Journal of Demographic Economics, **83**, 2017, 307–327.
doi:10.1017/dem.2017.12

ARE WE COUNTING ALL THE POOR?

Accounting for the Intra-Household Allocation of Consumption in Burundi

Marion Mercier
PSL, Université Paris-Dauphine, LEDa, UMR DIAL and IZA, Bonn

Philip Verwimp
Université Libre de Bruxelles

Abstract Having accurate poverty statistics is of primary importance for researchers and policy-makers. Based on original data on Burundi, we investigate the sensitivity of poverty headcount calculations to considering individual- instead of household-level consumption. Relying on a survey module which provides information on the share of expenses allocated to each member of the households, we calculate poverty statutes on an individual basis. Exploiting these direct measures to compute poverty headcounts allows us to put forward the discrepancy between individual- and household-level poverty computations. We identify "hidden poor," *i.e.* poor individuals living in non-poor households, and show that they are predominantly children. We finally discuss potential mechanisms that could drive the results, and emphasize the importance of improving data collection devices for poverty-related policy making.

Keywords: Poverty measurement, intra-household allocation, Burundi

1. INTRODUCTION

Poverty statistics are a fundamental input into the design, implementation, and evaluation of public policies, especially in developing countries. Yet, counting the number of poor based on household survey data is not a straightforward exercise, in particular, in contexts of poor data availability and/or quality. The poverty headcount corresponds to the number of people who live below a poverty line expressed in terms of consumption. Various methods of calculation of the poverty line have been developed [see Bidani and Ravallion (1994) for a comprehensive discussion], the most widely used being based on the "cost of

The data used in this paper were collected in an FNRS research project on longitudinal and intra-household dynamics. We thank FNRS for their support. We extend our appreciation to Lionel Rama Ngenzebuke for insightful discussions as well as our many Burundese research assistants for their input and effort in the data collection. Marion Mercier acknowledges support from the ARC project 15/19-063 on "Family transformations" (French speaking community of Belgium). Address correspondence to: Marion Mercier, PSL, Université Paris-Dauphine, LEDa, UMR DIAL and IZA, Bonn; e-mail: mercier@dial.prd.fr

basic needs approach" according to which poverty is the incapacity to fulfil basic food and non-food needs, and the poverty line the cost of those needs [Bidani and Ravallion (1994), Ravallion (1994, 1998)].

The poverty line corresponds to an amount of individual consumption.[1] Yet, in practice, most survey data provide household-level information on consumption. Then, the poverty status of an individual is inferred from the total consumption of her household, by assuming that consumption is distributed equitably among household members.[2] This standard method thus yields an index of poverty at the level of the household, and all the members of a (non-)poor household are assumed to be (non-)poor themselves. As such, it bypasses the black box that the intra-household distribution of consumption represents. Relying on an original survey providing information on this intra-household distribution in Burundi, we compare poverty incidence figures computed on the basis of the standard household-level method, which assumes equitable repartition of resources within the household, with poverty incidence computed at the individual level, based on the shares of the total household resources which are declared to be consumed by each member.

In the next section, we specify how the poverty line is computed by the "cost of basic needs" approach. We then recall some insights from the literature on intra-household distribution of consumption, which motivate an individual approach to poverty computations. Section 4 presents the data and method, and Section 5 presents the results. Section 6 discusses the mechanisms that are likely to lead our findings. Section 7 concludes.

2. COMPUTING POVERTY FROM HOUSEHOLD SURVEYS

The computation of the poverty headcount from household survey data implies the following methodological steps. To calculate the food component of the poverty line, one needs to identify the average basket of goods consumed by the poorest households. Households are first ranked according to their level of consumption (in local currency, per adult equivalent *i.e.* weighting individuals based on their gender and age). Then, the average bundle of food items consumed by the $x\%$ poorest households – this "x" corresponding to an estimated poverty incidence based on previous computations or on neighboring countries for instance – is taken as basket of reference.[3] Second, this basket of goods is re-scaled in order to reach the amount of calories per adult equivalent which is considered minimal in the context. In Burundi, the minimum caloric requirement is estimated to 2,500 calories per day and adult equivalent [Minecofin (2002)].[4] The monetary value of the re-scaled basket, which exactly fits this minimal caloric requirement while respecting the consumption habits of the poorest, is the food poverty line.

Notice that prices data are needed twice for this calculation, to value households' consumption and to value the re-scaled basket of goods. Ideally, one would like to observe the market prices that households face. In general, surveys rather provide prices declared by the respondents, as in our data. In order to mitigate the

https://doi.org/10.1017/dem.2017.12 Published online by Cambridge University Press

measurement errors that they may contain, we use the country-level median of declared prices for each food item.

The second component of the poverty line corresponds to non-food consumption. In the absence of a non-food equivalent to the minimal caloric requirements, the standard method consists in considering the share of non-food expenses of households whose total consumption is very close to the food poverty line. While these households could fit their caloric needs, they sacrifice part of their food consumption in favor of non-food consumption, making it arguable that they consider their non-food expenditures as absolutely necessary. The monetary value of this non-food consumption (per adult equivalent and based on declared prices) is taken as the non-food poverty line. In the case of Burundi, the non-food component of the poverty line is estimated to 18%, while the food component accounts for the remaining 82% of the poverty line [Bundervoet (2006)].

Note that, in order to minimize the recall bias, household surveys usually question respondents about their consumption over a short period of time prior to the interview (one or two weeks for food, one month for non-food in most cases). While this is not likely to be an issue for the measurement of food expenses, which are supposed to be spread relatively equally over time, it can generate a bias in the measurement of non-food expenses by failing to capture the less frequent purchases of durable goods. Such durable goods, like a house or a fridge, are also often goods used by all household members (possibly to a different extent), which are, by construction, left out of the computation of the poverty status.

Finally, the poverty line equals the addition between the food and non-food components, and households, as well as all their members, are considered poor if their consumption per adult equivalent is inferior to the poverty line.

