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No. 99/11

Censored Quantile Regressions of Poverty in Rwanda

by

Christophe Muller

Centre for Research in Economic Development and International Trade, University of Nottingham

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Acknowledgements
I am grateful to the Ministry of Planning of Rwanda that provides me the data, and in which I worked from 1984 to 1988 as a technical adviser for the French Cooperation and Development Ministry.

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Abstract
Using panel data from Rwanda, we estimate censored quantile regressions for both household chronic and transient seasonal poverty indices.

The estimation results show that the number of children, the age and the minority ethnic group of the head, and the distance to the nearest market are related to higher household chronic and transient poverty. In contrast, the education level of the head and the land area cultivated by the household are associated with lower household poverty indices.

While the censored quantile regression estimates are generally less significant, they help to reveal the significant influence on poverty of the characteristics of the household head (age, ethnic group, education) that are not well captured by Tobit estimates.

Résumé

A partir de données de panel du Rwanda, nous estimons des équations censurées de quantiles pour les indices de pauvretés chroniques et saisonnières transitoire des ménages.

Les résultats d'estimation montent que le nombre d'enfants, l'age et l'ethnie minoritaire du chef de ménage, ainsi que la distance au marché le plus proche sont relié à des niveaux plus élevés de pauvreté chronique et transitoire. En revanche, le niveau d'éducation du chef et la superficie en terre cultivée par le ménage sont associé à de plus faibles indices de pauvreté.

Bien que les estimations basées sur les régressions quantiles censurées soient généralement moins significatives, elles aident à mettre en évidence l'influence significative des caractéristiques du chef de ménage (age, ethnie, éducation) qui ne sont pas bien saisies par le modèle Tobit.

Outline

1. Introduction
2. The Data
3. Equations of seasonal Transient and chronic poverty
4. Conclusion

1. INTRODUCTION

Most of the poverty in the world is located in rural areas of developing countries (The World Bank (1990)). Most of the income of households in rural areas of LDCs comes from local agricultural output, either directly from their own crops when they cultivate land, or from the wages that they can obtain by working on other exploitations, or else from resources that depend closely on the purchasing power of peasants, such as shopkeepers' income.

This implies that climatic fluctuations (Nugent and Walther (1981)) are crucial for understanding the causes of poverty. Because of the high seasonal variability of production in the presence of liquidity constraints, the living standards of peasants may fluctuate considerably across seasons and may also fall under the poverty line at some seasons or during the whole year. The analysis of seasonal rural poverty in LDCs has attracted considerable interest (Chayanov (1864); Duby (1962); Chambers, Longhurst and Pacey (1981); Chambers (1982); Fortman (1985); FAO (1986); Gill (1991); Lipton and Ravallion (1993)).

Using annual data for several years, Chaudhuri and Ravallion (1992) show that no static indicator can approximate the averaged dynamic poverty. Because living standards of peasants fluctuate more across seasons than across years, such approximation may be worse with seasonal data. This suggests to separate chronic and seasonal components of poverty.

The statistical relationship between dynamic poverty (chronic or seasonal), household socio-demographic and environment characteristics is badly known. Bane and Ellwood (1986), Ruggles and Williams (1989) and Stevens (1995) estimate the exit rates out of poverty and the duration of poverty spells for US households. However, they focus on the incidence of poverty and do not separate transient and chronic poverty. Rodgers and Rodgers (1993) conduct an applied analysis of transient annual and chronic poverty for the US, but do not study the correlates of the two components of poverty. Grootaert and Kanbur (1995) find that the mobility of the poor in the distribution of per capita consumption during four years in Ivory Coast is large. Using a six years panel data in

post-reform rural China, Jalan and Ravallion (1996) find substantial transient annual poverty. They study the correlates of transient annual and chronic poverty, and find that they are not qualitatively different for the two components of poverty.

The aim of this article is to investigate the correlates of chronic and seasonal poverty of peasants in Rwanda. We present the data in section 2. In section 3, we estimate equations of transient seasonal and chronic poverty, in which the correlates are socio-demographic characteristics and the endowment of households, as well as environmental variables. Finally, we conclude in section 4.

