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WIDER Working Paper 2015/143

Estimating utility-consistent poverty in Madagascar, 2001–10

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December 2015

United Nations University World Institute for Development Economics Research

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Abstract: We adapt the standardized Poverty Line Estimation Analytical Software–PLEASe computer code stream based on Arndt and Simler's (2010) utility-consistent approach to measuring consumption poverty in order to analyse poverty in Madagascar in 2001, 2005, and 2010. This paper documents how the utility-consistent approach to inter-temporal and spatial deflation differs from the approach undertaken by the national statistical office to produce the official poverty estimates and how the trends in these estimates differ substantially. Further, we illustrate the importance of addressing extreme values for calculating unit prices, and how to handle redistricting when conducting revealed preference tests of the utility-consistency of not only regionally estimated poverty lines (i.e. do the consumption patterns in other spatial domains cost no less than the own-domain consumption patterns when both are evaluated at own-domain prices), but also of poverty lines over time.

Keywords: poverty measurement, utility-consistent poverty lines, Madagascar
JEL classification: D63, I32, O55

Tables: provided at the end of the paper.

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This study has been prepared within the UNU-WIDER project 'Reconciling Africa's Growth, Poverty and Inequality Trends: Growth and Poverty Project (GAPP)'.

ISSN 1798-7237 ISBN 978-92-9256-032-4 https://doi.org/10.35188/UNU-WIDER/2015/032-4

Typescript prepared by Lesley Ellen for UNU-WIDER.

UNU-WIDER gratefully acknowledges the financial contributions to the research programme from the governments of Denmark, Finland, Sweden, and the United Kingdom.

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1 Introduction

Madagascar is one of the poorest countries in the world, with macroeconomic indicators suggesting that the nation is poorer today than it was over 40 years ago. Average real per capita income in 2010 was approximately one-third of what it was in 1960. Yet our understanding of poverty in Madagascar is incomplete because it is hampered by issues with data and methodology. This is not surprising given the complexity of measuring poverty in a manner that is consistent over time and space, yet is also sensitive to local conditions. The contemporary literature on poverty in Madagascar has stressed consistency over time by focusing on the comparability of the survey instruments used to estimate nominal household consumption aggregates, the key welfare measure used in calculating poverty (Paternostro et al. 2001; Amendola and Vecchi 2007). Evidence that differing commodity lists (Pradhan 2000) and recall periods (Scott and Amenuvegbe 1990) affect the levels of reported consumption from household surveys led Malagasy statisticians to make every effort to ensure that the survey instruments used to measure poverty were comparable from 2001 onward.

The nominal household consumption aggregate, however, is but one admittedly important component of poverty measurement. Another is the poverty line. The appropriate estimation of poverty lines is essential not only to gauge a poverty threshold, but also as a cost-of-living index that allows interpersonal welfare comparisons when the costs of consuming basic needs vary over time and space (Ravallion 1998). The challenge is to estimate poverty lines that are consistent over time and space (i.e. the reference standard of living is fixed), and yet are also characterized by specificity in which the poverty lines reflect local consumption patterns and norms (Ravallion and Bidani 1994).

The purpose of this paper is to adapt the standardized Poverty Line Estimation Analytical Software (PLEASe) computer code stream based on Arndt and Simler's (2010) utility-consistent (UC) approach to measuring consumption poverty in order to analyse poverty in Madagascar in 2001, 2005, and 2010. We document how the UC approach to inter-temporal and spatial deflation differs from the approach undertaken by the national statistical office to produce the official poverty estimates (i.e. using urban consumer price indices), and how the trends in these estimates differ substantially. Further, we highlight the importance of addressing extreme values for calculating unit prices, and how to handle redistricting when conducting revealed preference tests of the utility-consistency of not only regionally estimated poverty lines (i.e. do the consumption patterns in other spatial domains cost no less than the own-domain consumption patterns when both are evaluated at own-domain prices), but of these poverty lines over time.

The structure of this paper is as follows. In Section 2, we elaborate on the methodology used to calculate poverty and describe the primary data sources. Section 3 describes how the Madagascar data was prepared for the exercise and how the PLEASe code was adapted for these data. In Section 4, we present the estimates of poverty based on the UC approach to calculating poverty lines, and explore the differences between these estimates and the original estimates made by INSTAT (2002, 2006, and 2011). Section 5 provides concluding remarks.

2 Methodology and data

In this section, we briefly describe the methodology and household survey data sources used to measure poverty in a manner that is consistent over time and space, and which is specific to local consumption patterns and norms.