3. INSIGHTS FROM THE LITERATURE

Recent empirical work has pointed out the importance of the measurement of poverty and weaknesses of the current available figures in a lot of developing countries. In his book, Jerven (2013) paints a bleak picture of the functioning of national statistics in Africa and its negative effect on the quality of data on economic performance and on poverty. A recent World Bank report on poverty in Sub-Saharan Africa (2016) also states that the measurement of poverty remains a challenge, notably because of the lack of regular and good quality data. Both publications stress how challenging the improvement of poverty computations and related data collections are.

Among the questions raised by poverty statistics calculation, the measure of individual poverty is crucial. While poverty statistics bypass the black box that the intra-household allocation of consumption represents, the individual level is arguably the conceptually relevant one to think about poverty. As stated in the introduction, the computation of the poverty line uses household-level data and assumes an equitable repartition of consumption between members. However, it

https://doi.org/10.1017/dem.2017.12 Published online by Cambridge University Press

is not so clear that the allocation of goods consumed by the household perfectly fits the individual weights assumed by the adult equivalence scale.

On the theoretical side, the tool that was first mobilized for studying household behavior was the "unitary" model of household behavior, which relies on the assumption that the household maximizes a unique utility function.[5] Contributions in empirical development economics have challenged this framework, notably by documenting that higher female income shares are associated with higher child expenditures [Thomas (1993), Haddad et al. (1997), Lundberg et al. (1997), Duflo (2003)]. Such results, which run counter to the predictions of the unitary household model for which it should not matter who is earning what part of the income, lent credit to alternative "collective" frameworks to model the intra-household allocation of resources.

Cooperative as well as non-cooperative models of decision-making have been employed to shed light on the intra-household allocation of resources black box [*e.g.* Browning and Chiappori (1998) and Lechene and Preston (2011), respectively]. Chiappori (1988, 1992), Cherchye et al. (2009, 2010), and Browning et al. (2013) use collective models to recover the sharing rule of consumption within a household. One question that has been at the core of this literature, in line with the empirical results cited above, is how intra-household allocation of resources affects children welfare, notably through women relative empowerment. For instance, Cherchye et al. (2012) apply a collective model to Dutch data to analyze a number of intra-household welfare issues, notably the impact of male and female wage changes on children's welfare, and to evaluate whether empowering mothers is more beneficial to children than empowering fathers. Doepke and Tertilt (2016) use a non-cooperative approach to nuance the commonly held belief that transfers to women (rather than to men) are beneficial for economic development. They claim that this is only the case if the economy thrives on human capital rather than physical capital. In their model, men care as much about children as women, but increases in female resources nevertheless lead to more spending on children because of the endogenous specialization pattern in the production of public goods within the household. In particular, transfers to the wife increase the provision of female-provided, time-intensive, public goods. Assuming that child-related public goods are relatively intensive in time, the model is consistent with the observed effects that transfers targeted to women have on spending on children.

In link with this question of targeted transfers, a related issue in the theoretical literature on non-unitary intra-household decision-making is the consumption of public goods. It is not obvious which goods are publicly and/or privately consumed within the household. Children-related consumption has typically been considered by collective models as a public good from which parents derive utility, possibly to a different extent, in a two-member household [see, for instance, Blundell et al. (2005)], just as they often enter adults' utility function in overlapping generation models [see, for instance, de la Croix and Doepke (2003)]. However, other papers have challenged this idea, arguing that observed household demand functions are more consistent with children having separate utility functions [Cherchye et al.

https://doi.org/10.1017/dem.2017.12 Published online by Cambridge University Press

(2009), Dauphin et al. (2011), Dunbar et al. (2013)]. Regardless of the modeling of utility functions for children, the issue of cooperation between the decision-makers and the heterogeneity of their preferences are fundamental theoretical determinants of the final level of provision of public goods and, subsequently, welfare within the household.

Although not asking the same question as we do, and not using the same methodology, these papers underline the role of the sharing rule within the household on members' individual welfare, and thus motivate an individual-level approach to poverty measurement. Closest to our own work, Dunbar et al. (2013) identify the intra-household allocation of resources based on the variation of expenses on a single private good across income and family size in Malawi. Building on the methodology of Browning et al. (2013), which allows for very general forms of sharing of goods, and assuming that children have separate utility functions rather than considering them as a public good for parents, they rely on declared individual shares of clothing expenses to estimate resource shares by household type which account for scale economies with respect to the consumption of household-level public goods. They notably find that headcounts computed on a household basis significantly understate child poverty. While the usual household-level calculation yields a poverty rate of 91% in their case, they estimate a poverty incidence of around 60% for men, 85% for women, and over 95% for children.

In this paper, instead of estimating households' sharing rules, we rely on survey data collected in Burundi in 2012, which directly provide measures of the individual shares of households' expenses. Without taking any prior on its type, we consider these observed shares as the outcomes of the intra-household decision-making process to estimate individual levels of food and non-food consumption. A limitation of our approach is that, in the absence of appropriate data, household-level public goods are left out from the analysis. The potential consequences of this issue are discussed below. We find that 13–16% of the individuals of our sample are attributed a household-level poverty status which does not correspond to their individual consumption. Household-level poverty computations underestimate the aggregate incidence of poverty by 2–4 percentage points, by hiding individuals who live in non-poor households while being poor. Although the methodology and data used are different, our results are very consistent with those of Dunbar et al. (2013), since these "hidden poor" are found to be predominantly children. We also find that a second group of people who suffer poverty while being part of non-poor households is composed of young males who head their households.

