INTRAHOUSEHOLD INEQUALITIES AND POVERTY IN SENEGAL

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Abstract:

This paper uses a novel survey to re-examine inequality levels in Senegal. Using consumption data collected at a relatively disaggregated level within households, it first underlines that consumption inequality in this country is likely to be much higher that what is commonly thought, with a Gini index reaching 0.53. This paper also reveals the extent of within household consumption inequalities. We show that within household inequality accounts for as much as 15% of total inequality in Senegal. One of the consequences of such unequal repartition of resources within households is the potential existence of "invisible poor" in households classified as non-poor. Our assessment is that as many as 12.5% of the poor individuals live in non-poor households. In total, our results suggest that the more complex the household structure, the bigger the household size, the more inequality is likely to be underestimated when computed using standard consumption surveys.

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1. INTRODUCTION

Inter-personal inequality in living standards within households is a relatively uncharted territory. Indeed, consumption or income data are usually collected at the household level, and individual consumption levels are derived from this aggregate measure. Standard measures of poverty and inequality are calculated assuming that resources are shared equally within the household (with some normalization for size and demographic composition). Thus, the individual poverty statuses calculated from most household surveys are homogenous at the household level.

Yet it appears likely that individuals within the same household do not always have the same living standards: income and resources are not necessarily pooled and members do not share in them equally. There is evidence that individuals within a household may not be equally vulnerable to shocks (Dercon and Krishnan 2000, Rose 1999). Their ability to protect themselves will also differ. Gender and age are arguably the most prominent individual attributes along which differentiation takes place within the household. In countries where poverty is widespread, such intra-household inequalities might be particularly serious as it might bring some individuals at very low levels of welfare.

In Senegal where households extend far beyond the parents-children nucleus, with both vertical and horizontal extensions of the household being very frequent, the chances for unequal distribution of resources among household members are particularly large. The household structure is rather complex, due to polygamy, to the frequent presence of foster children (see Beck et al 2015) and extended family members. Further, fertility level is relatively high (about five children per woman, see Lambert and Rossi 2016). In such context, aside from gender and age, other lines of differentiation might be relevant, such as the central or peripheral position in the household (as assessed by some measure of distance to the head of household for example).

Some attempts, based on structural models of intra-household allocation of resources (collective household models, see Chiappori 1988), deliver estimates of consumption shares by type of household members for nuclear households (Dunbar et al. 2013). In general, these estimates cannot be confronted to the actual sharing of resources, as these data are not available. Further, there is not yet an available model to account for the more complex structure and budgetary organization of West-African households.

We conducted an unusual survey aimed at better understanding household structure and intra-household resource allocation in Senegal (De Vreyer et al. 2008). The consumption section of the survey has been designed to collect consumption expenditures at the level of small groups within the household. Uniquely, the data can be used to construct a relatively individualized measure of consumption, which allows us to better assess individual economic welfare.

These data are very revealing on intra-household inequalities. The data demonstrate that not everyone has the same level of access to resources. In general, food expenditures are equitably distributed, as far as it is observable, since in most cases, meals are collectively taken within a single dish and we do not observe differences in individual food intake. Differences emerge with respect to non-food expenditures. It appears that intra-household inequalities account for a non-negligible share of total inequalities in Senegal.

We consider the consequences of these inequalities within households in terms of poverty analysis. It might be of importance in a country like Senegal where the poverty rate reaches about 48% at the time

of our survey (World Development Indicators[1]). We find that about 8% of non-poor households contain at least one poor cell. There are also non-poor cells in poor households. Larger cells, often containing young children, figure prominently among poor cells. It is estimated that by targeting poor households (instead of poor cells), policies aiming to reduce child poverty would miss between 13 to 18% of poor children (depending on the poverty line).

The estimations mentioned above are obviously highly dependent on the choice of a poverty line. In the paper, we explore sensitivity to this choice. We also aim at characterizing households where poor individuals might be missed by standard measures of consumption. This is a necessary step to improve targeting of social policies. Given that a number of new redistributive public policies are developed today, gaining a thorough understanding of these issues is all the more crucial.

We examine and document these inter-personal inequalities within households, revealing the characteristics associated with higher relative vulnerability. We further discuss how ignoring this dimension of inter-personal inequality leads to flawed poverty diagnostics. In section 2, we present the data collected with all their specificities. In section 3 we describe within households inequality and its contribution to overall inter-individual inequality. Section 4 is dedicated to the revision of poverty assessment brought about by the prevalence of within household inequalities, and section 5 concludes.

2. THE "POVERTY AND FAMILY STRUCTURE" SURVEY.

1. *CONTEXT*

Senegal is a West African country, with a population of about 14 million in 2013 (World Development Indicators), predominantly Muslim (95% of adults are Muslim according to our data), and made up of over twenty ethnic groups.

Senegal has a Human Development Index that ranked it 154th in 2012 (UNDP, 2013). GDP grew at an average of 5% per year in the 10 years before our survey took place (1995-2005) (Government of Senegal, 2013). At that date, nearly half of the population was still living with an income below the national poverty line (World Development Indicators). Having faced a series of economic shocks, the annual growth rate of GDP per capita staggered in the period 2005-2011 at an average of 0.5% per year and poverty only decreased modestly over the same period, from 48.3% to 46.7%. More than half the population is rural (55%) and the challenges faced for poverty reduction are even more acute in rural areas (Government of Senegal, 2013). According to World Development Indicators, Senegal presents relatively high levels of inequality with a Gini index calculated by the World Bank reaching 40.3 in 2011.