2.1 Methodology

As with any analysis of poverty, choices need to be made regarding (i) the welfare indicator, (ii) the threshold between the poor and the non-poor, and (iii) the measure of poverty. The household consumption aggregate is constructed in a standard manner by aggregating food and non-food expenditures, the estimated value of own produced food and non-food items and of in-kind payments, gifts received, and the estimated use value of durable goods and housing (Deaton and Zaidi 2002).

We briefly outline the procedure used to estimate poverty lines[1] for 12 spatial domains in Madagascar (urban and rural for each of the six provinces). Food poverty lines are estimated first, and are anchored to calorie requirements that are calculated separately for each domain, for purposes of specificity, based on the demographic structure and fertility patterns in the domain. This is a departure from the common practice, for poverty analysis in Madagascar, of using a standard requirement of 2,133 calories per person per day. An iterative approach is used to find the consumption bundle that meets the domain-specific calorie requirements and that reflects consumption patterns of relatively poor households in the spatial domain. This provides specific initial estimates of the food poverty lines. Revealed preference tests are then conducted to test the utility consistency of these poverty lines (i.e. do the consumption patterns in other spatial domains cost no less than the own-domain consumption patterns when both are evaluated at own-domain prices). When these tests are violated, maximum entropy methods are used to reconcile the differences so that domain specificity is maintained in the new poverty lines, while utility consistency is not violated. Once the region-specific food poverty lines are determined, the weighted averages of non-food consumption of households around the poverty line are added to the food poverty lines, to get the region-specific poverty lines.

With the welfare indicators and poverty lines in hand, we employ the Foster-Greer-Thorbecke (1984) class of poverty indices to measure levels and changes in poverty.

2.2 Data

The primary data sources used in this analysis are the 2001, 2005, and 2010 Madagascar Enquête Périodique auprès des Ménages (EPM). The EPM are general-purpose LSMS-type cross-section surveys conducted by the Institut National de la Statistique (INSTAT). They are nationally representative, stratified and clustered surveys conducted over three-month periods at the end of the calendar year, and contain information on household characteristics, expenditure, activities, and infrastructure. Detailed consumption information is collected for the purpose of constructing welfare measures.

Over the course of the three surveys, the sample size grew from 5,080 in 2001 to 11,781 in 2005, and to 12,460 in 2010. This reflects the need for the latter two surveys to be representative, at the urban and rural levels, of each of the 22 administrative regions created in 2004 as part of the government's decentralization programme. Fortunately, the 44 strata in these 2005 and 2010 surveys can be grouped to represent the same 12 strata in the 2001 survey (urban and rural for six provinces). Further, while slight changes were made to the questionnaire in response to demands from the government and from donors who financed the surveys, INSTAT's efforts over the years to maintain comparability for welfare measurement—reflected in the nearly identical questionnaire modules for food and non-food expenditures, education and health

[1] See Arndt and Simler (2010) and Arndt et al. (2013) for more details about the general procedure. The household consumption aggregates and poverty lines were calculated using the PLEASe software.

expenditures, housing values and characteristics, ownership of durable goods, gifts and remittances, and in-kind payments—bode well for consistent poverty and inequality measurement. Nonetheless, some issues arose with regard to estimating poverty with the PLEASe software. These are discussed in the following section.

3 Application of PLEASe

3.1 Data preparation

The bulk of the work in applying PLEASe to the Madagascar household survey data was related to preparing the data themselves. The PLEASe manual (Arndt et al. 2013) provides guidance for creating standard datafiles with common variable names. We therefore do not elaborate on this here. But it is worth emphasizing that in following the manual it is important to pay close attention to the units (e.g. daily and metric) and to item codes when preparing the data as these can be an easily avoided source of error. In addition, certain country-specific decisions need to be made in the process of preparing the data. We review the three most important ones for Madagascar here.

First, the choice of the spatial domains ('spdomain' in 'hhdata.dta') was complicated by the fact noted in the previous section that administrative decentralization in Madagascar led to the creation of 22 administrative regions from the original six provinces between the 2001 and 2005 surveys. For two reasons, we proceeded with 12 spatial domains for the analysis of all three survey years rather than 12 for 2001 and 44 for 2005 and 2010. First, the common spatial domains allow for intertemporal revealed preference tests over the survey years. Revealed preference conditions should hold not only over space, but also over time. When these conditions are violated over time, similar maximum-entropy methods can be used to reconcile the differences as described in the methodology section (Arndt and Simler 2010). These tests, however, require comparisons over the same geographic spaces (i.e. do the consumption patterns in the same spatial domain but in different time periods cost no less than the own-domain consumption patterns at a specific time when both are evaluated at own-domain prices for that specific time). Fortunately, the food items listed in the EPM questionnaires did not change over time, allowing for such intertemporal tests to be conducted provided that the spatial domains remained the same over all three surveys. As such, they were defined to be the same. A second reason for using 12 spatial domains in the analysis for 2005 and 2010 despite having 44 strata is that fewer domains help to reduce the impact of extreme values for unit prices calculated in these data. We elaborate on this below.