4. DATA AND METHOD

4.1. The Survey

We rely on a household survey implemented in Burundi in the fall of 2012, gathering consumption data for 1,238 households (6,452 individuals). This survey was designed as the third round of a panel, the first two waves having been collected

https://doi.org/10.1017/dem.2017.12 Published online by Cambridge University Press

in 1998 and 2007. The main emphasis was put on tracking original households present in an extract of the 1998 sample, in order to make long-run welfare analyses possible. Thus, although the 1998 survey interviewed a representative sample of the Burundi households, it is not the case of the 2012 round. It follows that the poverty statistics computed here (both at the individual and at the household level) cannot be assumed to be representative for the whole country in 2012. In particular, only rural households were interviewed. Moreover, since households were followed over time, one may infer that young households (with very young children) are underrepresented in the 2012 sample. This potential bias is, however, mitigated by the fact that split-off households, *i.e.* households newly formed by members who were previously residing in the parental household, were tracked from one wave to the other. Although it has to be kept in mind, the non-representativeness of the sample is not central here, to the extent that our focus is on the "internal" comparison between statistics obtained based on household- versus individual-level data.

With the ambition to tackle the black box of the intra-household allocation of consumption, the 2012 questionnaire included a module on individual consumption. For a certain number of items, the respondent was asked to specify the share of the household's expenses dedicated to five individuals or groups of individuals: the main adult male, the main adult female, the sons, the daughters, and the other household members. This module was asked to the woman considered as responsible for the household budget. In most cases (more than 64%), she is the wife of the household head, otherwise she is herself the head. Less than 1% of the respondents are other relatives of the household head. The idea beyond directing this module toward women is that, in the standard Burundi household, the man is the main provider of resources but the budget management is part of the woman's prerogatives. It is thus reasonable to assume that she is the one who has the most accurate idea of the share of each good which is consumed by each member. The module accounted for a varied list of items in order to make it possible to document the heterogeneity of allocations across different categories of goods. Unfortunately, as shown in Table 1, most of the items exhibit a high rate of missing data, except clothing and food on which we rely to compute our estimates of individual consumption.[6]

4.2. Computing Individual Poverty Status

Table 2 displays the average share of food and clothing expenses allocated to the male, female, and to each son and daughter. Women declare a much larger share of clothing expenses for themselves than for men. A difference also appears regarding food expenses, but it is much less pronounced. Last, expenses for girls and boys seem to be balanced.

Our benchmark estimates of individual consumption are computed as follows. We first allocate to each individual the share of the total food (resp., non-food) expenses of her household which corresponds to her declared share of consumption of food items (resp., clothes) to estimate her total expenses.

https://doi.org/10.1017/dem.2017.12 Published online by Cambridge University Press

TABLE 1. Data availability

		# of individuals with data
Household's total consumption		6,452
Individual shares	Clothing	5,619
	Health	2,298
	Food	6,205
	Traditional alcohol beverages	1,969
	Industrial beers	471
	Lemonades	244
	Milk	102
	Fruits	886
	Tobacco	536

TABLE 2. Average declared shares of food and clothing expenses

	Average share of food expenses (%)	Average share of clothing expenses (%)
Man	24.29	20.98
Woman	30.21	36.89
Each son	14.83	14.35
Each daughter	16.42	15.62

Three methodological points are to be noticed at this stage. First, one single figure is provided for the share of expenses dedicated to all the sons (respectively, daughters). We infer the individual share going to each child by dividing the share declared for sons (respectively, daughters) by the number of sons (respectively, daughters). This is also what is done to compute the average shares for each son and daughter displayed in Table 2. By doing so, we assume an equitable repartition between siblings of the same gender, regardless of their age. This is undoubtedly a limit of our approach, as children of different ages should reasonably consume differently, and older children could even be breadwinners themselves and/or act as additional decision-makers in the household. However, the average and median ages of the children of the sample (7.76 and 7, as shown in Table 3), together with the common practice in Burundese households that grown-up children leave the parental home at relatively young ages (when getting married themselves), minimize the potential consequences of this feature of the data.

A second concern could emerge regarding the quality of the data if the sum of the declared shares for each household and item was often different from 100. Reassuringly, this is not the case. The total is exactly equal to 100 in the vast majority of cases (95.26%), and it is between 90 and 110 for 98% of the *household* × *item* observations. We are thus confident over the fact that

https://doi.org/10.1017/dem.2017.12 Published online by Cambridge University Press

TABLE 3. Summary statistics

	# of individuals	Average	Median	Standard deviation
All				
Woman	5,065	51.23%		
Age	5,065	20.69	15	17.90
≤18 y.o.	5,065	56.29%		
Among >18 y.o.:				
Woman	2,214	52.48%		
Age	2,214	37.33	34	14.37
Among ≤18 y.o.:				
Woman	2,851	50.26%		
Age	2,851	7.76	7	5.13
Among >18 y.o. men:				
Age	1,052	38.12	35	14.87
Among >18 y.o. women:				
Age	1,162	36.62	32.5	13.87
Among ≤18 y.o. men:				
Age	1,418	7.84	7	5.12
Among ≤18 y.o. women:				
Age	1,433	7.68	7	5.15

misreporting of shares is not a big issue. To deal with the sums that fall below or above 100, we proportionately rescale individual shares in order to reach a total of 100.

Third, in this process, we deal with children in the same way as we deal with adults. Intuitively, this is closer to a framework *à la* Dunbar et al. (2013), where children have individual bargaining weights and their income shares are taken separately rather than as parts of the parents' income shares, than to theoretical models assuming that children's consumption is a public good. However, as we only observe the outcome of the repartition of consumption, other theoretical assumptions on the decision-making process could also be compatible with the observed final shares, including a framework in which expenditures on children enter the utility of both parents as a public good in a symmetric way, or a framework in which parents have different valuation of child utility as in Blundell et al. (2005). We stick to a general approach here, and focus on how accounting for individual shares – regardless of the intra-household decision-making mechanism which yields them – affects poverty figures.

Finally, our estimate of individual expenses is re-scaled per adult equivalent, so as to be comparable across gender and age categories. We compare it to the poverty line to determine individuals' poverty status.