2. THE DATA

Rwanda is a small African country with a population of 5.7 million in 1983. The political situation in 1983 was stable, much more peaceful than that of the recent civil war. In 1983, per capita GNP was 1983 US$ 270, making Rwanda a very poor country. More than 95 percent of the population lives in rural areas (Bureau National du Recensement (1984)), and agriculture accounts for 38 percent of GNP.

The growth rate of the population is 3.5 percent a year corresponding to an average of 8.3 children per fertile woman. A serious consequence of the demographic growth is a very serious pressure on land with the average farm covering around one hectare. Food production per capita dropped between 1980 and 1991 at a rate of 1.8 percent a year. Climatic seasonal fluctuations are considerable in Rwanda (Bulletin Climatique du Rwanda (1982, 83, 84)).

The data for the estimation is taken from the 1983 Rwandan national budget-consumption survey of 270 households that was conducted by the government of Rwanda and the French Cooperation and Development Ministry[1] in the rural part of the country (Ministère

[1] The main part of the collection was designed by INSEE (French statistical national institute). The author was involved in this project until the last stage of the analysis as project head for the French Ministry of Cooperation and Development.

du Plan (1986)). The survey was conducted from November 1982 to December 1983. Households were surveyed quarterly on their demographic characteristics, their budget and their consumption. Note that the quality of the consumption indicators calculated from this survey is exceptional (see Muller (1999) for details).

The sampling scheme (Roy (1983), completed by our own investigations during our stay at the Direction Générale de la Statistique du Rwanda, has four sampling levels (communes, sectors, districts and households).

Table 1 shows the descriptive statistics of the main variables for the sample of households. The average household has 5.22 members, with 2.67 children and 2.55 adults. The average age of members is 24.32 years. The head is generally not educated (1.81 years of schooling on average). 21.8 percent of these heads are women (mainly widows) and 10.9 percent of the heads belong to the Tutsi ethnic group.

The average land farmed by the average household is very small (1.24 ha), although the average household produces 57028 Frw (Rwandan Francs[2]) worth of agricultural output. Most of this production is used for an average consumption of 51848 Frw (10 857 Frw per capita). See Muller (1989) for a detailed description of the consumption of Rwandan peasants.

To account for geographical and seasonal price variations, we correct the individual welfare indicators with price indices I_{it} specific to each household and each period. We use local and seasonal prices, which ensures a more precise price correction than the national price index generally used in poverty studies. The living standard indicator for household i at period t is defined by $y_{it} = c_{it}/(I_{it}\, S_i)$

where c_{it} is the value of consumption of household i at period t ; I_{it} is the price index associated with household i and period t, S_i is the size of household i.

[2] In 1983, the average exchange rate was 100.17 Frw for US$ 1(source: IMF, International Finance Statistics)

3. EQUATIONS OF SEASONAL TRANSIENT AND CHRONIC POVERTY

3.1 Definition of the poverty indices and their estimators

Our unit of analysis is the household since we do not have information on individual allocations or individual incomes.

We use three different poverty lines expressed in terms of Rwandan Francs (Frw). Many different types of poverty lines have been proposed (e.g. van Pragg, Spit and van der Stadt (1982), Ravallion (1998)). In the absence of a definitive doctrine in this matter, our definitions are based on quintiles of the living standards distributions for all periods. The use of quintiles of living standards distributions does not mean that we stress on these quintiles in the definition of poverty lines. We only want to obtain poverty lines that are located in relevant parts of the distribution. Any other set of arbitrary absolute poverty lines could have been chosen. Thus, we do not consider a possible inaccuracy in the estimation of quintiles in the definition of these lines.

We define the poverty lines as follows.

z_A , the second quintile of the annual living standard indicator;

z_B , the sum of the second quintiles of the quarterly living standard indicators;

z_C , four times the minimum of the second quintiles of the quarterly living standard indicators.

