74	-5.37	-5.77	2.28	-3.22	-3.85	-4.27
9. Decrease distance to railroad to no more than 4 kilometers	4.83	-7.65	-9.04	-9.87	5.18	-9.15	-10.88	-11.93	4.29	-6.06	-7.34	-8.15
10. Improve irrigation (see notes below)	11.04	-16.01	-18.91	-20.78	11.69	-17.81	-20.85	-22.83	9.90	-13.80	-16.72	-18.58
11. Increase the number of bakeries per capita to the median value	-0.09	0.18	0.23	0.27	-0.09	0.19	0.24	0.29	-0.09	0.17	0.22	0.26
12. Increase the number of flour warehouses to median value	0.22	-0.45	-0.58	-0.68	0.22	-0.47	-0.58	-0.65	0.22	-0.42	-0.59	-0.71

Notes: The figures provide an estimate of the percentage change in real per capita consumption, P0, P1, and P2, resulting from the change described in the first column. P0 is the headcount index, P1 is the poverty-gap index, and P2 is the squared poverty-gap index. Change is measured as the difference between predicted values of only those individuals affected from the change less predicted values from the base model of the same individuals (described in Table 4). The irrigation simulation is the effect of improving the irrigation level to sufficient for all communities where it was reported not to be sufficient.

Table 12 Urban poverty simulations Affected population only (percent change over base simulation)

Number and description of simulation	All urban: Percentage change in Consumption	All urban: P0	All urban: P1	All urban: P2	Lower urban: Percentage change in Consumption	Lower urban: P0	Lower urban: P1	Lower urban: P2	Upper urban: Percentage change in Consumption	Upper urban: P0	Upper urban: P1	Upper urban: P2
1. Increase household average schooling by one year	6.03	-11.94	-14.90	-16.98	6.05	-11.76	-14.74	-16.83	6.00	-12.62	-15.51	-17.56
2. Increase household average schooling by two years	12.43	-23.08	-28.16	-31.63	12.47	-22.76	-27.89	-31.39	12.36	-24.27	-29.22	-32.63
3. Increase parents schooling to at least primary schooling	10.89	-19.54	-24.51	-27.90	10.89	-19.17	-24.16	-27.55	10.89	-20.86	-25.86	-29.28
4. Increase the area owned, cultivated land by 20 percent	2.52	-3.44	-5.15	-6.38	1.94	-3.89	-4.93	-5.57	2.82	-2.74	-5.55	-7.91
5. Increase the livestock holdings by 20 percent (in terms of value)	1.37	-3.12	-4.05	-4.71	1.37	-3.21	-4.13	-4.78	1.36	-3.01	-3.96	-4.63
6. Decrease by one the number of unemployed males in the household	6.33	-13.58	-16.94	-19.19	6.27	-12.85	-16.28	-18.64	6.46	-15.46	-18.70	-20.73
7. Decrease by one the number of unemployed females in the household	10.89	-24.30	-30.16	-34.09	11.80	-23.95	-29.65	-33.47	8.97	-25.23	-31.43	-35.58

Notes: The figures provide an estimate of the percentage change in real per capita consumption, P0, P1, and P2, resulting from the change described in the first column. P0 is the headcount index, P1 is the poverty-gap index, and P2 is the squared poverty-gap index. Change is measured as the difference between predicted values of only those individuals affected from the change less predicted values from the base model of the same individuals (described in Table 4). The irrigation simulation is the effect of improving the irrigation level to sufficient for all communities where it was reported not to be sufficient.

Table 13 National poverty simulations Affected population only (percent change over base simulation)

Number and description of simulation	Egypt Percentage change in Consumption	P0	P1	P2	Lower Egypt Percentage change in Consumption	P0	P1	P2	Upper Egypt Percentage change in Consumption	P0	P1	P2
1. Increase household average schooling by one year	4.68	-9.13	-11.66	-13.45	4.67	-9.24	-11.76	-13.56	4.68	-9.21	-11.75	-13.55
2. Increase household average schooling by two years	9.61	-17.77	-22.22	-25.31	9.60	-17.97	-22.37	-25.44	9.61	-17.91	-22.39	-25.50
3. Increase parents schooling to at least primary schooling	12.38	-21.68	-27.18	-30.89	12.38	-22.13	-27.61	-31.32	12.38	-21.58	-27.15	-30.92
4. Increase the area owned, cultivated land by 20 percent	2.65	-5.28	-6.94	-8.12	2.39	-5.71	-7.11	-8.09	2.79	-4.74	-6.85	-8.50
5. Increase the livestock holdings by 20 percent (in terms of value)	0.98	-2.22	-2.89	-3.37	0.97	-2.28	-2.96	-3.44	1.00	-2.14	-2.82	-3.30
6. Decrease by one the number of unemployed males in the household	3.19	-8.50	-11.74	-14.02	2.78	-7.89	-11.20	-13.59	3.82	-9.62	-12.76	-14.86
7. Decrease by one the number of unemployed females in the household	8.23	-18.67	-24.29	-28.16	8.52	-18.87	-24.50	-28.38	7.70	-18.16	-23.90	-27.85
8. Increase social capital index to at least one-half for all communities	1.63	-2.29	-2.64	-2.86	1.90	-2.71	-3.08	-3.30	1.31	-1.84	-2.20	-2.45
9. Decrease distance to railroad to no more than 4 kilometers	2.76	-4.38	-5.18	-5.65	2.97	-5.24	-6.23	-6.83	2.46	-3.47	-4.20	-4.67
10. Improve irrigation (see notes below)	6.32	-9.17	-10.83	-11.90	6.69	-10.20	-11.94	-13.07	5.67	-7.90	-9.58	-10.64
11. Increase the number of bakeries per capita to median value	-0.05	0.10	0.13	0.16	-0.05	0.11	0.14	0.16	-0.05	0.10	0.13	0.15
12. Increase the number of flour warehouses to median value	0.12	-0.26	-0.33	-0.39	0.12	-0.27	-0.33	-0.37	0.13	-0.24	-0.34	-0.40

Notes: The figures provide an estimate of the percentage change in real per capita consumption, P0, P1, and P2, resulting from the change described in the first column. P0 is the headcount index, P1 is the poverty-gap index, and P2 is the squared poverty-gap index. Change is measured as the difference between predicted values of only those individuals affected from the change less predicted values from the base model of the same individuals (described in Table 4). The irrigation simulation is the effect of improving the irrigation level to sufficient for all communities where it was reported not to be sufficient.

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