The non-food component of individual consumption is likely to be less well measured than the food component, since it is only based on the allocation of clothing expenses. In particular, if clothes of older children benefit the younger,

https://doi.org/10.1017/dem.2017.12 Published online by Cambridge University Press

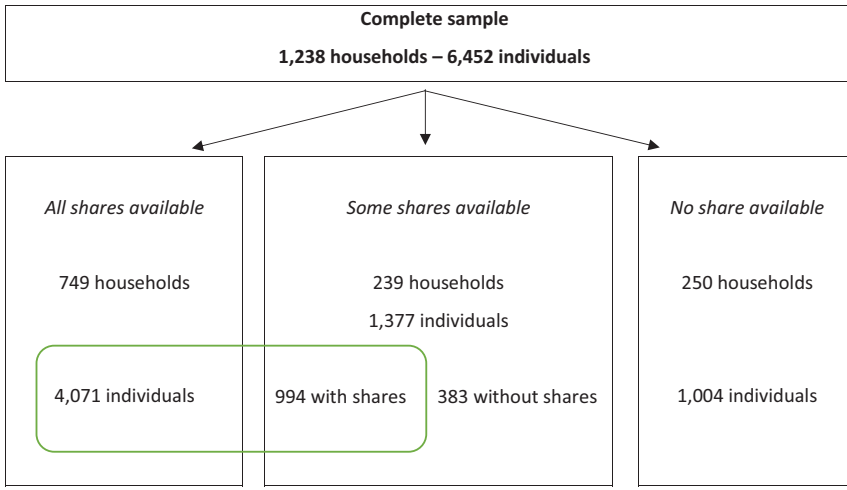

FIGURE 1. (Colour online) Composition of the sample – household and individual levels.

individual-level estimates might underestimate young children's non-food effective consumption. Moreover, as observed in Table 2, there is an important gender gap in declared clothing expenses, which might artificially boost women's non-food expenses and yield an underestimate of their poverty relative to that of their husbands. To account for this, in what follows we also display the results of a more restrictive calculation based on food shares only, and discuss them in comparison with the benchmark results.

4.3. The Sample

In the end, we estimate the individual poverty status of 5,065 individuals. Table 3 displays summary statistics on the sample of analysis. This sample is well balanced in terms of gender, and characterized by a high proportion of individuals below 18 years old. The share of women is stable across the two age categories (below and above 18), and the average age of young (respectively, adult) individuals proves to be similar between males and females.

As noted above, the module on individual shares of consumption suffers a relatively high rate of missing data. Figure 1 describes the composition of the sample, at the household and individual levels. The complete sample gathers 1,238 households (6,452 individuals), which can be divided into three subgroups. For 749 households, which correspond to 4,071 individuals, information on individual shares is available for all the members. For 239 households, we have information on the individual shares of some, but not all, members. There are 1,377 individuals living in these households: we observe the individual shares of 994 of them, while

https://doi.org/10.1017/dem.2017.12 Published online by Cambridge University Press

TABLE 4. Missing data issue – household-level analysis

	(1) Complete sample	(2) HH with all individual shares	(3) HH with individual shares of some but not all members	(4) HH with no individual shares
# of households	1,238	749	239	250
Poverty rate (%)	65.99	64.09	60.67	77.80
Diff. with Column (1)		*–1.91 (2.20)*	*–5.32 (3.37)*	*10.81*** *(3.23)*

Differences of means in comparison with the complete sample displayed in Column (1). Standard errors in parentheses. ***$p < 0.01$, **$p < 0.05$, *$p < 0.1$.

TABLE 5. Missing data issue – individual-level analysis

	(1) Complete sample	(2) Individual shares available
# of individuals	6,452	5,065
Women	52.25%	51.23%
Diff. with Column 1		*–1.01 (0.94)*
Age	21.38	20.69
Diff. with Column 1		*–0.69** (0.34)*
Head	18.49%	18.68%
Diff. with Column 1		*0.19 (0.73)*
Partner	13.75%	15.08%
Diff. with Column 1		*1.34** (0.66)*
Child	60.26%	66.24%
Diff. with Column 1		*5.98*** (0.91)*

Differences of means in comparison with the complete sample displayed in Column (1). Standard errors in parentheses. ***$p < 0.01$, **$p < 0.05$, *$p < 0.1$.

the remaining 383 are missing. Last, for 250 households (1,004 individuals), there is no information at all on individual shares.

Tables 4 and 5 document how our sample of analysis compares to the complete sample, respectively at the household and at the individual level. Table 4 displays the prevalence of household-level poverty in the complete sample and in the three subgroups of households defined above. It also tests whether poverty rate is significantly different between the complete sample and each of these three subgroups. It reveals that households with no information on individual shares [Column (4)] are poorer on average than the complete sample. However, households with complete information or with at least some information on the intra-household distribution of consumption, displayed in Columns (2) and (3), are not significantly different from the complete sample in terms of household-level poverty prevalence. This is reassuring over the consequences of missing data on our poverty computations.

https://doi.org/10.1017/dem.2017.12 Published online by Cambridge University Press

TABLE 6. Number and share of poor individuals

	(1) Based on household total expenses	(2) Based on individual shares of food and non-food items	(3) Based on individual shares of food items
Total	3,332 (65.78%)	3,535 (69.79%)	3,442 (67.96%)
Men	661 (62.83%)	680 (64.64%)	646 (61.41%)
Women	735 (63.25%)	648 (55.77%)	680 (58.52%)
Children (≤18 y.o.)	1,936 (67.91%)	2,207 (77.41%)	2,116 (74.22%)

Table 5 provides complementary statistics at the individual level. It compares the complete sample (6,452) to all the individuals for whom there is information available on expenses shares. As shown in Figure 1, shares data are available for 5,065 individuals: 4,071 living in households with complete information and 994 living in households with incomplete information.

Individuals for whom the share of expenses is available are a few months younger on average. They are not significantly more likely to be women, nor to head their household, but they are more likely to be partners of the household head and much more likely to be children of the household head. Said differently, individual shares are well informed for children, and less well informed for household heads as compared to their partners. This is in line with the fact that, in most cases, the respondent– the woman in charge of the budget – is the household head's partner. It could however generate a bias in our estimates of the individual-level poverty status of household heads, which we need to keep in mind.