2. *THE SURVEY*

The data come from an original survey entitled *Pauvreté et Structure Familiale* (Poverty and Family Structure, henceforth PSF) conducted in Senegal in 2006-7. The PSF survey results from the

[1] World Development Indicators, http://data.worldbank.org/data-catalog/world-development-indicators

cooperation between a team of French researchers and the National Statistical Office of Senegal.[2] It is a nationally representative survey covering 1,800 households spread over 150 clusters drawn randomly from the census districts so as to insure a nationally representative sample. About 1,780 records can be exploited. Nevertheless, for the purpose of this paper, we exclude households with missing consumption information and few (19) outliers. We are left with a sample of 1728 households.

This survey collects the usual information on individual characteristics, as well as a detailed description of household structure, consumption and budgetary arrangements.

a. CONSUMPTION

Contrary to traditional consumption surveys that only aim at estimating the level of household consumption, PSF is designed to allow a relatively precise measurement of individual access to resources. Interviews conducted at the early stages of the PSF project showed that within Senegalese households, it is possible to distinguish sub-groups of household members that are at least partly autonomous in their budget management. Consumptions common to various groups in the household appeared clearly defined, as well as the responsibilities for paying for those consumptions, and groups own resources turned out to be not entirely pooled. We designed the survey so as to capture this detailed information.

To best capture intra-household structure and resource allocation, each household was divided into "cells" whereby the head forms a cell with unaccompanied dependent members, each wife of the head and her children and any other dependents then form separate cells, as do any other adults with dependent (such as a married brother or a married son for example). Polygamous men other than the household head are treated in the same way as the head, with the husband and each wife in separate cells.This cell structure reflects households' internal organization in Senegal (and other parts of West Africa). In the PSF sample, more than a third of households contain at least three cells (see table 2 below).

Consumption data are collected in four distinct parts, food taken at home, household common consumption expenditures, including self consumption of household products, cell specific expenditures (such as clothing, mobile phone, transportation, and food outside the home expenditures) and finally expenses shared between several cells (but not common to the whole household). From this data, per capita consumption is computed at the cell level. Common consumption expenditures are attributed to cells on the basis of the number of members they include, assuming these expenditures are shared equally among all household members. Food expenditures are compiled based on a detailed account of who shares which meal and how much money is specifically used to prepare the meal.[3]

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[2] Momar B. Sylla and Matar Gueye of the Agence Nationale de la Statistique et de la Démographie of Sénégal (ANSD) on the one hand and Philippe De Vreyer (University of Paris-Dauphine and IRD-DIAL) Sylvie Lambert (Paris School of Economics-INRA) and Abla Safir (World Bank) designed the survey. The data collection was conducted by the ANSD thanks to the funding of the IDRC (International Development Research Center), INRA Paris and CEPREMAP. The survey is described in detail in De Vreyer et al., 2008.

[3] The DQ, « Dépense quotidienne », the name Senegalese give to the amount of money a woman has at her disposal to buy the fresh ingredients for the meals of the day. One of the husband's duties is to provide the DQ.

Each cell is ascribed its share in the food expenditures according to the per capita expenditures for the meals it joined in. Food expenditures for meals at home are often shared by the whole household. Nevertheless, in 17% of households, subgroups emerge that take some or all of their meals separately, making room for unequal food consumption among household members. In addition, some members take parts of their meal outside. In any event, non-food expenditures naturally offer wider possibilities of divergence within households.

All the analyses presented in this paper exclude housing expenses. In fact, only a very small share of the sample declares paying a rent for their dwelling. In some regions, and in many clusters, not a single household pays a rent. When everyone lives in their own-built adobe house, the market price for such dwelling simply doesn't exist. In such a situation, it is hardly possible to use the data to impute rents to home owners. Hence the term "total consumption" used in this paper in fact refers to total consumption except housing (rent) expenses.

A measure of total cell's consumption is then constructed — by adding expenditures specific to the cell and not shared with any other cell plus the cell's imputed share of the expenditures shared with other cells and of the household's joint expenditures—allowing an identification of unequal consumption levels within households. Our most individualized measure of consumption is then the per capita cell's consumption. The same can obviously be done using equivalence scales to obtain per adult equivalent consumption measures.

It is important to note that the survey is designed so that the information that is collected at the cell level is not the expenditures made <u>by cell's members</u> but really the expenditures made by anyone, whether or not member of the cell or of the household, <u>to the benefit of cell's members</u>. For example, any expenditure made by the head of household for the clothing of his children are recorded in the cell where the children are listed, more often than not that of their mother, that will be distinct from the one of their father. In addition to the level of consumption cells benefit from, the contributors to these expenditures are also registered, separately for each category of goods. In the above example, the identifier of the household's head would be recorded next to the clothing expenditures in the children's cell.

