

Dynamics of Rural Poverty in Madagascar

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Objectives of the paper

Analysing the dynamics of poverty from 1996 to 2002 using unique household panel data collected in four distinct areas of Madagascar

Two complementary approaches :

- components approach [Jalan and Ravallion (1998) (*China*); Muller (2000) (*Rwanda*); Haddad and Ahmed (2002) (*Egypt*)]
- Spell-based approach [Stevens (1999) (*United Kingdom*); Jarvis and Jenkins (1995, 1996) (*United Kingdom*); Devicienti (2001) (*United Kingdom*)]

Motivations

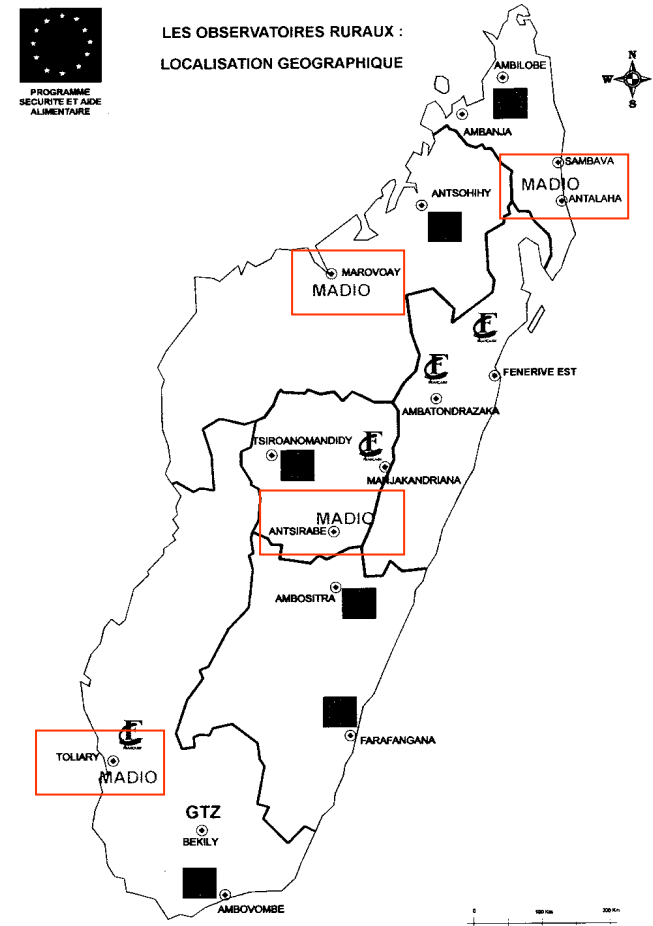
- Income and poverty dynamics have intrinsic social relevance and policy significance ;
- Many academic challenges raised by income and poverty dynamics ;
- Little research has been done on income and poverty dynamics.

The data

- Survey jointly administered by Madagascar's INSTAT and IRD through the *projet MADIO* ;
- Conducted every year since 1995, in four separate agro-climatic zones ;
- 500 households surveyed every year in each of the four regions ;
- High attrition with approx. 20% of the sample renewed each year

=> Balanced panel consists of 414 households surveyed from 1995 to 2002

-Very rich data on household demographics and education; living conditions; migration; consumption and incomes by source ; assets, savings and borrowing, etc.



Sample attrition issues : is attrition ignorable ?

Attrition hazards: sample with no new entrants

	Antalaha	Antsirabe	Marovoay	Toliara	All
1996	500	476	508	475	1959
As a % of 1996	100.0	100.0	100.0	100.0	100.0
1997	468	303	432	331	1534
As a % of 1996	93.6	63.7	85.0	69.7	78.3
1998	292	283	361	251	1187
As a % of 1996	58.4	59.5	71.1	52.8	60.6
1999	257	251	219	230	957
As a % of 1996	51.4	52.7	43.1	48.4	48.9
2000	224	228	197	204	853
As a % of 1996	44.8	47.9	38.8	42.9	43.5
2001	196	198	171	114	679
As a % of 1996	39.2	41.6	33.7	24.0	34.7
2002	83	188	162	0	433
As a % of 1996	16.6	39.5	31.9	0.0	22.1