5. RESULTS

Based on the standard household-level calculation, the incidence of poverty in our sample of analysis is found to be equal to 65.78%. Although our sample is not representative for the whole of Burundi in 2012, this headcount is very close to the figures of the World Bank, which estimates that 64.6% of the Burundese population and 68.8% of the rural Burundese population were living below the national poverty line in 2014.[7] On the other hand, relying on declared individual shares of expenses to infer individual-level poverty statutes leads to a 69.79% poverty incidence – *i.e.* a share of poor 4 percentage points larger than when we use household-level consumption [see Table 6, Column (2)]. Individual-level computations yield poverty rates of 64.64% for men, 55.77% for women, and 77.41% for children under 18.

https://doi.org/10.1017/dem.2017.12 Published online by Cambridge University Press

TABLE 7. Number of individuals by poverty status

Poverty status		(1) Based on food and non-food shares	(2) Based on food shares only
Household-level	Individual-level	# (%)	# (%)
Poor	Poor	3,022 (59.66%)	3,052 (60.26%)
Poor	Non-Poor	310 (6.12%)	280 (5.53%)
Non-Poor	Poor	513 (10.13%)	390 (7.70%)
Non-Poor	Non-Poor	1,220 (24.09%)	1,343 (26.52%)

As discussed above, the non-food component of the estimated individual consumption is less reliable than its food component, given that it is only based on the share of clothing expenses. In this perspective, Column (3) of Table 6 reports individual-level poverty computations based on food shares only. The results also point to an underestimation of aggregate poverty incidence by standard household-level computations. The gap between household- and individual-level poverty rates is however smaller, with a difference of 2 instead of 4 percentage points. Moreover, as women declare benefiting from a relatively large share of the household's clothing expenses, it follows that abstracting from individual shares in clothing expenses yields a larger estimated rate of poverty for women (58.52%) and smaller estimated rates of poverty for men (61.41%) and children (74.22%). Still, whatever the method used to compute individual-level statistics, poverty incidence is systematically estimated to be higher when individual consumption is accounted for, and much higher for children.

The number of non-poor individuals living in poor households is smaller than the number of poor individuals living in non-poor households. More precisely, in the benchmark estimates using food and non-food individual shares, more than 10% of the individuals are considered as poor based on their share of expenses but are part of non-poor households, while a little more than 6% are non-poor living in poor households [see Table 7, Column (1)]. Thus, around 16% of the individuals of the sample are wrongly categorized in terms of poverty status if their household's total consumption is taken as reference, and standard household-level poverty computations underestimate the incidence of poverty by overlooking poor individuals living in households considered as non-poor. The results are consistent when considering individual poverty estimates based on food shares only, although the picture is slightly more nuanced. As shown in Column (2) of Table 7, in that

https://doi.org/10.1017/dem.2017.12 Published online by Cambridge University Press

TABLE 8. Characteristics of the "hidden poor"

	(1) All	(2) "Hidden poor" – Based on food and non-food shares		(3) "Hidden poor" – Based on food shares only	
	Average (#)	Average (#)	*Diff. with Col. 1*	Average (#)	*Diff. with Col. 1*
Age	20.69	16.57	*–4.11***	15.12	*–5.56****
	(5,065)	*(513)*	*(0.82)*	*(390)*	*(0.92)*
≤18 y.o.	56.29%	68.42%	*12.13****	69.49%	*13.20****
	(5,065)	*(513)*	*(2.29)*	*(390)*	*(2.59)*
Woman	51.23%	42.69%	*–8.54****	43.33%	*–7.90****
	(5,065)	*(513)*	*(2.31)*	*(390)*	*(2.63)*
Among ≤18 y.o.: woman	50.26%	46.15%	*–4.11*	46.49%	*–3.77*
	(2,851)	*(351)*	*(2.83)*	*(271)*	*(3.18)*
Among >18 y.o.: woman	52.48%	35.19%	*–17.30****	36.13	*–16.35****
	(2,214)	*(162)*	*(4.05)*	*(119)*	*(4.69)*
Household size	6.33	6.33	*–0.01*	6.49	*0.16*
	(5,065)	*(513)*	*(0.10)*	*(390)*	*(0.11)*
Household head	18.68%	14.23%	*–4.45***	11.28%	*–7.40****
	(5,065)	*(513)*	*(1.79)*	*(390)*	*(2.02)*
Head's partner	15.08%	4.87%	*–10.21****	2.82%	*–12.26****
	(5,065)	*(513)*	*(1.61)*	*(390)*	*(1.83)*
Head's kid	66.24%	80.90%	*14.66****	85.90%	*19.66****
	(5,065)	*(513)*	*(2.16)*	*(390)*	*(2.44)*

Differences of means in comparison with the average displayed in Column (1).
Standard errors in parentheses. $^{***}p < 0.01$, $^{**}p < 0.05$, $^{*}p < 0.1$.

case, nearly 8% of the sample is made of poor members of non-poor households, while 5.5% are non-poor in poor households. In total, more than 13% of the individuals are then wrongly categorized by household-level computations.

When the benchmark estimates are considered, 513 individuals are poor living in non-poor households (Table 7, Column (1)). Who are these "hidden poor?" Table 8 displays their average demographic characteristics, as well as those of the whole sample of analysis, and the differences between the two (Columns (1) and (2)). It clearly appears that the "hidden poor" are younger: their average age is around 16.5 years old, versus nearly 21 years old in the complete sample. Children aged under 18 represent more than 68% of the "hidden poor," while less than 56.5% of the total sample.

Moreover, a relatively important share of the "hidden poor" is men. When we consider separately children and adults, it appears that the share of girls is not significantly different between "hidden poor" aged under 18 and the total sample

https://doi.org/10.1017/dem.2017.12 Published online by Cambridge University Press

TABLE 9. Status of the adult "hidden poor"

	Household head	Head's partner	Head's kid
Computations based on food and non-food shares	72 (44.44%)	25 (15.43%)	65 (40.12%)
Computations based on food shares only	43 (36.13%)	11 (9.24%)	65 (54.62%)

of children, while the share of women is significantly smaller among "hidden poor" aged over 18 than among the whole sample of adults. Said differently, the "hidden poor" seem to gather two categories of individuals: children (both girls and boys), and young adults who are predominantly men.