Second, before running PLEASe on country-specific data, it is important to check that the 'quantity' and 'value' variables in the constructed, 'cons_nom_in.dta' data file result in reasonable unit prices at the household-item level. Since unit prices (the values per unit backed out of information on total quantities and values spent on particular items) are used to value home consumption and to calculate poverty lines, extreme values of these prices can distort poverty estimates. Such extreme values, along with unrealistic initial poverty estimates, were found in the 2005 and 2010 EPM data. This was not the case, however, for the 2001 EPM. Since unit prices are the ratio of the amount spent on an item divided by the quantity purchased, there are two potential sources of error when unit prices take on extreme values. In the Madagascar case, as in the cases of many developing countries where local measurement units are prevalent, the measurements of quantities were problematic. The same care that was taken in checking and verifying both values and quantities of food items purchased in the 2001 EPM was difficult to achieve in 2005 and 2010 because of the logistical challenges associated with the more than doubling of the sample sizes. The pragmatic approach taken by the INSTAT survey team was to

focus the enumerators' and supervisors' attention on the accuracy of reported expenditure values for the latter two surveys. As such, the expenditure values are reliable for these two years, while the expenditure quantities are less so.

To minimize the likelihood that extreme values would unduly influence the poverty estimates using PLEASe, household-item quantities reported in the 2005 and 2010 EPM data were replaced with imputed quantities when the reported quantities resulted in unit prices that were outside of the 95 per cent confidence interval around the median for the particular item in the spatial domain. In such cases, during the data preparation stage, item-specific unit prices were replaced by the spatial-domain median, and the imputed quantity was calculated as the reported total value divided by the median unit price. These adjustments primarily affected important food items such as local rice, imported rice, paddy, maize, cassava, and sweet potatoes, and constituted roughly 6 per cent of reported food items. In addition to data cleaning, defining spatial domains to represent larger areas (i.e. urban and rural areas in the original six provinces rather than urban and rural areas in the 22 regions) allowed for average unit prices to be calculated in a manner that was less susceptible to the effects of extreme values. Admittedly, the cost of this sample aggregation is less regional specificity. But, combined with the benefits of allowing intertemporal revealed preference testing, this was considered to be a reasonable cost worth incurring.

Finally, adjustments needed to be made to the input data in the 'hhdata.dta' to recognize that the EPM surveys were conducted over a relatively short time period (three months). PLEASe allows for adjustments to be made to household consumption to take into account temporal price variation over the year using temporal price indices (TPI). Since this was not the case with the EPM data, these within-survey temporal adjustments did not need to be made. Consequently, two TPI variables were not relevant to the Madagascar case but are required in the PLEASe code. These variables were created in 'hhdata.dta' and set equal to one for all households. The first is the 'survquar' variable, which in standard applications is the sequential interview quarter (i.e. four survey quarters over the course of the year). Secondly, 'reg_tpi', is the identifier for the regions used in TPI calculations. Finally, in the initialization file, '010_initial_$year' the global macros 'tpi_reg_n', which specifies the number of TPI regions, and 'temp_n', which specifies the number of time periods used in TPI calculations, are each set to one. With these settings, the TPI equals one in all cases and therefore no TPI adjustments are made.

3.2 PLEASe code preparation

Once the data were appropriately formatted and were sufficiently cleaned, the next step was to adjust the PLEASe code for the Madagascar case. This involved adjusting three Stata do-files located in the PLEASe directory for each survey year entitled 'new'. Each of these files is addressed in turn.

1. '000_boom.do':

Aside from setting the path so that Stata recognized the locations of the various files on the analysts' computers, the 'year' needed to be set for each of the three years of the analysis. For example when PLEASe was run on the 2005 EPM, the appropriate line of code was

```
global year '2005'
```

Additionally, the year of the previous survey needed to be defined in order for the intertemporal (between survey years) revealed preferences tests to be conducted. When applied to the 2005 EPM data, the previous survey year was 2001. Hence the appropriate PLEASe code is

global prevyear '2001'

When applied to the 2001 EPM, however, there was no previous survey year for such comparisons to be made. As such, the numerical value for the year was left blank,

global prevyear

2. '010_initial.do':

This is an important file that defines the parameters and code options used in the remainder of the PLEASe code. The instructions in this file are self-explanatory. In addition to the TPI related globals mentioned above, 'spdom_n' was set to 12 to reflect the number of spatial domains and to correspond to the numbers in the 'spdomain' variable.