A first remark to be made is that by proceeding in this way, several members of the household are contributing information to the consumption survey. Since the household head doesn't observe directly all individual expenditures, in particular in a context where individual resources are not public knowledge within the household (see Boltz et al. 2015), interviewing other household's members allows to record expenditures that might have gone unnoticed otherwise. Further, the sheer fact that consumption is recorded in a more disaggregated manner allows for a better recall. As a result, the total amount of expenditures we record is significantly higher than the one reported by the standard consumption survey conducted in Senegal the previous year (ESPS).[4] The mean is about 30% higher in PSF than in ESPS. This difference is in itself an important result: traditional surveys in countries where individuals within the household do not share fully the information on their resources and on

[4] Enquête Suivi de la Pauvreté au Sénégal (ESPS), conducted in Senegal between December 2005 and April 2006.

their expenditures are likely to seriously underestimate consumption.[5] Such underestimation is likely to be more important for households in the upper part of the consumption distribution. In fact, poor households have less often several income earners or transfer recipients, so that opportunities for individual, unnoticed, expenditures are plausibly less frequent. Consequently, if we use the same poverty line, poverty headcount computed on the PSF data yields only a slightly lower poverty level than when computed on ESPS and the poverty gap is hardly different (see table 1).

In what follows, we talk of *individual consumption* or *per capita cell's consumption* when we measure consumption per capita at the cell level, while the term *per capita household's consumption* designates the measure obtained with the more "traditional" way of measuring individual consumption, when individuals' access to resources is estimated from the aggregate household measure of consumption. The comparison between the inequality and poverty diagnostics reached when using one or the other measure of consumption is the basis of the analysis presented in this paper.

The poverty analysis is conducted in adult equivalent terms, so as to produce estimates comparable to those based on ESPS. The equivalence scale used is the following: adults aged 15 or over receive weight 1; children between 0 and 14 have weight 0.5. This is the one used by Ndoye et al (2009) for their poverty analysis.

Table 1: "Poverty estimates"

	ESPS	PSF	ESPS	PSF
	FGT(0)	FGT(0)	FGT(1)	FGT(1)
National	50.8	47.84	16.4	16.69
Dakar	32.5	29.07	8.3	8.18
Other urban areas	38.8	37.24	10.8	10.44
All urban areas		32.71		9.18
Rural areas	61.9	59.32	21.5	22.39

PSF2006/2007, N=1728 observations, authors' calculations. ESPS results taken from Ndoye et al (2009)

It is interesting to note that despite recording higher average consumption, the PSF survey produces poverty estimates that are very comparable to that obtained with the ESPS survey, both in terms of headcount and poverty gap, so that in aggregate, the poverty diagnostic doesn't differ much.

b. Household Structure

Table 2 describes the main characteristics of Senegalese households. These households are large, with about eight members on average in the PSF sample, with a dependency ratio nearly equal to 50%. They are typically multigenerational and extended both horizontally and vertically, with 28.7% of

[5] The difference with the ESPS estimates should also be in part ascribed to the economic growth of Senegal in 2006, but it was not more than 2% and cannot explain much of the gap observed.

household members that are neither the head, nor one of his wives or children. Two thirds of households include such “extended” family members.

Polygamous unions are common, with 23% of married men and 35% of married women engaged in such unions. Most of these comprise a husband and two wives (only 20% of polygamous unions have more than two wives). We find that 31% of polygamous men have non-cohabiting wives. In half of these cases, the husband is either considered the head of both households, or of one, while one of the wives is considered head of the other household. In the other half, a married polygamous woman lives in a separate household headed by a relative (mainly her father, brother or son).

More than half of the households live in rural areas, while 28% are in Dakar. About one fifth of those households are headed by a woman and 40% by an uneducated person. Cells other than the household head’s cell are in vast majority (80%) headed by a woman, are younger and less often educated. Less than 2% of those cells are that of polygamous men that are not household heads.

Table 2a: Household characteristics

	N	Mean	min	Max
Household size	1,781	8.26	1	44
Number of cells per household	1,781	2.50	1	12
3 cells or more (%)	1,781	37.85		
Nb of children 0-5 y.o.	1,781	1.52	0	11
Nb of children 5-15 y.o	1,781	2.11	0	13
Nb of elderly 66+ y.o	1,781	0.31	0	4
Share of extended family members in hh (%)	1,781	28.69	0	97
Hhold contains extended family members (%)	1,781	66.94		
Dakar (%)	1,781	28.32		
Other urban areas (%)	1,781	19.71		
Rural areas (%)	1,781	51.97		
Female household head (%)	1,781	20.56		
Polygamous male hh.head (%)	1,781	22.10	0	100
Polygamous female hh. head (%)	1,781	5.47	0	100
Uneducated hh. head (%)	1,781	42.18	0	100
Age of the household head.	1,777	49.82	18	93

Table 2b: Cell characteristics

	N	Mean	min	Max
Cell size	4,372	3.30	1	15
Nb of children 0-5 y.o.	4,370	0.61	0	5
Nb of children 5-15 y.o	4,370	0.84	0	7
Nb of elderly 66+ y.o	4,370	0.12	0	3
Female cell head (%)	4,372	56.79		
-excl household head	2,591	80.91		
Polygamous male cell head (%)	4,372	9.97		
-excl. household head	2,591	1.88		
Polygamous female cell head (%)	4,372	19.64		
-excl household head	2,591	29.08		
Uneducated cell head (%)	4,372	52.76		
-excl household head	2,591	59.81		
Age of the cell head.	4,367	42.19	0	98
-excl household head	2,588	37.14	6	98

PSF2006/2007 survey, using sampling weights.

3. INEQUALITY AND INTRA-HOUSEHOLD INEQUALITIES LEVELS

a. GLOBAL INEQUALITY.