1996 Characteristics by Attrition Status

	Ever Out	Always in		All
Age (%)				
18-25	9.64	6.24	**	8.66
26-35	25.44	22.4		24.57
36-50	34.89	40.42	**	36.48
51+	30.03	30.95		30.29
Household size (%)				
1-2	17.03	5.54	***	13.72
3-6	56.59	50.58	**	54.86
7-9	20.49	30.95	***	23.5
10+	5.89	12.93	***	7.92
Sex of head (%)				
Male	79.79	86.14	***	81.62
Female	20.21	13.86	***	18.38
Education of head (%)				
None	0.54	0.26		0.44
CEPE	76.64	78.89		77.4
BEPC	17.45	15.57		16.81
CFECP	2.68	2.37		2.58
BAC	2.01	2.64		2.22
sup	0.67	0.26		0.53
Marital status of head (%)				
Single	5.99	2.08	***	4.86
Married	63.11	77.6	***	67.29
Concubine	8.8	4.16	***	7.46
Divorced	13.3	7.85	***	11.73
Widowed	8.8	8.31		8.66
Location of residence (%)				
Antalaha	39.29	19.17	***	33.49
Marovoay	28.34	43.42	***	32.69
Antsirabe	32.37	37.41	*	33.82
Size of rice land owned (%)				
None	27.6	20.75	**	25.59
1-50 ares	21.41	23.58		22.05
51-100 ares	20.33	20.99		20.53
101-150 ares	11.69	11.32		11.58
151-200 ares	5.99	8.96	**	6.87
More than 200 ares	12.97	14.39		13.38
Consumption per capita (1000Fmg)				
	342	353		345

Notes. ***, **, * Significantly different from "Always in" at 1 percent level, 5 percent level and 10 percent level respectively. All tests are two-sample tests of proportions except for the consumption variable where the test is a two-sample t-test on the equality of means.

Dynamic attrition logit model with focus on lagged consumption

Dynamic attrition model

Latent index:

$$A_{it} = f(c_{i,t-1}, c_{i,t-2}, c_{\text{mean}}, \sigma_c^2) + X_{i0} \theta + v_{it}$$

where:

A_{it} equals 1 if household attrites at time t , conditional on still being respondent at time $t-1$ (0 otherwise);

$c_{i,t-1}$ and $c_{i,t-2}$ are consumption per capita in the current and the previous period;

c_{mean} and σ_c^2 are the mean and variance of consumption per capita from 1996 to current period.

X_{i0} is of vector of time-invariant variables measured in 1996

	Coef.	z
c(t-1)	-0.012	-0.23
c(t-2)	-0.147	-2.53
mean(consumption)	-0.018	-0.17
var(consumption)	0.002	0.25
Household characteristics		
Household size	-0.058	-2.70
Age of head	-0.015	-0.81
Age ² of head	0.014	0.76
Female head (<i>dummy</i>)	-0.086	-0.50
Single head (<i>dummy</i>)	0.220	0.96
Divorced (<i>dummy</i>)	0.144	0.81
Widowed (<i>dummy</i>)	-0.079	-0.36
Non educated head (<i>dummy</i>)	-0.125	-0.54
Primary school educated head (<i>dummy</i>)	-0.279	-1.31
Middle school educated head (<i>dummy</i>)	-0.370	-1.60
Location dummies		
Antalaha I	0.712	5.07
Antalaha II	0.177	1.19
Antsirabe I	-1.066	-5.48
Antsirabe II	-0.465	-2.65
Marovoay I	0.076	0.52
Year dummies		
1998	-0.360	-2.75
1999	-0.165	-1.23
2000	-1.085	-6.71
2001	-0.763	-4.79
Intercept	0.269	0.59
Observations	4085	
Pseudo-R ²	0.08	

Notes: Dependent variable is 1 if household attrites in next period, 0 if not. Mean(consumption) is the mean consumption from 1996 to current period; c(t-1) and c(t-2) are consumption in the

Identifying the poor

We follow a “cost-of-basic-needs” approach as developed by Ravallion (1998) and augmented by an iterative solution proposed by Pradhan et al. (2001) for Indonesia

The computation of our poverty estimates relies on two steps:

- i) the definition of a measure of individual welfare;
- ii) the definition of a poverty line.