The last part of Table 8 focuses on individual's status in the household. On average, "hidden poor" do not belong to larger or smaller households. Expectedly given their age profile, they are significantly less likely than the average to be the household head or the partner of the household head, and significantly more likely to be the son or daughter of the head.

Column (3) of Table 8 displays the same averages and differences of means considering the computations based on food shares only. All the previous comments remain valid. This notably reassures us over the fact that the overrepresentation of children among the "hidden poor" does not stem from our approximate measure of non-food consumption based on clothing expenses.

It appears in Table 8 that "hidden poor" are less likely to be household heads. This average is driven by the large number of children in hidden poverty. However, if we focus on the "hidden poor" aged above 18 (Table 9), it turns out that more than 44% (respectively, 36%) are household heads as far as benchmark estimates (respectively, computations based on food shares only) are considered. This confirms that, aside from children, the second category of "hidden poor" gathers young males often heading their households.

To complement these findings, Table 10 displays the results of multivariate Probit estimations in which the dependent variable equals one if the individual is a "hidden poor." We successively introduce as explanatory variables the gender and age of the individual, her link with the household head and the size of her household. The three specifications are run using the benchmark measure of hidden poverty (based on food and non-food shares) in Columns (1)–(3), and the restrictive measure (based on food shares only) in Columns (4)–(6).

If women and older members are less likely to be "hidden poor," the age effect turns non-significant as soon as the status within the family is controlled for. This result suggests that the intra-household repartition of consumption depends more on individuals' positions within the household than on their relative age. Moreover, the size of the household is slightly negatively associated with hidden poverty. This correlation, which suggests that larger households favor equity, is however not robust to our alternative measure of individual poverty. Last, the significance

https://doi.org/10.1017/dem.2017.12 Published online by Cambridge University Press

TABLE 10. Determinants of the probability to be "hidden poor"

	(1)	(2)	(3)	(4)	(5)	(6)
	Computations based on food and non-food shares			Computations based on food shares only		
Woman	–0.202***	–0.136***	–0.139***	–0.175***	–0.107*	–0.108*
	(0.0483)	(0.0526)	(0.0526)	(0.0526)	(0.0561)	(0.0562)
Age	–0.00834***	0.00145	0.00183	–0.0115***	0.00152	0.00164
	(0.00146)	(0.00253)	(0.00248)	(0.00147)	(0.00275)	(0.00270)
HH head		0.294**	0.281**		0.407***	0.404***
		(0.117)	(0.117)		(0.148)	(0.148)
Child of the head		0.655***	0.681***		0.890***	0.897***
		(0.118)	(0.117)		(0.149)	(0.146)
HH size			–0.0213*			–0.00484
			(0.0111)			(0.0122)
Constant	–1.018***	–1.761***	–1.649***	–1.131***	–2.137***	–2.113***
	(0.0417)	(0.137)	(0.153)	(0.0433)	(0.167)	(0.189)
Observations	5,065	5,065	5,065	5,065	5,065	5,065

Probit estimations. Robust standard errors in parentheses. ***$p < 0.01$, **$p < 0.05$, *$p < 0.1$.

of the relationship between gender and hidden poverty is much lower when this second measure is used, which is in line with the fact that our proxy for non-food shares – clothing expenses – generates an upward bias on the measurement of women consumption.

6. DISCUSSION

Inequality of consumption within households results in some individual poverty, which does not appear in household-level statistics. First, we find that many children have a level of individual consumption that falls below the poverty line, although they belong to non-poor households. This is in line with previous results obtained with different methodological approaches. From the theoretical and empirical literature, we derive four mechanisms which could explain the prevalence of child poverty in non-poor households:

(i) A preference-based mechanism, in the frame of a collective model, whereby men value children less than women, resulting in less resources for children when men are in control of household resources. In particular, children hidden poverty would then emerge in richer households where the male generates more resources and thus enjoys more bargaining power.
(ii) A household production mechanism *à la* Doepke and Tertilt (2016), whereby preferences are symmetric between men and women and children are a time-intensive public good. If men believe that physical assets are more important than human capital, given the state of the Burundese economy, then they would not transfer resources to women, which would imply lower kid consumption and potentially generate hidden poverty among children.
(iii) A model whereby the breadwinner needs to eat first in order to have enough food intake to secure the survival of at least some household members. If the household is close to (but above) the poverty line, this may result in children consuming below the poverty line while living in non-poor households.
(iv) A cultural mechanism whereby the great respect for older people in Burundi and the custom that they eat before the children do leads to fewer consumption for children. Again, if the household is close to (but above) the poverty line, such respect may result in children consuming below the poverty line. Here, the modeling of interactions between generations seems at least as important as the modeling of interactions between the spouses.

Mechanisms (i) and (ii) both underpin a collective-type of intra-household decision-making, while mechanisms (iii) and (iv) are compatible both with a collective model and with a unitary model in which household members maximize a utility function giving less weight to children consumption.

The data at hand do not allow us to test properly for the existence of these mechanisms. However, Table 11 provides partial insights on this discussion by displaying the pairwise coefficients of correlation between parents' and children's shares of expenses. While both men's and women's shares of clothing expenses are negatively correlated with each child's own share of clothing consumption, the

https://doi.org/10.1017/dem.2017.12 Published online by Cambridge University Press

TABLE 11. Correlations between the shares of expenses of the members

	Man	Woman
Each son	**–0.2115*** **	**0.0594*** **
	*–0.3314****	*–0.4266****
Each daughter	**–0.2381*** **	**0.0882*** **
	*–0.3480****	*–0.3571****

Coefficients of correlation between the shares of food expenses in bold, coefficients of correlation between the shares of clothing expenses in italics. $^{***}p < 0.01$, $^{**}p < 0.05$, $^{*}p < 0.1$

picture is different for food consumption. The share of food expenses dedicated to the man is negatively correlated with the shares of the children, and the opposite is true for the woman. Although only suggestive, this result is compatible with a collective model of heterogeneous preferences between men and women [mechanism (i) above], where richer males have more bargaining power and value less children. As shown by Doepke and Tertilt (2016), symmetric preferences between men and women can also lead to a situation where increases in female resources yield more spending on children relative to increases in male resources, because of the household production mechanism. Mechanism (ii) is thus also compatible with the correlations observed in Table 11. On the other hand, the negative correlation between men's and children's shares of food expenses lends less credit to mechanisms (iii) and (iv), which would rather predict a positive relation between what the breadwinner/older members consume and what the youngest can consume.