4 Poverty estimates

Poverty rates in Madagascar, as measured using PLEASe,[2] are high and rose over the course of the three survey periods (Table 1). In 2001, 57.8 per cent of the population was poor, compared to 59.1 per cent in 2005, and 61.7 per cent in 2010. Although poverty is largely a rural phenomenon, with over 63 per cent of the rural population below the poverty line, it is also becoming increasingly urban. The urban headcount ratio rose by nearly 10 percentage points, from 34.2 per cent in 2001 to 43.8 per cent in 2010.

These poverty estimates based on UC poverty lines differ considerably from INSTAT's original estimates. The original estimates are uniformly higher than the UC estimates. For example, the original national headcount ratios are 9.7 to 14.8 percentage points higher than the UC poverty rates. The differences are less stark with the poverty severity estimates, ranging from 1.2 to 9.1 percentage points. Moreover, the estimated changes in poverty over the three survey periods are different in nature. The original estimates indicated that the national poverty level fell by 1 percentage point between 2001 and 2005, compared to the 3.3 percentage point rise using the UC estimate. Although both approaches estimate a rise in the headcount ratio between 2005 and 2010, the magnitude from the original estimates (7.8 percentage points) is markedly higher than from the UC estimates (2.6 percentage points). Further, while the original estimates found large increases in the depth and severity of poverty (8.1 and 6.2 percentage points, respectively), the UC approach found little change (0.1 and -0.4 percentage points, respectively).

In urban areas, while the INSTAT poverty estimates are uniformly higher than the UC poverty estimates, the changes over time are similar. Both show large increases in the urban headcount ratio between 2001 and 2005 of roughly 8 percentage points, followed by smaller increases (between 1 and 2 percentage points) in the latter half of the decade. In terms of the depth and severity of urban poverty, both approaches found similarly sized increases over the decade. But the INSTAT estimates attribute this more to the changes in the latter half of the decade, while the UC estimates attribute it more to the changes in the first half.

The differences stemming from the two approaches are more dramatic for rural areas than for urban areas both in terms of levels and changes. As with the national estimates, the INSTAT rural poverty estimates are uniformly and substantially higher than the UC estimates (e.g.

[2] The poverty rates are reported in the comma-delimited povmeas_ent.csv file in the PLEASe 'out' directory. Poverty lines can also be found in the povlines_ent.csv file in the same directory.

between 9.8 and 16.0 percentage point differences for the headcount ratios). Further, the large swings in rural poverty that the INSTAT estimates show are either muted or non-existent for the UC estimates, depending on the poverty measure considered. For example, while the INSTAT headcount ratio falls by 3.7 percentage points between 2001 and 2005 and then rises by 8.7 percentage points between 2005 and 2010 (for a total rise of 5.0 percentage points over the decade), the UC estimates suggest a smaller initial decline (0.9 percentage points) and subsequent rise (2.5 percentage points). For the more distribution sensitive poverty measures, both approaches indicate declines in the depth and severity of rural poverty over the entire decade. But this is where the similarity ends. The INSTAT estimates suggest substantial swings in the interval (large declines in the first half of the decade mostly offset by large increases in the latter half), whereas the UC estimates indicate smaller and persistent decreases.

The estimates of and changes in poverty levels for spatial domains (urban and rural areas within the pre-2004 provinces) show considerable variation between the original INSTAT and the UC estimates (Table 2). In some cases, the two methods produce remarkably similar headcount ratios (e.g. roughly 64 per cent in rural Antananarivo in 2005). Whereas in others, the differences are marked (e.g. 79 per cent poor in rural Antsiranana in 2001 according to the INSTAT estimates, and 60 per cent poor according to the UC estimates). While in most cases the patterns of change are similar, there are instances where they differ substantively. For example, the INSTAT estimates show large rises in both urban and rural poverty in Antananarivo in both the first and second halves of the decade, the UC estimates suggest that the large rises in poverty there between 2001 and 2005 are offset by declines (large for rural areas) between 2005 and 2010.