We calculate the Foster-Greer-Thorbecke P_2 poverty indices, also called poverty severity indices for every quarter t in 1983. This is done for the six poverty lines. Foster, Greer and Thorbecke (1984) analyse the properties of these poverty indices. They are considered as axiomatically sound. P_2 satisfies the monotonocity axiom, the transfer axiom and the subgroup monotonocity axiom.

$$(1) \qquad P_2(z) = \int_0^z (1 - y / z)^2 \, d\mu(y)$$

where y is the living standard indicator, z a poverty line and μ is the probability measure of the living standards distribution.

We estimate the poverty indices at period t, using ratios of Horwitz-Thompson estimators:

$$(2) \qquad \hat{P}_2(z) = \frac{\sum_{s=1}^{n} \frac{(1 - y_s / z)^2 \, 1_{[y_s < z]}}{\pi_s}}{\sum_{s=1}^{n} \frac{1}{\pi_s}} \quad where \; \pi_s = \frac{m_h \, r_{hij} \, q_{hijk}}{M_h \, N_{hi} \, R_{hij} \, Q_{hijk}}$$

π_s is the inclusion probability of household s (s = 1,...,n); M_h is the number of communes in strata h; m_h is the number of communes drawn in strata h; N_{hi} is the number of sectors in commune i of strata h, R_{hij} is the number of districts in sector j of commune i of strata h, r_{hij} is the number of drawn districts in sector j of commune i of strata h, Q_{hijk} is the number of households in district k of sector j of commune i of strata h, and q_{hijk} is the number of households drawn in district k of sector j of commune i of strata h.

Ravallion (1988) and Rodgers and Rodgers (1993) propose transient and permanent poverty indices based on the definition of the aggregate (or "for several years") poverty index as an arithmetic average of the period-specific indices : $AP = \frac{1}{T} \sum_{t=1}^{T} P_t$ where P_t is the poverty index of period t, and T is the number of periods. In our case the periods are the quarters.

The chronic poverty index (CP) is measured using the poverty index formula applied to the annual stabilised living standards measure (sum of the living standards of the four quarters). The poverty line is made proportional to the length of the considered period. Transient poverty is defined as TP = AP - CP.

Similarly, for any household i, one can define its chronic poverty index, CP_i, and its transient poverty index, TP_i, by considering that the aggregation is only over this household instead of the whole population.

3.2 The model and the estimation method

We investigate now the correlates of chronic and transient seasonal poverty indices for rural households in Rwanda. The understanding of factors related to poverty has attracted varied interests in the recent literature. Tables composed of poverty indices for different populations (poverty profiles) have been made possible by the existence of classes of decomposable poverty indices (Foster and Shorrocks (1988, 1991)). For example, Shari (1979), Glewwe (1987) and Slesnick (1993) present tables of incidence of poverty by groups of households. Rodgers and Rodgers (1992)[3], Alwang et al. (1996) also show tables of various poverty indices by groups of households.

Econometric analyses of poverty indices have also been undertaken. Lanjouw and Stern (1991), Dercon and Krishnan (1994), Rodriguez and Smith (1994) and Mason (1996) estimate logit and probit models for the incidence of poverty. Paxson (1992), Gabriel and Cornfield (1995) and Coulombe and McKay (1996) present least squares estimates for equations of logarithms of earnings or incomes, or living standards of households. Coulombe and McKay (1994) conduct a probit estimation of the incidence of poverty, and show OLS estimates for the depth of poverty (P_1/P_0).

Appleton (1994) accounts for both the quantitative dimension of poverty and for censorship by estimating Tobit models. Finally, Jalan and Ravallion (1996) estimate censored quantile regressions of chronic and annual transient poverty indices.

The estimated model is the following. Two dependent variables are considered:

TP_i : the transient poverty index of household i;

CP_i : the chronic poverty index of household i.

[3] Slesnick, and Rodgers and Rodgers do not study populations of peasants in LDCs.

TP_i and CP_i are null for a large set of observed households and strictly positive for others.