Our second result is the emergence of another category of "hidden poor" gathering males heading their households, congruently with a decline in women poverty rate when we go from household- to individual-level computations. We take this result with very much caution for two main reasons. First, as discussed in Section 4.3, our estimates of the individual-level poverty status of household heads could be biased by the missing data issue. Second, this result might be linked to the declarative nature of the data if women overestimate their share of consumption relative to that of their husbands. This is even more likely if men benefit from food and other consumption items which escape the eye of their wives. Such a mechanism, documented for instance by Zelizer (1989) for North America in the early 20th century, is compatible with a non-cooperative model of household consumption. It could also reflect an intermediate, "semi-cooperative", functioning, as described by d'Aspremont and Dos Santos Ferreira (2013). In our setting, one could imagine that part of the male consumption is punctured from the household budget in a first step, and that the remaining resources are cooperatively allocated between all the household members in a second step.[8] Such an isolation of part of the man's consumption from the budget referred to by the woman when answering the module on resource allocation would lead to an under- (respectively, over-) estimate of the consumption of young male heads of

https://doi.org/10.1017/dem.2017.12 Published online by Cambridge University Press

households (respectively, of their wives). In the end, this last (exploratory) result deserves more research to investigate (i) whether it is empirically robust, and (ii) which theoretical mechanisms are behind it.

Our results only rely on food and clothing expenses and do not account for the existence of publicly consumed goods (although, as discussed earlier, some models assume that children constitute a public good). This undoubtedly makes our measure of individual welfare partial. It is arguable that for the sake of comparing individual- versus household-level computations, the two measures of poverty need to be built on the same basis, which is the case here since the standard household-level computation also ignores exceptional expenses for durable goods and assets. By construction, standard poverty measures focus on private consumption. However, beyond the exercise of "internal" comparison between two measures, the investigation of individual poverty tackled in this paper aims of course at going further in the direction of improving poverty measurement. To this respect, the absence of public goods is a serious limitation. Individual poverty might be underestimated for household members who disproportionately contribute to the public good relative to the utility that they get from it, and vice versa. For instance, a transportation means such as a motorbike might disproportionately benefit the household head, and the fact that we ignore it could lead us to over- (respectively, under-) estimate woman's and children's (respectively, man's) welfare. This single example is of course not sufficient to have an idea about how excluding public goods might affect our results, given the heterogeneity of possible household-level public goods, the heterogeneity of individuals' preferences for diverse public goods, and the debate about their identification in the first place (in particular considering children-related expenses). The methodology implemented here, as well as the data used, do not allow us to make any step in the direction of accounting for public good consumption in the measurement of poverty, but certainly recall the importance of considering it at the same time as they show the importance of considering the intra-household allocation of private consumption.

7. CONCLUSION

The recent theoretical interest in the modeling of intra-household decision making and the derivation of the sharing rule has increased the understanding of household behavior in the absence of individual consumption data. Moreover, detailed and innovative ways of data collection in household surveys have allowed direct observation of individual consumption. The 2012 Burundi survey on which we rely is part of the latter undertaking.

These data allow us to perform expenditure calculations at the individual level. We find that poverty computations based on household-level private consumption tend to hide part of the poverty incidence by bypassing intra-household inequalities, *i.e.* poor (respectively, non-poor) individuals living in non-poor (respectively, poor) households. In our case, in function of the chosen methodology, 13–16% of the individuals of the sample appear to be attributed a different poverty status

https://doi.org/10.1017/dem.2017.12 Published online by Cambridge University Press

depending on whether household- or individual-level consumption is used. Among them, 8–10% are poor if we focus on their individual consumption, but live in non-poor households. Household-level computations thus yield an underestimate of poverty incidence. In the context of Burundi, hidden poverty gathers two categories of individuals: children (of both sexes), and, to a lesser extent, young males. To document further this individual poverty hidden from the household-level statistics, more accurate data on the allocation of non-food items, as well as on the use of household-level public goods, would be very beneficial.

Although mostly descriptive, and based on crude estimates of individual shares of expenses, the results of this paper highlight the sensitivity of poverty statistics to the unit of observation of consumption. Our main finding is the importance of hidden poverty among children in Burundi, which echoes the results of Dunbar et al. (2013) in the case of Malawi. In terms of policy implications, if this result was confirmed in other contexts, it would advocate for (i) designing tools, at the local level, to identify the children who, even if they do not live in the poorest households, are at high risk of suffering poverty on an individual basis. Primary schools and community-level health centers could typically play a role in this identification process; and congruently (ii) developing poverty-alleviating programs which do not only target the poorest of the poor, but also the children in (marginally) non-poor environments. Conditional cash transfers attached to children-level outcomes, which have also been shown to affect the intra-household allocation of resources, are an obvious candidate in this perspective. Last, in more global terms, our results emphasize the importance of improving poverty data collection devices and the precision of poverty computations, notably in the perspective of the design of pro-poor policies and of the evaluation of public programs tackling poverty.

NOTES

1 More precisely, it is an amount of consumption per adult equivalent, which accounts for age and gender.

2 Equity does not mean that all members should consume the same share of the pie, but their level of consumption is assumed to be proportionate to their adult equivalent, which accounts for age and gender.