What accounts for these differences? Both approaches use similar methods to construct the nominal household consumption aggregate (Deaton and Zaidi 2002), and indeed the nominal household consumption aggregates are similar. The source of the differences thus follows from the handling of the poverty lines and deflation. As shown in Table 3, the INSTAT and UC poverty lines differ substantially for each of the spatial domains. On average, the UC poverty lines are 33 per cent lower than the INSTAT poverty lines. But this is not uniform as the differences range from 21 per cent in urban Antsiranana in 2005 to 45 per cent in rural Fianarantsao in 2005. Given the importance of specificity in constructing poverty lines, it is informative to consider the regional poverty lines relative to the poverty line in the capital, urban Antananarivo. When doing so, an interesting pattern emerges when the two methods give different costs of living compared to the capital. In the four instances where the INSTAT rural poverty lines indicate higher costs of living compared to urban Antananarivo (2005 Anstiranana, 2010 Fianarantsoa, 2010 Toamasina, and 2010 Toliara) the UC rural poverty lines suggest that relative costs of living are lower, which is more consistent with our intuition about differences in urban and rural price levels.

To understand why the poverty lines differ for the two approaches, we must understand how the INSTAT poverty lines were derived. The original INSTAT approach to maintaining consistency with regard to the poverty lines was to use 2001 as the benchmark. The national poverty line was calculated for 2001, and in subsequent years this poverty line was scaled up to 2005 and 2010 prices using the Antananarivo CPI. This inflated 2001 poverty line was then applied to the 2005 and 2010 regionally deflated household consumption aggregates to calculate poverty. The consumption aggregates were regionally deflated using Paasche indices calculated in each stratum relative to the consumption basket for the capital (Antananarivo) using the maximum number of common items (i.e. items consumed in all of the strata). For 2001, the spatial deflators were calculated from EPM data. This differs from the UC approach in that the latter estimates poverty lines for each region for each year and relies on revealed preference tests and maximum entropy methods to maintain consistency.

Further, the original 2001 national food poverty line, which forms the basis of the national poverty line, was estimated as the cost of consuming 2,133 calories per person per day based on the consumption patterns of the poorest 30 per cent of households ranked by the consumption aggregate. This also differs from the UC approach, which does not fix the calorie requirements to be the same across all regions. Rather it allows the demographic characteristics of the particular region to dictate the differing calorie requirements. In addition, the program estimates initial poverty lines by valuing the minimum cost of consuming domain-specific calorie requirements based on the consumption patterns of the poorest 60 per cent of households in each domain.[3] This process is repeated over five iterations using the poverty lines from the previous iteration as the thresholds for determining the consumption patterns of the poor households. As illustrated in Table 4, the UC minimum calorie requirements differ across regions and are on average 43 to 62 calories higher than the INSTAT-standard 2,133. One would thus expect, *ceteris paribus*, that the UC poverty lines would be higher than the original, given that the former is based on the estimated cost of acquiring more calories than the latter, and given that the initial consumption patterns reflect those of the poorest 60 per cent of households rather than the poorest 30 per cent. But this is not the case. Indeed, as illustrated in Table 2, the UC poverty lines range from 21 to 46 per cent *lower* than the de facto original regional poverty lines (calculated by deflating the national poverty line to region-specific prices).

The source of the lower UC poverty lines thus must follow from the composition of the basket used to value the region-specific calorie requirements. Unfortunately, the original Stata code used to construct the 2001 poverty line and regional deflators cannot be located. Thus we cannot compare the consumption baskets used to create the UC poverty lines with the original basket from 2001. Nonetheless, we can compare the province-level urban CPI weights (these are only calculated at the urban level) to the UC consumption basket weights aggregated to the same level. As illustrated in Table 5 for 2010, the UC consumption baskets place more weight on non-food items compared to the CPI baskets, offsetting the higher calorie requirements of the former.

5 Concluding remarks

This paper provides an application to Madagascar of the standardized PLEASe computer code stream based on Arndt and Simler's (2010) utility-consistent approach to measuring consumption poverty. In applying the code, we highlight the importance of addressing extreme values for calculating unit prices, and how to handle redistricting when conducting revealed preference tests of the utility-consistency of not only regionally estimated poverty lines (i.e. do the consumption patterns in other spatial domains cost no less than the own-domain consumption patterns when both are evaluated at own-domain prices), but of these poverty lines over time.

We document how the UC approach to inter-temporal and spatial deflation differs from the approach undertaken by the national statistical office (INSTAT) to produce the official poverty estimates (i.e. using urban consumer price indices), and how the trends in these estimates differ substantially. In the case of Madagascar in 2001, 2005, and 2010, the source of the differences between the UC and INSTAT approaches is the handling of the poverty lines and deflation of the household consumption aggregates. Although differing region-specific calorie requirements contribute partly to the disparity among the poverty lines of the two approaches, the differing compositions of the baskets used to value these calorie requirements play a more important role.

[3] Note that 60 per cent poor is a conservative estimate given INSTAT's national poverty estimates (see Table 1).