The latent transient poverty is denoted TP_i^* . The latent chronic poverty is denoted CP_i^* . Using the same notations as Powell (1986), we specify equations for the opposite of poverty indices:

$$-TP_i^* = X_i' \beta + u_i \quad \text{and} \quad -CP_i^* = X_i' \gamma + v_i$$

where X_i is a vector of independent variables for household i; β and γ are parameters; u_i and v_i are error terms representing household and environment heterogeneity as well as measurement errors. Then,

$TP_i = TP_i^*$ if $TP_i^* > 0$
$TP_i = 0$ otherwise
$CP_i = CP_i^*$ if $CP_i^* > 0$
$CP_i = 0$ otherwise

Another modelling approach could have been to estimate the dynamic income process of the households and to derive chronic and transient poverty indices from the income model. There are several reasons for not choosing this method. First, this would necessitate strong stochastic assumptions such as joint normality of error terms at all quarters, which would lead to the estimation of an autoregressive model of dimension four, likely to be difficult. Second, measurement errors associated with household income, especially for the households under study, are typically substantial, and the process in which income is transformed into per capita consumption is unknown and probably complex since it involves liquidity or subsistence constraints. Finally, because our major concern is the study of poverty, it seems more relevant to focus on the population of the poor and examine directly the transient and chronic poverty indices, rather than to estimate an income model for all the population, which may be excessively influenced by the characteristics of the rich (as shown in Yitzhaki (1996)).

We estimate equations of TP and CP calculated from P_2 indicators with the three poverty lines based on the second quintiles of the corrected per capita real consumption distributions.

We test normality and homoscedasticity using Tobit estimates (for all TP and CP indicators), with the method proposed by Pagan and Vella (1989), which is inspired by the principle of generalised residuals (Gouriéroux, Monfort, Renault and Trognon (1987)). Normality is very strongly rejected at the 1 percent level for all poverty lines. Homoscedasticity is rejected at the 5 percent level for different types of heteroscedasticity, orthogonally to household composition, land area and prices. This supports the estimation of censored quantile-regressions (CQREG) that are robust to heteroscedasticity and non-normality. Powell (1983, 1986) has studied the properties of these estimators.

We estimate the confidence intervals of the estimates of β and γ using the bootstrap method with 1000 bootstrap iterations in order to account for the low sample size. Hahn (1995) shows that these confidence intervals estimators have asymptotically correct probabilities.

The CQREG estimates (e.g. for β) are defined by the minimisation with respect to β of the following objective function.

$$(3) \qquad Q_n(\beta, q) = \frac{1}{N}\sum_{i=1}^{N} \rho_q(Y_i - \mathrm{Max}(0, X_i'\beta))$$

where q is the considered quantile,

$$\rho_q(x) \equiv (q - 1_{[x<0]}).x$$

and where $1_{[.]}$ is the indicator function.

Y_i is the dependent variable (CP_i or TP_i). X_i is the vector of independent variables. N is the sample size.

The choice of the quantile in censored quantile-regressions is motivated by the need to focus on the population of the poor. This corresponds to the specification of a quantile close to 1 in the censored quantile-regressions (of the opposite of poverty indices), assuming that, as it is the case, the extreme quantiles for the conditional distribution are close to the extreme quantiles of the unconditional distribution. We also prefer estimations of quantiles close to 1 in the CQREG estimation so as to dispose of most of the information described by poverty indicators in the maximised objective function. Quantiles 0.90 and 0.975 are estimated for transient poverty, and 0.975 for chronic poverty.

The estimation method enables us to correct for bias coming from selectivity and heteroscedasticity problems. As described in Buchinski (1994, 1995), the estimation is obtained by a combination of a linear programming algorithm and selection of a sub-sample at every iteration of the optimisation. The bootstrap estimation of the variance-covariance matrix of parameters is applied when convergence has been obtained. Finally, we also estimate Tobit models as complements.

We discuss now the choice of correlates, keeping in mind that the descriptive model is a preliminary step towards a causal model. The choice of independent variables in poverty equations is a difficult question. We consider several explanatory lines.