While these steps are supposedly rather current practice today, their implementation is complicated by the fact that we are interested in inter temporal as well as inter regional comparisons.

Definition of a measure of individual welfare

Our measure of individual welfare is per capita consumption.

- a better proxy for measuring households' welfare than incomes.
- includes cash expenditure and the imputed value of in-kind spending on food, clothing, medicines, housing, education, recreation, and transportation.

+ Price deflator to allow for inter-temporal and inter-regional comparisons

Identifying the poor

Definition of a poverty line

The "cost-of-basic-needs" method relies on an additive decomposition of the poverty line (PL) into two elements:

- a food poverty line (FPL) and
- a non-food allowance (NFA).

The food component is anchored to nutritional requirement for good health :

FPL = level of expenditure necessary to achieve an intake requirement of N calories per person per day.

Problem : not sufficient to compute because the same intake can be achieved through a near infinite mix of foods => basket of goods that corresponds to the average quantities actually consumed by a "reference population".

The food component is then augmented with an allowance for non-food goods.

Circularity problem between determining the reference population and the resulting headcount poverty rate => iterative approach developed by Pradhan et al (2001) for Indonesia.

Identifying the poor

Poverty estimates

In order to reflect regional nutritional preferences and norms, one food basket was developed for each region => PLs differ across regions

Summary data by region

Fmg per person	Antalaha	Antsirabe	Marovoay	Toliara
Mean per capita consumption	487 462	401 215	526 508	224 471
Food Poverty Line (FPL)	333 553	290 642	341 675	430 315
Non Food Allowance (NFA)	55 444	76 358	84 818	98 642
Poverty Line (PL = FPL + NFA)	388 996	367 000	426 493	528 957
PL as a share of mean PCC	0.80	0.91	0.81	2.36

Note: Mean consumption is computed over the 1996-2002 period except for households in the Toliara region which were not surveyed in 2002.

Identifying the poor

Poverty estimates

Poverty indicators across years and regions

FGT0	1996	1997	1998	1999	2000	2001	2002
Antalaha	0.81	0.31	0.45	0.19	0.51	0.47	0.21
Antsirabe	0.43	0.41	0.66	0.70	0.69	0.79	0.75
Marovaoy	0.58	0.46	0.61	0.61	0.48	0.43	0.39
Toliara	0.95	0.96	0.99	0.92	0.97	0.97	-
FGT1	1996	1997	1998	1999	2000	2001	2002
Antalaha	0.31	0.07	0.09	0.03	0.12	0.10	0.04
Antsirabe	0.13	0.11	0.21	0.25	0.27	0.32	0.30
Marovaoy	0.19	0.13	0.17	0.16	0.13	0.09	0.05
Toliara	0.61	0.66	0.71	0.59	0.59	0.66	-
FGT2	1996	1997	1998	1999	2000	2001	2002
Antalaha	0.15	0.02	0.02	0.01	0.04	0.03	0.01
Antsirabe	0.06	0.04	0.09	0.11	0.12	0.16	0.15
Marovaoy	0.09	0.05	0.06	0.06	0.05	0.03	0.01
Toliara	0.45	0.48	0.54	0.43	0.40	0.48	-

Note: Households in the Toliara region were not surveyed in 2002.

Identifying the poor

Poverty estimates

Share of poor in current year who are chronically poor (%)

	Antalaha	Antsirabe	Marovoay	Toliara
1996	35.3	82.4	67.2	99.3
1997	51.3	91.1	71.3	99.4
1998	43.9	81.1	68.7	96.9
1999	75.8	78.2	64.3	99.1
2000	42.3	80.3	71.9	97.9
2001	44.1	75.6	63.1	97.8
2002	81.0	75.1	61.0	-

Note: Households are identified as being chronically poor if their mean consumption over the period falls below the poverty line.

Analysing chronic and transient poverty

Chronic and transient poverty measures [Ravallion, 1998 ; Jalan and Ravallion, 1998]

- Chronic component of poverty:

$$C_i = P(Ec_i, Ec_i, \dots, Ec_i)$$

where $P(\dots, \dots, \dots)$ is an aggregate inter-temporal poverty measure for a given household.

