Determinants of rural poverty in Uganda

Past research has identified geographical, historical, biophysical and economic factors that influence rural poverty in Uganda. The most frequently quoted factors are natural resources, farming systems, access to markets and infrastructure, and population density. These factors and their relevance are briefly reviewed below, and potential variables or proxies for these factors are presented.

NATURAL RESOURCES

Human survival depends on natural resources which are turned, by agricultural and industrial activities, into goods and services for the maintenance of human communities, their welfare and economic development. In agriculture-dependent subsistence communities, poverty levels are likely to depend on a number of factors that can affect agricultural productivity, including;

- Climate variables, such as temperature and rainfall.
- Length of the growing period (LGP).
- Vegetation activity and phenology indicators, such as multi-temporal vegetation indices.
- Terrain characteristics, such as slope and elevation.
- Soil quality indicators, such as measures of physical and chemical soil properties.

These factors can act and interact in complex ways. For example, acid soils, are favourable for coffee production but not for maize and bean production. Abundant rainfall can promote crop growth and high yields, but may also favour crop pests. Poor human nutrition leads to lower levels of human health, affecting future productivity.

FARMING SYSTEMS

Agricultural activities are the largest source of income in rural Uganda. Greater levels of crop and livestock production and greater ownership of land and livestock assets usually suggest greater levels of affluence. A predominance of livestock, however, can also occur in poor communities where livestock is the only livelihood option. For example, poor pastoralists are isolated and live a nomadic existence that is heavily dependent on ruminant livestock. Ownership of mainly monogastric species in a land-less peri-urban context is not indicative of wealth but a reflection of poverty. Since this study focuses on livestock production systems, possible relevant variables from agricultural census data include the densities of cattle, sheep, goats, pigs and poultry. Ideally, however, data on livestock ownership and the contribution made by livestock to peoples' livelihoods should also be included.

ACCESS TO MARKETS AND INFRASTRUCTURE

Von Thünen was a nineteenth century economist and landowner in North Germany who developed a theory of land-use patterns based on the marginal productivity of land at different distances from a major city in which (it was assumed) all the productivity was sold. In this theory, different types of agricultural production systems would be most profitable at different distances from the city (e.g. dairying and intensive farming nearest to the city and ranching farthest from it). Von Thünen directly and indirectly provided theories on pricing, land use intensity, specialisation and economies of scale (Garnick 1990; Chomitz and Gray 1996). Key variables to take account of these ideas therefore include distances and time taken to travel to roads, centres of population, markets and agricultural inputs such as labour, animal health services and feed (in the case of livestock farming).

POPULATION DENSITY

Areas of high productivity tend to have high population densities. Higher densities of people also imply greater labour availability and greater consumer demand. Rural population densities increase in the vicinity of urban areas and close to transport networks, and are naturally correlated with access to markets.

HEALTH OF PEOPLE, CROPS AND LIVESTOCK

The prevalence of diseases - in crops, livestock and people - is also key to welfare. Some of this is direct; human health is itself a measure of welfare and dealing with human health problems and controlling diseases in crops and livestock are often major expenses in poor households, for example. Other effects are indirect; human ill-health impacts on agricultural labour productivity, for example. Whilst explicit data on these issues may not be available at an appropriate scale and resolution for Uganda, there are often strong correlations between disease prevalence or vector abundance and similar environmental variables to those used here (see for example the reviews in Hay *et al.* 2000 and Pfeiffer *et al.* 2008). These remotely sensed environmental variables thus have the potential to capture much of the variability in the health of people, and their crops and livestock.