First, some authors focus on the origins of the income from economic activities. This generally includes the quantity and the quality of land, which is the main input in agriculture. Second, earnings functions can be specified using human capital or life cycle theories (Willis (1986)). This implies incorporating: age; experience; education levels and activity types of members. However, for households in a context of imperfect markets, the usual separation theorems of the Arrow-Debreu framework may not apply. This invalidates most results of the earnings functions theoretical literature. Even the meaning of the effects of age and education on living standards is unclear in this context. This augments the interest of an applied study since the theoretical guides are fragile in this

case. In a nonseparable context, land is likely to directly influence living standards, in contrast with the typical results of the earnings function literature.

Third, another approach consists in including the endowments, assumed to be exogenous, that describe the main production factors, with a preference for specifications in terms of stocks rather than flows: land, number of active household members, physical capital and assets, human capital, access to markets.

Finally, a fourth set of variables can be related to the specification of the poverty indicators and the control for econometric misspecifications. These variables are: household composition and its dependency ratio; characteristics of the head (age and sex, education) and various socio-demographic variables describing for example the religion or the marital status of the members, the caste or the ethnic group. We consider that these variables can play at least three roles. They help to control for an imperfect choice of adult-equivalent scales, for unobserved heterogeneity of households, and for omitted demographic changes correlated with poverty status (such as fertility). They may also embody some complementary information about the preferences of the household and its internal decision process, which may influence its income and consumption decisions, especially when production and consumption decisions are non-separable. Finally, they may be correlated with segregation restricting the access of the household to certain resources. Regional dummy variables can play a similar role, while also accounting for the geographical heterogeneity of the environment.

3.3 The estimation results

Table 2 shows the estimates of Tobit and quantile-censored regressions. The results are simply correlates and do not necessarily relate to a structural causality model. The discussion provides suggestive interpretations based on significant parameters common to several trials.

The choice of the estimation method (CQREG or Tobit) matters with a loss of apparent efficiency in CQREG. The results are also sensitive to the choice of the poverty line, although some stability in signs of coefficients occurs when they are significant. In fact,

beyond common similarities, different correlation structures correspond to different poverty lines.

Some variables are never significant: the number of adolescents, the dummy variable for female head, and the dummy variable for the Northwest region.

The estimates are consistent with the beneficial influence of the volume and the quality of the main inputs (land and labour) on living standards. Land area is sometimes associated with lower CP in Tobit estimates, significantly at 10 % level. The permanent rather than the transient character of this variable on poverty may explain the fact that land area has no effect on the TP. The number of adults has been found associated with lower TP, significantly at 10 % level in some CQREG estimates. The education level of the household head contributes significantly at 10 % level both to lower CP and lower TP in Tobit estimates.

By contrast, the number of babies and the number of young children have generally a negative effect on living standards whatever the estimation method. This noxious effect may reflect the fact that these members are mostly a burden for households. It may also stem from imperfect adult-equivalent scales, since with per capita indicators, the weights of babies and children in the adult-equivalent scale is overestimated. Therefore, the household living standard may be underestimated for large size households.

Old heads are associated with higher CP in most Tobit estimates. This may be caused by lower productivity, since these households have typically bad access to economic and labour opportunities.

Households directed by a Tutsi head are associated with highest CP and TP, which is consistent with past negative shocks on their living standards due to political events. In particular civil troubles in 1959 and 1973 severely touched the Tutsi community.

The distance to the market has positive effects on chronic poverty for all estimation methods and no significant effects on transient poverty. Indeed, costly access to the

market reduces opportunities for transactions and jobs, and results in lowest permanent exchange gains.

The dummy variables for the Southwest, Centre-South and East have sometimes significant effects, although they are difficult to interpret because of the large size of these regions.

The censored quantile regression estimates are generally less significant. However, they help to reveal the significant influence on poverty of the characteristics of the household head (age, ethnic group, education) that are not well captured by Tobit estimates.

4. CONCLUSION

We have estimated in this paper equations of chronic and transient seasonal poverty for households in rural Rwanda in 1983, using Tobit and censored quantile-regressions methods.

The estimation results show that the number of children, the age and the minority ethnic group of the head, and the distance to the nearest market are related to higher household chronic and transient poverty. In contrast, the education level of the head and the land area cultivated by the household are associated with lower household poverty indices. In contrast with the Tobit estimates, The significant influence on poverty of the characteristics of the household head are particularly exposed by the use of censored quantile-regressions.