Using per capita household's expenditures level, the Gini index is 54 %, quite a bit higher than the one reported in the WDI (40.3% for 2011)[6]. As expected, the Gini index of inequality in the distribution of individual food expenditures is much lower than that of non-food spending, reaching 39% vs. 72% (see table 3).

Table 3: Inequality measures

	Gini	90/10	75/25	Mean log dev	Theil
Per capita Household consumption:					
Per capita household's total consumption	53.96	7.88	3.03	0.50	0.69
Per capita household's non-food consumption	71.60	20.46	5.07	1.02	1.33
Per capita household's food consumption	39.46	5.95	2.48	0.26	0.28
Individual consumption:					
Per capita cell's total consumption	56.39	8.56	3.09	0.56	0.82
Per capita cell's non-food consumption	75.20	25.82	5.77	1.18	1.60
Per capita cell's food consumption	40.68	6.44	2.55	0.28	0.29

PSF2006/2007, N=1728, authors' calculation, using sampling weights

All other measures of inequality display the same result: when using the per capita cell's consumption measure, rather than the per capita household's consumption, inequality levels are revised upward. Most of the difference comes from the inequality of non-food consumption, while inequality in food consumption is only mildly affected. The Gini of total consumption increases to 56% when each individual is attributed their cell's per capita consumption level (and that of non-food consumption to 75%). The difference with that based on per capita household's expenditures might seem small, but it would be wrong to interpret this as the sign of negligible intra-household inequalities. In fact, a Theil decomposition indicates that nearly 17% of total inequalities in non-food expenditures occur within households (table 4). This is obviously much less in the case of food expenditures, reaching only about 6% of total inequalities.

[6] It is slightly lower when using per adult equivalent measure of consumption. See table A1 in the appendix.

Table 4: Inequality decomposition

	Theil within	Theil between	share within
Individual consumption	0.13	0.69	15.77
Individual non-food consumption	0.27	1.33	16.86
Individual food consumption	0.02	0.28	6.17

PSF2006/2007, N=1728, authors' calculations, using sampling weights.

It is well known that inequality measures are particularly sensitive to measurement error. In this particular case, working at the cell level rather than the household one might exacerbate the problem. It is therefore necessary to evaluate the sensitivity of our estimates of inequality to such measurement error at the cell level. The inequality decomposition is likely to be affected and this will be assessed. (*This will be done very soon, both by estimating confidence intervals using bootstrap and by simulating measurement errors).*

b. WITHIN HOUSEHOLD INEQUALITY.

One might want to characterize the level of inequality a given household is experiencing. This can be done in various ways. Table 4 gives the measures of within household Theil indexes and points at a rather high inequality level in terms of non-food consumption. We can also use the ratio of expenditures of the richest cell to that of the poorest. Inequalities within the household are also evident by this measure: the ratio between the expenditures of the richest and poorest cells within a household can be as high as 5.3 after trimming off the 5% most unequal households. On average, the richest cell has a consumption that is more than twice as much as that of the poorest (Table 5).

Using this ratio, it can be seen that it is lower than 1.25 for a good third of the households with 2 cells of more, but greater than 2 for more than a quarter of those households. We will categorize the first group of households as "low inequality" households, the latter as "very high inequality" households, and the remaining middle group as "high inequality" households.

Table 5: Within Household Inequality

	N	Mean	p25	p50	p75
Max/min	1,399	2.42	1.15	1.43	2.08
Low inequality: Max/min<=1.25	1,399	0.36			
Very high inequality: Max/min>=2	1,399	0.27			

PSF2006/2007, sample of households with 2 cells or more, authors' calculations.

It is worth noting that in the large households (those with 3 cells or more), the cell of the household head is often the richest cell. One could worry that this is in part spurious if the household head declared as his expenditures some that in fact benefit to the whole household. Nevertheless, the levels of inequality among the other cells of the household are quite high as well, since, excluding the cell of the household head, the ratio of max consumption to min consumption still reaches 2.2 on average. Clearly, in those households with 3 cells or more, within household inequality is higher if we take the head into account (the max to min ratio reaches 3 on average).

We examine the correlates of being an unequal household (table 6). Column (1) presents the coefficients of an ordered probit estimation for an ordered variable taking value 1 if the household presents a low inequality level, 2 a high inequality level and 3 for a very high inequality level, as defined above. Column (2) gives the OLS estimation where the dependent variable is the log of the within household Theil index. Both approaches give rather similar results.

Household structure clearly plays a role in explaining intra-household inequality. In a nearly mechanical way, larger households are more likely to be unequal. Polygamous households and households with young children appear to also allow for more heterogeneity of consumption levels. In a less expected manner, households containing extended family members display lower levels of inequality. It appears within household inequality level increases with household consumption, and in a related way is lower when the household head is uneducated and higher if the household lives in Dakar.

Table 6: Correlates of within household inequality.