- Transient component of poverty = difference between overall poverty and its chronic component:

$$T_i = P(c_{i1}, c_{i2}, \dots, c_{iD}) - P(Ec_i, Ec_i, \dots, Ec_i)$$

Empirical poverty measure used in the paper:

$$\begin{aligned} P(c_{it}) &= P(1-c_{it})^2 \text{ if } c_{it} \leq 1 \\ &= 0 \text{ otherwise} \end{aligned}$$

Estimation strategy

Our models of transient and chronic poverty are as follows:

$$T_i = T_i^* \text{ if } T_i^* > 0, \text{ where } T_i^* = x_i^* \beta^T + u_i^T \\ = 0 \text{ otherwise}$$

$$C_i = C_i^* \text{ if } C_i^* > 0, \text{ where } C_i^* = x_i^* \beta^C + u_i^C \\ = 0 \text{ otherwise}$$

Estimators :

-Tobit

Limits:

- Relies on normality and homoscedasticity assumptions;
- Estimates not robust to the presence of outliers

-Censored Least Absolute Deviation (CLAD)

Correlates of chronic and transient poverty - Panel 1996-2002

	Censored quantile regression			
	Chronic poverty		Transient poverty	
	Coef.	t	Coef.	t
Socio-demographic characteristics				
Household size (log)	0.077	3.24	0.013	1.45
Proportion of babies: 0-5 years	0.334	2.17	0.107	1.68
Proportion of children: 5-15 years	0.234	1.58	0.082	1.32
Proportion of young adults: 15-20 years	0.219	1.55	0.055	0.83
Proportion of active members	-0.066	-1.09	0.003	0.12
Proportion of wage earners	0.054	0.85	-0.017	-0.69
Proportion of illiterate adults	0.224	1.73	0.061	1.21
Proportion of primary school educated adults	0.136	1.03	0.030	0.56
Proportion of middle school educated adults	0.090	0.60	0.077	1.26
Characteristics of the head				
Male head (<i>dummy</i>)	-0.032	-0.81	0.011	0.62
Single head (<i>dummy</i>)	-0.078	-2.07	0.022	1.19
Age of head	0.005	1.46	-0.001	-0.62
Age ² of head	0.000	-0.99	0.000	0.51
Non educated head (<i>dummy</i>)	0.004	0.13	-0.002	-0.10
Primary school educated head (<i>dummy</i>)	0.022	0.61	0.000	0.02
Middle school educated head (<i>dummy</i>)	0.038	0.99	-0.026	-1.16
Agriculture: main activity (<i>dummy</i>)	0.024	0.85	0.002	0.14
Head belongs to main ethnic group (<i>dummy</i>)	-0.017	-0.97	-0.009	-1.31
Head is catholic (<i>dummy</i>)	0.041	2.03	-0.003	-0.42
Head is protestant (<i>dummy</i>)	0.045	2.19	0.001	0.10
Livestock				
Number of oxen	0.005	0.77	-0.003	-1.07
Number of bullocks	-0.002	-0.68	-0.001	-0.49
Number of cows	-0.062	-3.58	-0.001	-0.27
Number of porks	-0.004	-0.91	-0.004	-2.34

Correlates of chronic and transient poverty - Panel 1996-2002

	Censored quantile regression			
	Chronic poverty		Transient poverty	
	Coef.	t	Coef.	t
Characteristics of dwelling				
Numbers of rooms in dwelling	-0.016	-3.04	-0.002	-0.78
Roof: sheet metal (<i>dummy</i>)	-0.055	-3.65	-0.007	-1.02
Roof: tiled (<i>dummy</i>)	0.062	0.57	-0.006	-0.27
Permanent walls (<i>dummy</i>)	-0.008	-0.19	-0.019	-1.24
Brick walls (<i>dummy</i>)	0.024	1.23	-0.043	-3.27
Water access: pump (<i>dummy</i>)	0.018	0.58	0.011	0.70
Water access: well (<i>dummy</i>)	-0.065	-3.07	-0.009	-0.96
Agriculture				
Owned rice land per capita	-0.003	-3.50	0.000	-2.03
Mean rice yield	-0.007	-4.04	-0.003	-3.70
Standard deviation of rice yield	0.002	1.47	0.002	2.39
Association membership and social capital				
HH belongs to a credit association (<i>dummy</i>)	-0.041	-2.07	-0.017	-2.01
HH belongs to a producers' association (<i>dummy</i>)	-0.057	-2.32	-0.020	-1.75
HH belongs to a water users' association (<i>dummy</i>)	-0.033	-1.20	0.009	0.63
Number of ceremonies organised by the HH	-0.034	-2.37	-0.001	-0.16
Number of ceremonies the HH has been invited to	-0.003	-3.35	0.000	-0.17
Number of members involved in collective actions	-0.002	-0.23	-0.005	-1.23
Location (<i>not reported</i>)				
Number of obserations	256		423	
	0.54		0.31	