The UC consumption baskets place more weight on non-food items compared to the CPI baskets used by INSTAT, thus offsetting the higher calorie requirements of the former. The specificity of these UC weights, based on consumption patterns of the poor in the spatial domains, is a strength of this approach compared to the previous approach taken by INSTAT.

References

Amendola, N., and G. Vecchi (2007). 'Growth, Inequality and Poverty in Madagascar, 2001–2005'. Mimeo. Antananarivo: World Bank.

Arndt, C., U.R Beck, M.A. Hussain, K. Simler, and F. Tarp (2013). 'User Guide to Poverty Line Construction Toolkit: Version 2.0'. Development Economics Research Group. Copenhagen: University of Copenhagen.

Arndt, C., and K. Simler (2010). 'Estimating Utility-Consistent Poverty Lines with Applications to Egypt and Mozambique'. *Economic Development and Cultural Change,* 58(3): 449–74.

Deaton, A., and S. Zaidi (2002). 'Guidelines for Constructing Consumption Aggregates for Welfare Analysis'. Living Standards Measurement Study Working Paper 135. Washington, DC: World Bank.

Foster, J., J. Greer, and E. Thorbecke (1984). 'A Class of Decomposable Poverty Measures'. *Econometrica,* 52: 761–6.

INSTAT (2002). *Enquête Périodique auprès des Ménages 2001: Rapport Principal.* Antananarivo: Ministère de l'Economie, des Finances et du Budget.

INSTAT (2006). *Enquête Périodique auprès des Ménages 2005: Rapport Principal.* Antananarivo: Ministère de l'Economie, des Finances et du Budget.

INSTAT (2011). *Enquête Périodique auprès des Ménages 2010: Rapport Principal.* Antananarivo: Ministère de l'Economie, des Finances et du Budget.

Paternostro, S., J. Razafindravonona, and D. Stifel (2001). 'Changes in Poverty in Madagascar: 1993–1999'. Africa Region Working Paper Series 19. Washington, DC: World Bank.

Pradhan, M. (2000). 'How Many Questions should be in a Consumption Questionnaire? Evidence from a Repeated Experiment in Indonesia'. Cornell Food and Nutrition Policy Program Working Paper 112. Ithaca, NY: Cornell University.

Ravallion, M. (1998). 'Poverty Lines in Theory and Practice'. Living Standards Measurement Study Working Paper 133. Washington, DC: World Bank.

Ravallion, M., and B. Bidani (1994). 'How Robust Is a Poverty Profile?' *World Bank Economic Review,* 8: 75–102.

Scott, C., and B. Amenuvegbe (1990). 'Effect of Recall Duration on Reporting of Household Expenditures: An Experimental Study in Ghana'. Social Dimensions of Adjustment in sub-Saharan Africa Working Paper 6. Washington, DC: World Bank.

TABLES

Table 1: Original INSTAT and utility-consistent (UC) poverty estimates, Madagascar 2001–10

	INSTAT estimates			UC estimates			Difference		
	2001	2005	2010	2001	2005	2010	2001	2005	2010
National									
Headcount ratio (P_0)	**69.7**	**68.8**	**76.5**	**57.8**	**59.1**	**61.7**	**11.9**	**9.7**	**14.8**
Depth of poverty (P_1)	34.9	26.8	34.9	24.8	23.3	23.4	10.2	3.5	11.5
Severity of poverty (P_2)	20.9	13.4	19.6	13.4	12.0	11.6	7.5	1.3	7.9
Urban									
Headcount ratio (P_0)	**43.9**	**52.0**	**54.2**	**34.2**	**42.7**	**43.8**	**9.7**	**9.3**	**10.4**
Depth of poverty (P_1)	18.1	19.3	21.3	12.8	15.4	16.0	5.3	4.0	5.3
Severity of poverty (P_2)	9.7	9.4	11.0	6.5	7.6	7.8	3.2	1.8	3.2
Rural									
Headcount ratio (P_0)	**77.2**	**73.5**	**82.2**	**64.6**	**63.7**	**66.2**	**12.6**	**9.8**	**16.0**
Depth of poverty (P_1)	39.8	28.9	38.3	28.2	25.5	25.3	11.6	3.4	13.1
Severity of poverty (P_2)	24.2	14.5	21.7	15.4	13.3	12.6	8.8	1.2	9.1

Notes: 'INSTAT' indicates original poverty lines calculated by INSTAT. 'UC' indicates Arndt and Simler (2010) utility-consistent poverty lines estimated with PLEASe. The rates are all multiplied by 100.

Source: Authors' elaboration based on the EPM data (INSTAT 2002, 2006, and 2011).