VARIABLES	(1) Type of household	(2) Log of within household Theil
Other urban areas	-0.233***	-0.594***
	(0.0781)	(0.196)
Rural	-0.195**	-0.373*
	(0.0912)	(0.191)
Polygamous hhold head	0.196***	0.308**
	(0.0745)	(0.147)
Hhold contains extended family members	-0.0233	-0.0556*
	(0.0148)	(0.0295)
Hhold size	0.0447***	0.0942***
	(0.0169)	(0.0338)
Uneducated hhold head	-0.180**	-0.343**
	(0.0748)	(0.135)
Log per capita household expenditures.	0.230***	0.501***
	(0.0483)	(0.111)
Nb of children 0-5 y.o.	0.130***	0.258***
	(0.0261)	(0.0529)
Nb of children 5-15 y.o	0.0233	-0.0125
	(0.0268)	(0.0492)
Nb of elderly 66+ y.o	0.0599	0.00412
	(0.0622)	(0.141)
Constant cut1	2.952***	
	(0.661)	
Constant cut2	4.032***	
	(0.665)	
Constant		-11.76***
		(1.516)
R-squared		0.118
Observations	1,399	1,393

(1) Ordered probit estimates : The type of household varies from 1 to 3, 1 being the most equal and 3 the most unequal.
(2): OLS estimates.
Additional controls: ethnic group of the household head and religion. Standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1

The evidence of strong within-household inequality raises the suspicion that some poor individuals might go unnoticed because they live in households where not everyone is poor and that may not be identified as poor by poverty measures based on standard assessment of consumption levels. This issue is explored in the next section.

4. MEASURES OF POVERTY IN SENEGAL

a. *POVERTY LINES*

In this section we examine the poverty rates obtained from consumption observed at the cell and household levels in the PSF. In order to compare with the results of previous surveys, we choose to use the same poverty lines as that of Ndoye et al. (2009), which presents a poverty profile established with data from the Enquête Suivi de la Pauvreté au Sénégal (ESPS), conducted in Senegal between December 2005 and April 2006. Two lines are retained, established following the basic needs approach. First a food poverty line is defined as the cost of the food basket that provides with at least 2400 kcal per day. The second line is the national poverty line in Senegal. It is obtained by augmenting the food poverty threshold with the amount of resources that is necessary to cover individual basic needs other than nutrition. This amount is obtained through the observation of the average non food consumption of households of which food consumption per adult equivalent is more or less than 5% of the food poverty threshold.

In order to transpose this procedure to our data, we have to hold account of the fact that between 2005-2006 and 2006-2007 when the PSF was on the field, the consumption price index increased. The PSF has been conducted between November 2006 and April 2007, almost exactly a year after the ESPS. In order to estimate the average evolution of the price index between these two periods, we computed the average of the annual inflation rates calculated over the 6 twelve months periods going from November 2005 to November 2006, December 2005 to December 2006, January 2006 to January 2007, February 2006 to February 2007, March 2006 to March 2007 and April 2006 to April 2007. For total consumption this leads to an average one year inflation rate of 4.7% and 5% for food consumption. Table 8 shows the values of the two poverty lines for Dakar, other towns and rural areas separately.

The food poverty line is very close to the $1.25 (PPP 2005) international line (that would be equal to 366 CFA francs at the time of our survey). The $2 line corresponds to 586 CFA francs.

Table 8: Value of the poverty thresholds

	Food poverty line	National poverty line
Dakar	397	968
Other Towns	370	693
Rural Areas	357	588

Note: numbers correspond to daily expenditures per adult equivalent. Measurement unit is the CFA franc.

b. POVERTY OF HOUSEHOLDS, POVERTY OF CELLS

In table 9, we present the various poverty estimates obtained for the two poverty lines. The upper part shows poverty estimates based on per adult equivalent household consumption, while the bottom part present results based on per adult equivalent cell consumption. As already mentioned the overall poverty estimates using PSF are slightly below the measures obtained with the usual consumption survey conducted by the Senegalese statistical office (see table 2). Nevertheless, looking at the upper part, we can see that poverty remains high in Senegal, particularly in the rural areas where it strikes 59% of the population. Acute poverty, measured with the food poverty threshold, is concentrated in the rural areas, where it reaches alarming levels with a bit more than 28% of the population. These results are in line with those obtained by the 2005 Demographic and Health Survey (Ndiaye and Ayad, 2006), which finds that in rural areas 20.6% of children have a height for age z-score below the median WHO reference by more than two standard deviations. This percentage equals 8.5% in urban areas. The same survey shows that 76.8% of children and 54.4% of mothers in urban areas, 85.7% of children and 63.9% of mothers in rural areas were afflicted by a more or less severe form of anaemia. Thus in spite of real progress in the fight against poverty malnutrition remains an important problem in Senegal.

Table 9: Poverty estimates PSF 2006/2007 - different poverty lines

	Food poverty line		National poverty line	
	FGT(0)	FGT(1)	FGT(0)	FGT(1)
Per adult eq. household consumption:				
National	17.95	4.61	47.84	16.69
Dakar	1.58	0.34	29.07	8.18
Other urban areas	7.74	1.44	37.24	10.44
Rural areas	28.29	7.48	59.32	22.39
Individual consumption:				
National	20.03	5.57	51.61	18.74
Dakar	1.92	0.46	34.63	10.29
Other urban areas	9.85	2.15	40.48	11.95
Rural areas	31.10	8.88	62.51	24.59

PSF2006/2007, authors' calculations, using sampling weights.

Strikingly, using per adult equivalent cell consumption rather than per adult equivalent household consumption leads to revise poverty levels upwards, both for the head count and the poverty gap.