3 Following Bundervoet (2006), who discusses the estimation of poverty in the case of Burundi, we set x equal to 50. Our estimates of aggregate poverty incidence will confirm that this choice is reasonable. Intuitively, setting a larger x would imply introducing more sophisticated and expensive items in the basket of reference, and would yield a higher food poverty line and a larger number of poor. On the other hand, setting a very small x would lead us to limit the basket of reference to the simplest goods, which would yield a smaller food poverty line and a smaller estimate of poverty incidence.

4 Minimum caloric requirement in the case of Rwanda, which is a very similar context.

5 The core role of family economics in economy was notably established by Becker's work. See Chiappori (2015) for a summary of its contribution.

6 We tackle the missing data issue in Section 4.3.

7 World Development Indicators.

8 Anderson and Baland (2002) theorize a sequence of events in the case of female participation to roscas, and Gobbi (2016) develops a theory in which parents follow a cooperative model to decide their supply of labor and, in a second step, decide non-cooperatively on the amount of childcare provided.

https://doi.org/10.1017/dem.2017.12 Published online by Cambridge University Press

REFERENCES

Anderson, S. and J.-M. Baland (2002) The economics of roscas and intrahousehold resource allocation. *Quarterly Journal of Economics* 117(3), 963–995.

Beegle, Kathleen, Luc Christiaensen, Andrew Dabalen, and Isis Gaddis (2016) *Poverty in a Rising Africa*. World Bank Publications, Washington, DC.

Bidani, Benu and Martin Ravallion (1994) How robust is a poverty profile? *The World Bank Economic Review* 8(1), 75–102.

Blundell, Richard, Pierre-André Chiappori, and Costas Meghir (2005) Collective labor supply with children. *Journal of Political Economy* 113(6), 1277–1306.

Browning, Martin and Pierre-André Chiappori (1998) Efficient intra-household allocations: a general characterization and empirical tests. *Econometrica* 66(6), 1241–1278.

Browning, Martin, Pierre-André Chiappori, and Arthur Lewbel (2013) Estimating consumption economies of scale, adult equivalence scales, and household bargaining power. *The Review of Economic Studies* 80(4), 1267–1303.

Bundervoet, , Tom (2006) Estimating poverty in Burundi. *Households in Conflict Network Working Paper* 20.

Cherchye, Laurens, Bram De Rock, and Frederic Vermeulen (2009) Opening the black box of intra-household decision making: theory and nonparametric empirical tests of general collective consumption models. *Journal of Political Economy* 117(6), 1074–1104.

Cherchye, Laurens, Bram De Rock, and Frederic Vermeulen (2010) The revealed preference approach to collective consumption behavior: testing and sharing rule recovery. *Review of Economic Studies* 78(1), 176–198.

Cherchye, Laurens, Bram De Rock, and Frederic Vermeulen (2012) Married with children: a collective labor supply model with detailed time use and intrahousehold expenditure information. *The American Economic Review* 102(7), 3377–3405.

Chiappori, Pierre-André (1988) Rational household labor supply. *Econometrica* 56, 63–90.

Chiappori, Pierre-André (1992) Collective labor supply and welfare. *Journal of Political Economy* 100(3), 437–467.

Chiappori, Pierre-André (2015) Gary Beckers' contribution to the economics of matching and marriage. *Journal of Demographic Economics* 81(1), 7–11.

d'Aspremont, Claude and Rodolphe Dos Santos Ferreira (2013) Household behavior and individual autonomy: an extended Lindahl mechanism. *Economic Theory* 55(3), 643–664.

Dauphin, Anyck, Abdel-Rahmen El Lahga, Bernard Fortin, and Guy Lacroix (2011) Are children decision-makers within the household?. *The Economic Journal* 121(553), 871–903.

de la Croix, David and Matthias Doepke (2003) Inequality and growth: why differential fertility matters. *The American Economic Review* 93(4), 1091–1113.

Doepke, Matthias and Michèle Tertilt (2016) Does female empowerment promote economic development?. Unpublished manuscript.

Duflo, Esther (2003) Grandmothers and granddaughters: Old-age pensions and intrahousehold allocation in South Africa. *The World Bank Economic Review* 17(1), 1–25.

Dunbar, Geoffrey R., Arthur Lewbel, and Krishna Pendakur (2013) Children's resources in collective households: identification, estimation, and an application to child poverty in Malawi. *The American Economic Review* 103(1), 438–471.

Gobbi, Paula (2016) Childcare and commitment within households. Unpublished manuscript, revision of the IRES Discussion Paper 2013/19.

Haddad, Lawrence J., John Hoddinot, and Harold Alderman (1997) *Intra-household Resource Allocation in Developing Countries: Models, Methods, and Policy*. Johns Hopkins University Press, Baltimore, MD.

Jerven, Morten (2013) *Poor Numbers: How we are Misled by African Development Statistics and what to do About it*. Cornell University Press, Ithaca, NY.

Lechene, Valérie and Ian Preston (2011) Noncooperative household demand. *Journal of Economic Theory* 146(2), 504–527.

Lundberg, Shelly J., Robert A. Pollak, and Terence J. Wales (1997) Do husbands and wives pool their resources? Evidence from the United Kingdom child benefit. *Journal of Human Resources* 32(3), 463–480.

Minecofin (2002) *A Profile of Poverty in Rwanda.* Rwanda: Government report, Ministry of Finance.

Ravallion, Martin (1994) *Poverty Comparisons*. Fundamentals of Pure and Applied Economics, Volume 56, Harwood Academic Press, Chur, Switzerland.

Ravallion, Martin (1998) *Poverty Lines in Theory and Practice.* Living Standards Measurement Study Working Paper 133, World Bank Publications, Washington, DC.

Thomas, Duncan (1993) The distribution of income and expenditure within the household. *Annales d'Economie et de Statistique* 29, 109–135.

Zelizer, Viviana A. (1989) The social meaning of money: "Special monies". *American Journal of Sociology* 95(2), 342–377.

https://doi.org/10.1017/dem.2017.12 Published online by Cambridge University Press