OTHER FACTORS

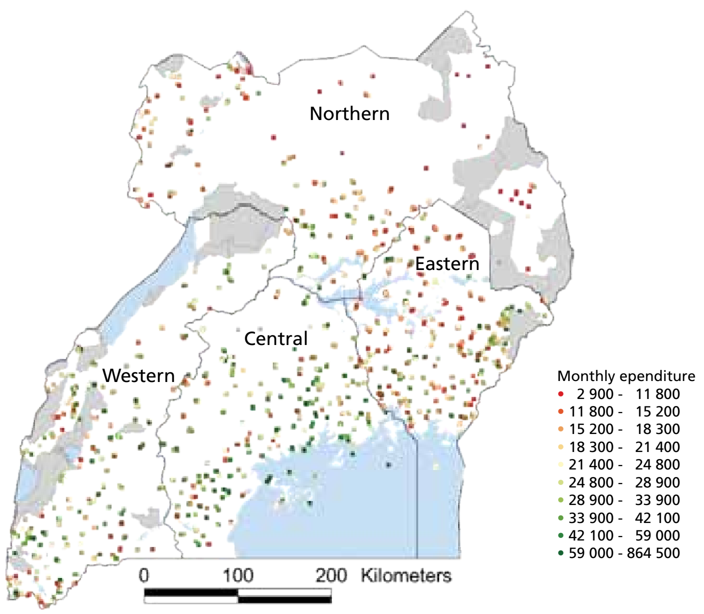
Many other factors have been shown to relate to rural poverty and agricultural productivity. Land tenure is one of the most important whereby greater land security is thought to lead to greater output and better land management practices. Access to credit (banks, rural credit systems and micro credit) can make a difference if directed at small holders, as can the provision of extension services, adoption of new products and technology and the capacity to innovate. Unfortunately, such variables were not available for Uganda in sufficient detail for their inclusion in the present analysis. Here, the emphasis is on remotely sensed and other environmental datasets to provide independent variables for the analyses, resulting in a strong environmental bias, as opposed to the more prevalent socio-economic approaches.

This section describes briefly the data used in the present analysis. Unless otherwise stated, all spatial data are stored as ESRI shape files (points, lines and polygons) or ESRI grids (raster) in geographical co-ordinates (Uganda straddles the equator, so scale distortions are minimal). Map legends for expenditure are based on deciles computed from the household level or aggregated (at about 1km) household level estimates. Grey shading indicates protected areas on the maps.

HOUSEHOLD SURVEY DATA

The Uganda Bureau of Statistics (UBOS) has carried out a number of nationally representative surveys since 1988 (see Table 1 in Rogers *et al.* 2006). In this analysis the second Uganda National Household Survey (UNHS-2) was used, which was carried out between May 2002 and April 2003 (UBOS 2003). Data for 5 614 rural households with reliable geographical coordinate data were selected from a total of 9 711 records (urban and rural) in the survey. The dependent variable used was monthly household expenditure, corrected for the number of adult equivalents per household. Figure 1 shows the location of the households and Table 1 provides summary statistics for the regional differences in rural per-adult equivalent monthly expenditure in Ugandan Shillings. The monthly expenditure data did not exhibit a normal distribution so were transformed before prior to the analysis, as described below.

Figure 1. Rural household locations from the 2002-3003 Uganda National Household survey, showing monthly adult equivalent expenditure (in Uganda shillings).



Note: The administrative boundaries shown refer to the four regions of the country.

There are clear regional differences, with the Central and Western regions having higher levels of expenditure and correspondingly lower percentages of households below the poverty line than the Eastern and Northern regions. Across Uganda, 38 percent of the rural households in the survey were below the poverty line, but this varies from 24 percent in the Central region to 60 percent in the Northern region.

Table 1. Descriptive statistics for rural, monthly adult equivalent expenditure 2002-2003.

a) Summary statistics

Region	Count	Mean	Std Err Mean	Std Dev	Skewness	Kurtosis
Uganda	5 614	32 492	417	31 255	7.6	130.2
Central	1 515	41 153	1 009	39 286	8.1	135.4
Western	1 479	34 237	711	27 332	3.6	22.8
Eastern	1 563	28 813	754	29 816	9.0	131.5
Northern	1 057	23 074	614	19 962	4.8	45.0

b) Quartiles including the Inter Quartile Range (Upper – Lower Quartile)

Region	Minimum	Lwr Q	Median	Upr Q	Maximum	IQ Range
Uganda	2 915	16 728	24 813	37 377	864 534	20 649
Central	4 752	21 858	31 140	47 200	864 534	25 342
Western	3 556	18 382	26 910	40 002	349 200	21 620
Eastern	4 444	15 595	22 681	32 809	608 589	17 215
Northern	2 915	12 102	18 138	26 722	304 400	14 620

c) Poverty lines and rates

Region	Poverty line	Above	Below	Above %	Below %
Uganda	20 760	3 466	2 148	62%	38%
Central	21 322	1 156	359	76%	24%
Western	20 308	1 010	469	68%	32%
Eastern	20 652	875	688	56%	44%
Northern	20 872	425	632	40%	60%