Analysing transitions in and out of poverty

Non parametric analysis

Survivor function and exit rates from poverty, for all households beginning a poverty spell
(Kaplan-Meier estimates)

Nb. of years since poverty spell started	Total number of households at risk of poverty exit at start of period	Cumulative prop. remaining poor	Annual exit rate from poverty
1	391	1	0
2	197	0.62	0.38
3	123	0.48	0.23
4	83	0.40	0.16
5	61	0.34	0.14
6	15	0.33	0.03

Survivor function and poverty re-entry rates, for all households ending a poverty spell
(Kaplan-Meier estimates)

Nb. of years since non-poverty spell started	Total number of households at risk of poverty re-entry at start of period	Cumulative prop. remaining non-poor	Annual re-entry rate to poverty
1	411	1	0
2	179	0.62	0.38
3	98	0.48	0.23
4	57	0.38	0.20
5	31	0.34	0.11
6	18	0.30	0.13

Multivariate approach

We estimate proportional odds discrete-time survival models for poverty exit and for poverty re-entry, by letting the probability of exiting out of (or re-entering into) poverty in any given year be represented by a standard logit specification.

The estimates are based on models that include, in addition to duration terms, time-varying covariates such as age, education, sex and marital status of the household head, household size and household demographic composition and controls for calendar year and location.

Poverty exit and re-entry logit regressions	Poverty exit rate		Poverty re-entry rate	
	Coef.	z	Coef.	z
Duration dummies [ref.: 1]				
2	-0.273	-0.97	-0.253	-0.87
3	-0.403	-1.04	0.065	0.18
4	-0.578	-1.37	-0.494	-0.83
5	-0.567	-0.59	0.084	0.14
Socio-demographic characteristics				
Household size	-0.435	-5.80	0.471	6.01
No adult (<i>dummy</i>)	-1.828	-1.94	1.067	1.40
Dependency ratio	-0.320	-2.58	0.062	0.42
Proportion of illiterate adults	-1.550	-1.69	-0.663	-0.72
Proportion of primary school educated adults	0.147	0.17	-0.698	-0.86
Proportion of middle school educated adults	-1.172	-0.73	-0.936	-0.77
Characteristics of the head				
Male head (<i>dummy</i>)	0.283	0.53	-0.345	-0.64
Single head (<i>dummy</i>)	0.208	0.42	0.071	0.13
Age ² of head	0.076	1.49	-0.100	-1.71
Age of head	-0.001	-1.42	0.001	1.72
Non educated head (<i>dummy</i>)	0.151	0.27	0.652	1.15
Primary school educated head (<i>dummy</i>)	-0.255	-0.53	0.512	1.07
Middle school educated head (<i>dummy</i>)	0.137	0.22	0.791	1.53
Head belongs to main ethnic group (<i>dummy</i>)	-0.130	-0.47	-0.050	-0.19
HH head changed between t-1 and t (<i>dummy</i>)	-0.705	-0.50	-0.496	-0.58