Table 2: Original INSTAT and UC poverty estimates by spatial domain, Madagascar 2001–10

	INSTAT estimates			UC estimates			Differences		
	2001	2005	2010	2001	2005	2010	2001	2005	2010
Antananarivo - urban	29.2	41.6	49.8	21.1	37.3	35.1	8.1	4.3	14.7
Antananarivo - rural	56.6	64.7	73.4	45.3	64.2	53.1	11.3	0.4	20.3
Fianarantsoa - urban	59.1	71.6	63.1	42.5	59.7	54.7	16.7	11.9	8.4
Fianarantsoa - rural	87.8	78.7	92.1	74.3	65.9	77.4	13.5	12.9	14.7
Toamasina - urban	60.6	55.8	56.9	46.8	44.3	45.8	13.8	11.5	11.1
Toamasina - rural	88.2	75.6	83.6	74.2	62.4	65.1	14.0	13.1	18.5
Mahajanga - urban	50.1	47.0	51.9	36.5	37.8	45.9	13.7	9.2	6.0
Mahajanga - rural	78.3	76.6	75.9	71.8	62.4	60.5	6.5	14.2	15.4
Toliara - urban	51.5	64.3	64.5	50.2	43.7	57.1	1.2	20.6	7.4
Toliara - rural	83.4	77.4	86.6	70.5	65.0	72.9	13.0	12.5	13.7
Antsiranana - urban	27.2	33.8	34.1	21.9	27.8	27.8	5.3	6.0	6.2
Antsiranana - rural	79.0	69.8	76.3	60.0	54.1	68.1	19.1	15.7	8.2
Urban	43.9	52.0	54.2	34.2	42.7	43.8	9.7	9.3	10.4
Rural	77.2	73.5	82.2	64.6	63.7	66.2	12.6	9.8	16.0
National	69.7	68.8	76.5	57.8	59.1	61.7	11.9	9.7	14.8

Notes: 'INSTAT' indicates original poverty lines calculated by INSTAT. 'UC' indicates Arndt and Simler (2010) utility-consistent poverty lines estimated with PLEASe. The rates are all multiplied by 100.

Source: Authors' calculations from the EPM data (INSTAT 2002, 2006, and 2011).

Table 3: Original and UC poverty lines, Madagascar, 2001–10

	2001			2005			2010		
	Orig	UC	**% Diff**	Orig	UC	**% Diff**	Orig	UC	**% Diff**
Ariary per person per day									
Antananrivo - urban	542	358	**-33.9**	836	646	**-22.7**	1,284	866	**-32.6**
Antananrivo - rural	522	340	**-35.0**	821	536	**-34.7**	1,200	770	**-35.8**
Fianarantsoa - urban	502	326	**-35.0**	818	521	**-36.3**	1,197	851	**-28.9**
Fianarantsoa - rural	513	301	**-41.3**	823	451	**-45.2**	1,287	762	**-40.8**
Toamasina - urban	550	362	**-34.2**	835	572	**-31.5**	1,361	937	**-31.1**
Toamasina - rural	523	333	**-36.4**	822	501	**-39.1**	1,311	789	**-39.8**
Mahajanga - urban	498	338	**-32.1**	824	574	**-30.3**	1,209	922	**-23.7**
Mahajanga - rural	468	347	**-25.8**	791	514	**-35.0**	1,176	748	**-36.4**
Toliara - urban	515	406	**-21.2**	884	502	**-43.2**	1,289	940	**-27.1**
Toliara - rural	523	338	**-35.4**	794	498	**-37.2**	1,355	819	**-39.5**
Antsiranana - urban	612	473	**-22.8**	909	718	**-21.0**	1,388	1,080	**-22.2**
Antsiranana - rural	607	420	**-30.7**	902	593	**-34.2**	1,366	920	**-32.7**
Relative to urban Antananarivo									
Antananrivo - urban	100.0	100.0	**-**	100.0	100.0	**-**	100.0	100.0	**-**
Antananrivo - rural	96.4	94.9	**-1.6**	98.1	82.9	**-15.5**	93.4	89.0	**-4.7**
Fianarantsoa - urban	92.7	91.2	**-1.6**	97.8	80.6	**-17.6**	93.2	98.3	**5.5**
Fianarantsoa - rural	94.7	84.0	**-11.2**	98.4	69.8	**-29.0**	100.2	88.0	**-12.2**
Toamasina - urban	101.5	101.0	**-0.4**	99.8	88.4	**-11.3**	106.0	108.3	**2.2**
Toamasina - rural	96.6	93.0	**-3.7**	98.3	77.5	**-21.2**	102.1	91.1	**-10.7**
Mahajanga - urban	91.9	94.4	**2.7**	98.5	88.8	**-9.8**	94.1	106.5	**13.1**
Mahajanga - rural	86.3	96.9	**12.3**	94.5	79.5	**-15.9**	91.6	86.4	**-5.7**
Toliara - urban	95.1	113.4	**19.2**	105.7	77.6	**-26.6**	100.3	108.6	**8.2**
Toliara - rural	96.5	94.4	**-2.2**	94.9	77.1	**-18.8**	105.5	94.6	**-10.3**
Antsiranana - urban	113.1	132.1	**16.8**	108.7	111.1	**2.2**	108.1	124.8	**15.4**
Antsiranana - rural	112.0	117.4	**4.9**	107.8	91.8	**-14.9**	106.4	106.3	**-0.1**