The results show that the aggregated approach leads to an underestimation of poverty rates by 0.3 to 5.5 percentage points, depending on the poverty line and the residential area. This corresponds to an underestimation of the prevalence of poverty by 7.3% (national poverty line) and 10.4% (food poverty line) at the national level. The underestimation is particularly severe in Dakar (above 15%), as could have been expected given the especially high within household inequality in that area.

As can be seen in table 9, the difference in poverty measures based on per capita household consumption or per adult equivalent cell consumption depends on the chosen poverty line. The sensitivity of these results to this choice requires further assessment of the robustness of the above findings. Figures 1 to 4 below show the estimated difference between the poverty rates obtained with

per capita household consumption and per capita cell consumption depending on the position of the poverty line.[7] Figure 1 to 3 show the results obtained for Dakar, the other towns and the rural areas respectively, while figure 4 show those for Senegal as a whole. As we can see the difference between poverty rates is significant for a large range of poverty lines. For rural areas the maximum gap is obtained for a poverty line that lays between the food and national poverty thresholds. For Dakar and other towns, the graph shows that a larger gap would be obtained with higher poverty thresholds, and that below the food poverty lines, the difference is hardly statistically significant.

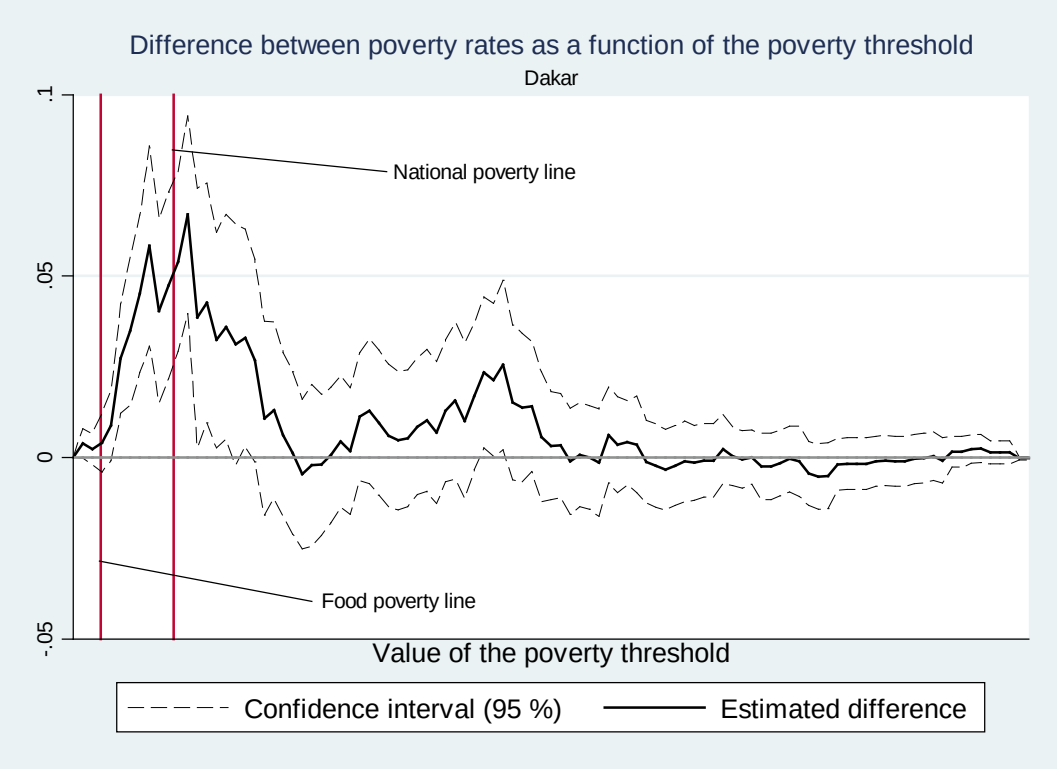

Figure 1

[7] Graphs have been drawn using Stata command cfgts2d from the DASP Package and available on line at http:// http://dasp.ecn.ulaval.ca/ (Araar and Duclos, 2007).