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Poverty exit and re-entry logit regressions	Poverty exit rate		Poverty re-entry rate	
	Coef.	z	Coef.	z
Other household characteristics				
Number of oxen	-0.010	-0.14	-0.038	-0.66
Number of bullocks	0.225	3.13	-0.028	-0.37
Number of cows	0.107	1.72	-0.179	-2.05
Number of porks	0.211	1.80	-0.386	-2.26
Numbers of rooms in dwelling	0.479	3.70	-0.694	-3.54
Owned rice land per capita	0.001	0.72	0.000	0.29
Gain in land resources between t-1 and t (<i>dummy</i>)	0.800	2.55	-0.458	-1.23
Loss of land resources between t-1 and t (<i>dummy</i>)	0.078	0.23	0.069	0.25
Poverty gap	-3.126	-4.16	-	-
Non-poverty gap	-	-	-0.409	-2.68
Association membership				
HH belongs to a credit association (<i>dummy</i>)	0.103	0.33	0.328	1.04
HH belongs to a producers' association (<i>dummy</i>)	0.926	2.15	-1.088	-2.14
HH belongs to a water users' association (<i>dummy</i>)	-0.331	-0.73	0.798	1.32
Year dummies [ref.: 2002]				
1998	-0.290	-0.73	0.561	1.55
1999	-0.770	-2.13	0.442	1.16
2000	-0.111	-0.31	0.693	1.99
2001	-0.811	-2.49	0.334	1.00 ¹⁹

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Poverty exit and re-entry logit regressions	Poverty exit rate		Poverty re-entry rate	
	Coef.	z	Coef.	z
Location [ref.: Antalaha - village 1]				
Antalaha - village 2	0.161	0.25	0.393	0.97
Antsirabe - village 1	-1.145	-1.25	-	-
Antsirabe - village 2	-1.675	-1.85	0.896	0.72
Antsirabe - village 3	-0.733	-0.91	1.563	1.94
Antsirabe - village 4	-2.067	-1.88	-	-
Antsirabe - village 5	-2.578	-2.80	2.284	1.87
Antsirabe - village 6	-2.161	-2.21	2.246	2.66
Antsirabe - village 7	-1.395	-1.79	3.134	3.65
Antsirabe - village 8	-2.452	-3.14	2.889	3.26
Antsirabe - village 9	-1.512	-1.94	2.053	3.37
Antsirabe - village 10	-2.413	-3.04	3.807	3.86
Antsirabe - village 11	-1.610	-2.33	2.293	4.59
Antsirabe - village 12	-1.191	-1.38	2.356	2.51
Marovoay - village 1	-0.077	-0.12	0.171	0.40
Marovoay - village 2	-0.143	-0.21	0.043	0.10
Intercept	1.334	0.83	0.068	0.04
Observations	706		610	
Log likelihood	-304.4		-302.7	
Pseudo R ²	0.314		0.248	20

Conclusion

Measure and analyse the dynamics of rural poverty from 1996 to 2002 using panel data collected in four distinct areas of Madagascar.

Two complementary approaches were implemented, namely the components approach and a spell-based approach.

Results based on the former one show that the models determining chronic and transient poverty differ :

- chronic poverty is associated with traditional determinants of total poverty (socio-demographic variables, variable and fixed physical assets),
- transient poverty is determined by variable physical assets and the riskiness in agriculture.

Analyses of the transitions into and out of poverty based on the spell-based approach reject duration dependency, suggesting heterogeneity within the poor.

Conclusion

Some policy implications : targeting

1. the targeting of the chronic poor can be based on the same observables as the ones typically used as proxies of poverty.
2. much of the transient poor would be missed through such a targeting scheme and finding a good proxy to identify them is not straightforward.
3. our results also speak for regional targeting since there appears to be strong diversity across regions.

Some policy implications : policy content

1. any measure directed towards improvement of household human and physical capital and household productivity may be efficient against poverty
2. measures aimed at improving and stabilizing crop yields should contribute to alleviate both chronic and transient poverty in a relatively short-term.
3. Since targeting the transient poor is difficult, any measure contributing to reduce risks or exposure to risks should be promoted : encouraging the breeding of small livestock should contribute to lowering exposure to transient poverty.

Conclusion

New directions for further research

1. It would be interesting to re-run the regressions for each region in order to check whether the models determining chronic and transient poverty on the one hand and transitions into and out of poverty on the other hand are region-specific. Exploratory work suggests that it is indeed the case.
2. Our analysis of poverty transitions suffers from a lack of data on demographic events. Identifying and coding these events require information at the individual level. The construction of an individual panel from our data set should allow us to address this problem.
3. The exploration of the causal relationship between social capital and poverty deserves more attention, with a focus on endogeneity issues.