Table 1: Descriptive Statistics

Variable	Mean	Standard Deviation
Total Consumption	51 847.7	25409.4
Total Production	57 027.8	36 682.1
Per Capita Total Consumption	18 856.7	5 344.5
Total Surplus	5180.2	26521.7
Female head	0.208	0.406
Age of the head	47.45	16.32
Household size	5.22	2.34
Average age of members	24.32	13.40
Tutsi head	0.109	0.313
Land area (m^2)	12398	13156
Number of children 0-3	0.853	0.877
Number of children 4-10	1.072	1.058
Number of adolescents 11-15	0.743	0.926
Number of young 16-20	0.509	0.774
Number of adults	2.042	0.750
Northwest	0.147	0.355
Southwest	0.158	0.366
Centre-North	0.200	0.401
Centre-South	0.249	0.433
East	0.245	0.431
Education of the head	1.808	2.498

Table 2 : Regressions of the transient and chronic poverty indices

(opposite of poverty indicators)

	Chronic poverty (q=0.025)		
independent variables	Z_A	Z_B	Z_C
constant	-.0924812 (-1.476)	-.1127144 (-1.493)	-.0467196 (-0.627)
nb babies	-.0498012 (-1.885)	-.025009 (-1.167)	-.0161753 (-0.879)
nb children	-.0181624 (-0.922)	-.0297594 (-1.631)	-.0446135 (-2.693)
nb adolescents	.0116344 (0.830)	.0299231 (1.382)	.0278117 (1.445)
nb young	.0052729 (0.798)	.0023708 (0.115)	-.0099193 (-0.521)
nb adults	-.0083674 (0.028)	-.0016363 (-0.078)	-.0216267 (-1.108)
Tutsi head	-.1211314 (-1.333)	-.1914047 (-1.833)	-.1683564 (-1.765)
Female head	-.0765208 (-1.400)	-.0752085 (-1.427)	-.0769162 (-1.550)
Age of the head	.000275 (-0.052)	.0003928 (0.289)	.0014906 (1.143)
Education of the head	.004085 (0.960)	.0143535 (1.893)	.0164089 (1.933)
Distance to market	-.001441 (-1.880)	-.0015127 (-2.136)	-.001809 (-2.545)
Land	.0014915 (0.617)	.0003575 (0.464)	.0004553 (0.500)
Northwest	-.0492467 (-0.180)	.0004526 (0.007)	-.0475465 (-0.830)
Southwest	-.0653119 (-0.526)	-.0325567 (-0.537)	-.1072808 (-2.120)
Centre-South	-.0245398 (-0.496)	-.057444 (-1.179)	-.0728283 (-1.606)
East	.0632631 (1.857)	.083288 (2.130)	.062618 (1.647)

Student's t in parentheses.

(opposite of poverty indicators)

	Transient poverty (q=0.1)		
independent variables	z_A	z_B	z_C
constant	-.049118 (-1.349)	-.0372761 (1.043)	-.0122827 (-0.427)
nb babies	-.0138709 (-1.806)	-.0168899 (-2.383)	-.0197038 (-3.206)
nb children	.0000253 (0.005)	-.0007179 (-0.136)	-.0027695 (-0.564)
nb adolescents	0003776 (0.047)	.0013781 (0.165)	-.0017312 (-0.195)
nb young	.0011757 (0.147)	-.0005883 (-0.078)	-.0057659 (-0.778)
nb adults	.011263 (1.270)	.0125702 (1.700)	.008923 (1.520)
Tutsi head	-.0137901 (-0.542)	-.020683 (-0.887)	-.02905 (-1.632)
Female head	.0095319 (0.606)	.011991 (0.790)	.0014956 (0.117)
Age of the head	-.0004053 (-0.863)	-.0005557 (-1.380)	-.0006254 (-1.734)
Education of the head	.0020076 (0.656)	.0021098 (0.736)	.0001068 (0.0046)
Distance to market	-.0002672 (-0.828)	-.0002631 (-0.879)	-.0000692 (-0.283)
Land	.0000318 (0.059)	-.0000802 (-0.146)	-.0001874 (-0.380)
Northwest	0067395 (0.207)	.0103069 (0.320)	.0266949 (1.171)
Southwest	-.0192409 (-0.615)	-.0257337 (-0.920)	-.0331591 (-1.104)
Centre-South	-.0154011 (-0.612)	-.0153313 (-0.710)	-.0097511 (-0.447)
East	.0198237 (0.848)	.0182678 (0.869)	.017501 (0.809)

Student's t in parentheses.