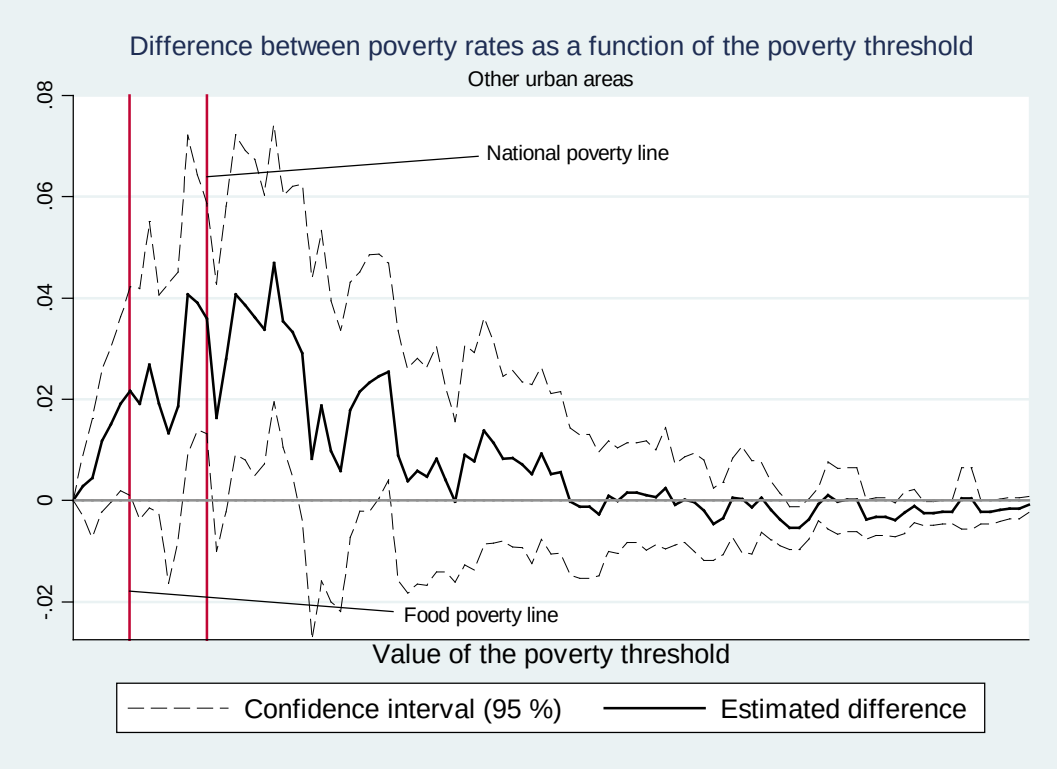

Figure 2

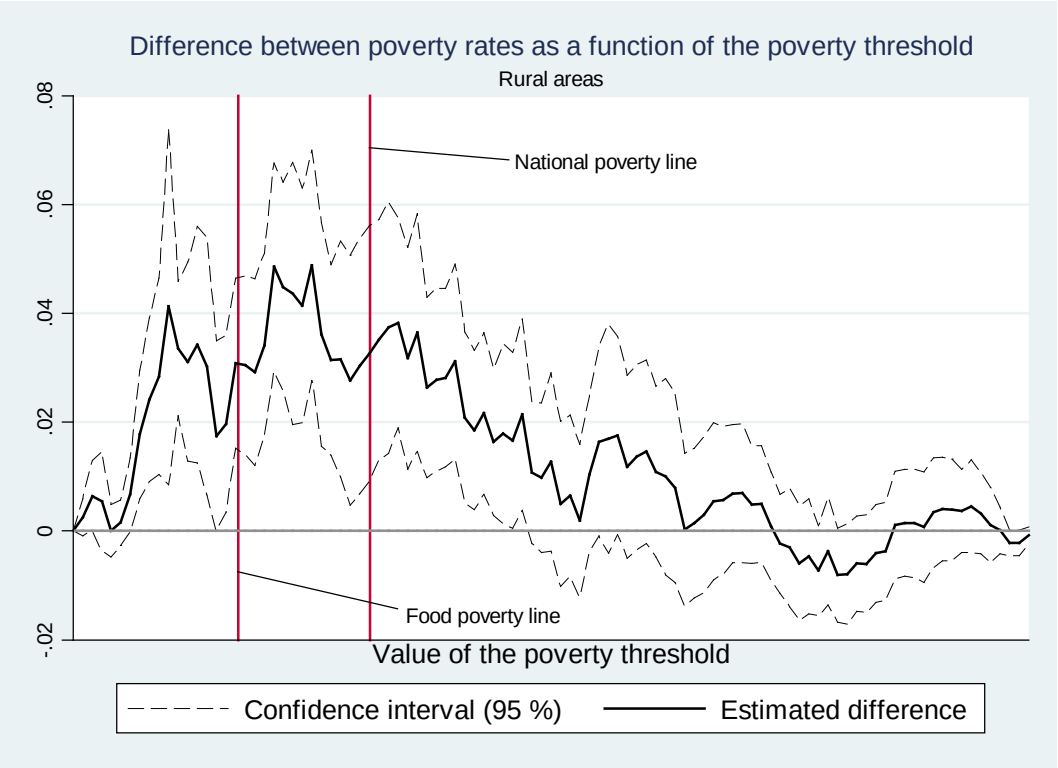

Figure 3

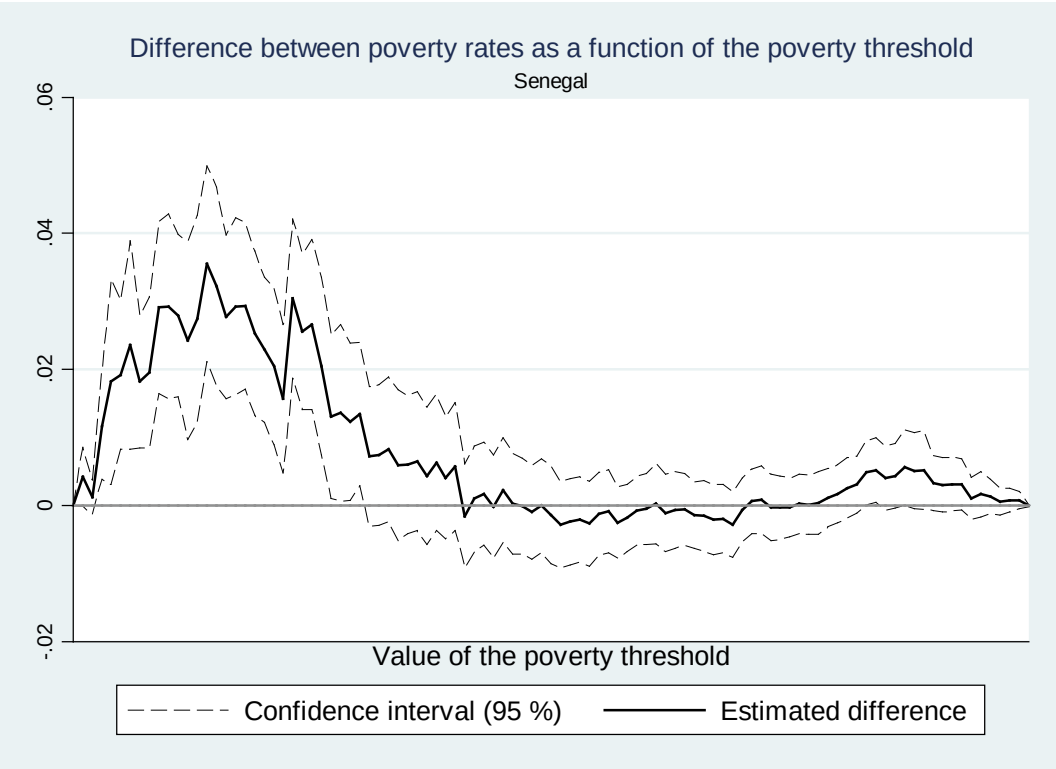

Figure 4

c. *Being poor among the non-poor.*

The inequalities documented above induce the existence of poor cells within non-poor households and, inversely, non-poor cells within poor households. This can be seen in table 10, where one finds the distribution of cells according to their poverty status and that of their household. We observe that the proportion of poor cells belonging to a non-poor household varies between 2.6% and 5.3% of cells depending on the poverty threshold (column 4). Looking now at the population percentages (column 6) we observe that poor cells in non-poor households represent a higher proportion of the population than that of cells. The opposite is true for non-poor cells within poor households. In other words poor cells in non-poor households seem to be large cells, and that explains the higher poverty rate when using per adult equivalent cell consumption rather than per adult equivalent household consumption.

In total, following the national poverty threshold, about 8%[8] of non-poor households include at least one poor cell, which means that 11.5% of the members of non-poor households are in fact poor, or that 12.5% of the poor live in non-poor households. This suggests that measuring poverty using a well-being measure computed at the household level can lead to a serious underestimation of the extent of poverty. In what section 4.f, we shall see that this is especially true for children.

Table 10: Distribution of the poor by Poverty Status of their household

	Households	Cells	Individuals

[8] 4.92/(58.1+4.92) from column 2.

	N	%	N	%	N	%
National poverty line:						
Poor in non-poor household	85	4.92	223	5.30	856	6.25
Poor in poor household	608	35.19	1,600	38.04	5,953	43.45
Non-poor in poor household	31	1.79	172	4.09	317	2.31
Non-poor in non-poor hhold.	1,004	58.10	2,211	52.57	6,576	47.99