SMALL AREA ESTIMATE POVERTY DATA

Whilst various methods have been used for poverty mapping, some reviewed by Davis (2003), the most common is the SAE technique, discussed by Ghosh and Rao (1994) and developed and exemplified in a series of World Bank studies (*e.g.* Hentschel *et al.* 2000; Elbers and Lanjouw 2000; World Bank 2000). This involves the application of econometric techniques to combine sample survey data with census data to predict poverty indicators using all households covered by the census. The survey provides the specific poverty indicator and the parameters, based on regression models, to predict the poverty levels for the census households. Usually the poverty indicator is a consumption- or expenditure-based indicator of welfare, such as the proportion of households that fall below a certain expenditure level (*i.e.* the poverty line). The basic methodology is quite simple. At the 'zero stage' the comparability of data sources is established and variables common to the census and survey are identified. In the 'first stage' a regression model is estimated between log per capita consumption or expenditure in the household survey and the variables common both to survey and census. The model thus provides a set of empirical regression parameters. These regressions are generally nested at various spatial levels, from regional down to household levels. In the 'second stage' these regression parameters are applied to the census households, where they are used to predict consumption or expenditure in the much more extensive census population, and thus to estimate poverty and inequality for each group of interest. The precision of the poverty estimates is evaluated by computing standard errors, which increase with the level of disaggregation. In general:

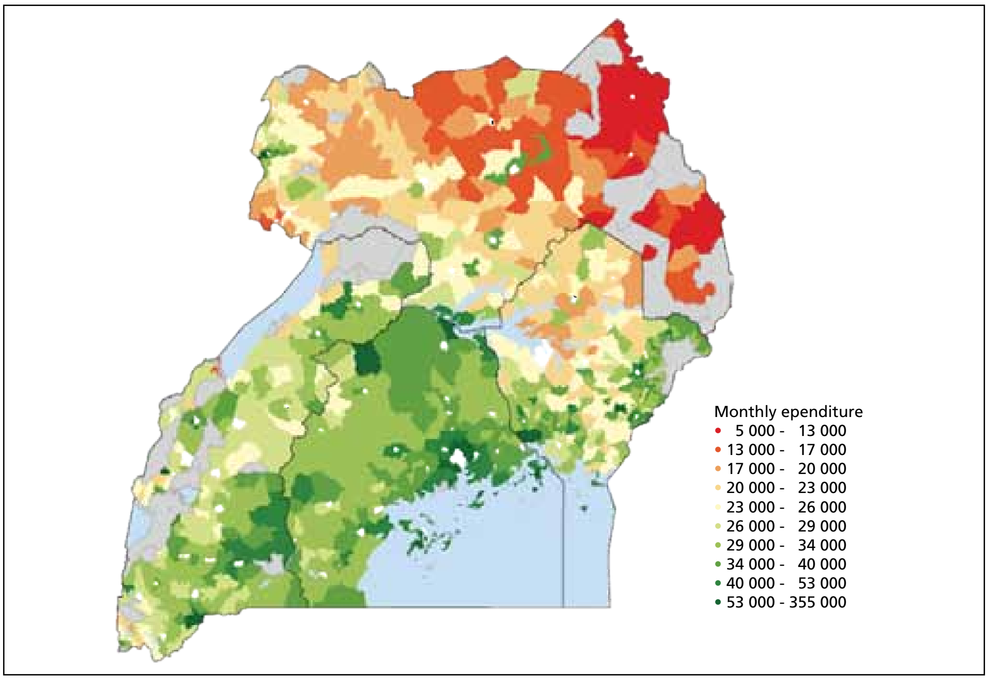
$$y_i = A_i'\beta_i + \varepsilon_i$$

where y_i is the welfare indicator for household i, A_i' is a vector of independent variables (and associated parameters, β_i) common to the welfare survey and the census and ε_i is a normally distributed error term.

Small area poverty estimates have been made for a number of countries, for example Ecuador (Hentschel *et al.* 2000), South Africa (Alderman *et al.* 2000; Statistics South Africa 2000), Nicaragua (Arcia *et al.* 1996); Vietnam (Minot *et al.* 2003); Epprecht and Heinimann 2004); Kenya (Ndeng'e *et al.* 2003); and Uganda (Emwanu *et al.* 2003; 2007).

At the time that Rogers *et al.* (2006) published their working paper, small area estimates (SAE) of welfare had not been produced for the UNHS-2 household survey data, so direct comparisons with the environmental approach were not possible. Since then, however, SAE poverty mapping has been applied to the same household survey used in the present analysis. Emwanu *et al.* (2007) combined information from the 2002/03 UNHS-2 (UBOS 2003) and the 2002 Population and Housing Census (UBOS 2002) to develop poverty maps at district, county and sub-county levels. The sub-county estimates are shown in Figure 2.

Figure 2. Small area (sub-county) estimates of average rural monthly adult equivalent expenditure (in Uganda shillings).



Source: Emwanu *et al.* (2007).