Notes: 'Orig' indicates original poverty lines calculated by INSTAT. 'UC' indicates Arndt and Simler (2010) utility-consistent poverty lines estimated with PLEASe. '% Diff' indicates the percentage difference.

Source: Authors' calculations from the EPM data (INSTAT 2002, 2006, and 2011).

Table 4: Region- and time-specific minimum calorie requirements

				Difference from INSTAT standard (2,133 calories/day)		
	2001	2005	2010	2001	2005	2010
Antananrivo - urban	2,221	2,224	2,212	88	91	79
Antananrivo - rural	2,182	2,178	2,177	49	45	44
Fianarantsoa - urban	2,176	2,197	2,185	43	64	52
Fianarantsoa - rural	2,171	2,169	2,146	38	36	13
Toamasina - urban	2,189	2,230	2,224	56	97	91
Toamasina - rural	2,165	2,187	2,175	32	54	42
Mahajanga - urban	2,189	2,218	2,189	56	85	56
Mahajanga - rural	2,181	2,167	2,132	48	34	-1
Toliara - urban	2,185	2,180	2,170	52	47	37
Toliara - rural	2,167	2,169	2,130	34	36	-3
Antsiranana - urban	2,202	2,212	2,216	69	79	83
Antsiranana - rural	2,144	2,207	2,152	11	74	19
Minimum	2,144	2,167	2,130	11	34	-3
Maximum	2,221	2,230	2,224	88	97	91
Mean	2,181	2,195	2,176	48	62	43

Source: Authors' calculations from the EPM data (INSTAT 2002, 2006, and 2011).

Table 5: Comparison of consumption weights in CPI and EPM 2010 poverty lines

	Antananarivo	Fianarantsoa	Toamasina	Mahajanga	Toliara	Antsiranana	Total
CPI weight structure in 2010							
Food and beverages	48.7	50.7	55.0	57.9	60.1	50.1	50.6
Clothing and footwear	6.2	10.7	8.9	10.1	4.4	7.3	6.8
Housing, water, electricity, gas, and other fuels	19.5	16.3	12.5	13.1	14.0	19.4	18.0
Furnishings, household equipment, and routine house items	4.5	4.8	4.6	5.0	4.0	5.1	4.5
Health	2.4	3.1	2.8	4.8	2.4	1.6	2.6
Transport	9.4	3.9	4.3	2.5	5.5	6.6	7.9
Recreation and culture	2.5	2.5	4.3	2.6	1.6	1.1	2.5
Education	3.5	5.3	4.0	2.5	3.3	6.1	3.7
Restaurants and hotels	2.0	0.2	0.6	0.2	2.6	0.0	1.6
Miscellaneous goods and services	1.4	2.4	3.0	1.4	2.0	2.7	1.7
Total	100	100	100	100	100	100	100
Difference relative to utility-consistent consumption weights (EPM 2010) – EPM – CPI							
Food and beverages	-11.1	-22.3	-13.7	-12.4	-7.7	-14.9	-15.9
Clothing and footwear	3.2	7.1	5.4	5.9	0.7	3.3	3.3
Housing, water, electricity, gas, and other fuels	13.1	13.3	8.2	9.3	8.6	15.2	13.2
Furnishings, household equipment,and routine house items	1.2	2.4	0.8	1.0	0.8	0.2	1.1
Health	1.6	2.6	1.9	3.5	1.0	0.4	1.6
Transport	3.3	1.0	1.3	-0.1	2.4	3.2	4.0
Recreation and culture	1.8	2.2	3.8	2.1	1.3	0.7	2.0
Education	-0.5	2.7	0.8	-1.0	0.8	0.0	0.2
Restaurants and hotels	-0.6	-0.2	0.0	-0.6	0.4	-0.6	0.1
Miscellaneous goods and services	-11.9	-8.7	-8.5	-7.8	-8.4	-7.4	-9.7

Sources: Authors' elaboration based on the EPM data (INSTAT 2011).