(opposite of poverty indicators)

	Transient poverty (Tobit)		
independent variables	z_A	z_B	z_C
constant	0017086 (0.103)	.0088761 (0.517)	.0145402 (0.814)
nb babies	-.0103558 (-2.901)	-.0115756 (-3.136)	-.0120501 (-3.147)
nb children	-.0093779 (-3.493)	-.0107827 (-3.876)	-.0112624 (-3.910)
nb adolescents	-.0023821 (-0.755)	-.0019889 (-0.608)	-.0013778 (-0.403)
nb young	-.0026053 (-0.744)	-.0033505 (-0.932)	-.0033145 (-0.886)
nb adults	.0015789 (0.396)	.002921 (0.713)	.0034254 (0.809)
Tutsi head	-.0174412 (-2.079)	-.0182961 (-2.124)	-.0184932 (-2.083)
Female head	0098487 (1.255)	.0103317 (1.272)	.0090645 (1.077)
Age of the head	-.0002553 (-1.148)	-.0003267 (-1.418)	-.0003647 (-1.519)
Education of the head	.0024121 (1.847)	.0025406 (1.881)	.0021461 (1.533)
Distance to market	.0000153 (0.118)	9.25e-10 (0.000)	3.27e-06 (0.024)
Land	.000356 (1.467)	.0003586 (1.428)	.0003794 (1.449)
Northwest	.006449 (0.687)	.004893 (0.507)	0048342 (0.484)
Southwest	-.004027 (-0.454)	-.0056281 (-0.615)	-.0058659 (-0.617)
Centre-South	-.0074343 (-0.919)	-.0081949 (-0.982)	-.0074155 (-0.857)
East	.0198734 (2.318)	.0214774 (2.417)	.0237959 (2.572)

Student's t in parentheses.

(opposite of poverty indicators)

	Chronic poverty (Tobit)		
independent variables	Z_A	Z_B	Z_C
`constant	.1907139 (3.320)	.1843574 (3.030)	.1885627 (2.931)
nb babies	-.0517724 (-4.372)	-.0500973 (-4.061)	-.0468161 (-3.637)
nb children	-.0330876 (-3.881)	-.0331788 (-3.719)	-.0323745 (-3.462)
nb adolescents	-.0092626 (-0.926)	-.0086302 (-0.833)	-.0092795 (-0.864)
nb young	-.0064677 (-0.569)	-.0053506 (-0.447)	-.0060088 (-0.473)
nb adults	.0119136 (0.970)	.0191473 (1.389)	.0187115 (1.300)
Tutsi head	-.0390424 (-1.487)	-.0422553 (-1.570)	-.0448716 (-1.588)
Female head	-.0286729 (-1.191)	-.0258497 (-1.001)	-.0324779 (-1.195)
Age of the head	-.0014668 (-2.027)	-.0013888 (-1.860)	-.0011121 (-1.392)
Education of the head	.0051135 (1.196)	.0040655 (0.931)	.0042534 (0.902)
Distance to market	-.0008658 (-2.230)	-.0007746 (-1.938)	-.0008034 (-1.965)
Land	.001392 (1.676)	.00144 (1.658)	.0012719 (1.388)
Northwest	-.0046472 (-0.158)	.0063688 (0.201)	.0070797 (0.216)
Southwest	-.0315353 (-1.176)	-.0286802 (-1.028)	-.0299618 (-1.057)
Centre-South	-.0399451 (-1.591)	-.0415956 (-1.592)	-.0311259 (-1.150)
East	.0720175 (2.429)	.0634473 (2.074)	.0784764 (2.320)

Student's t in parentheses.

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