Food poverty line:						
Poor in non-poor household	37	2.14	110	2.62	406	2.96
Poor in poor household	190	11.00	517	12.29	1,970	14.38
Non-poor in poor household	10	0.58	85	2.02	173	1.26
Non-poor in non-poor hhold.	1,491	86.28	3,494	83.07	11,153	81.40

PSF2006/2007, authors' calculations.

d. Cells and Household poverty profiles

In this section, we estimate the probability for a household and for a cell to be classified as poor using a logit model. We here define poverty using the national poverty line.

In table 11, column (1) gives the results of the estimation at the household level. Clearly, rural households are more likely to be poor, and this is by far the stronger correlates of poverty, with a risk of poverty more than 2.5 times higher for rural household than for Dakar ones.

Table 11: Poor Households and poor cells

VARIABLES	(1) Household poverty	(2) Cell poverty	(3) Cell poverty Hhold FE	(4) Cell poverty Hhold FE
Female household head	0.599***	0.548***		
	(-3.04)	(-4.21)		
Hhold head's age	1.011***	1.002		
	(2.64)	(0.42)		
Hhold dependency ratio	2.262**	1.056		
	(2.53)	(0.21)		
Household size	1.188***	1.054***		
	(6.85)	(3.73)		
Number of cells	0.691***	0.949		
	(-3.94)	(-0.95)		
Hhold head is able to read	0.571***	0.759**		
	(-3.32)	(-2.09)		
Hhold head is able to calculate.	0.849	0.998		
	(-0.96)	(-0.02)		
Hhold head received koranic education	0.970	0.904		
	(-0.25)	(-1.02)		
Other urban areas	1.170	1.147		
	(0.96)	(1.32)		
Rural areas	2.645***	2.340***		
	(6.40)	(8.96)		
Female cell head		1.097	1.133	1.011
		(0.68)	(0.42)	(0.03)
Cell head's age		1.009**	1.018*	1.018
		(2.11)	(1.80)	(1.46)
Cell head is able to read		0.781*	0.738	0.759
		(-1.69)	(-1.03)	(-0.77)
Cell head is able to calculate.		0.625***	0.690	0.733
		(-3.23)	(-1.33)	(-0.84)
Cell head received koranic education		1.058	1.258	1.491
		(0.54)	(0.86)	(1.14)
Cell dependency ratio		1.128	2.121**	1.710
		(0.84)	(2.39)	(1.36)
Cell size		1.181***	1.416***	1.257***
		(7.38)	(6.98)	(3.66)
Cell head is the hhold head		0.923	0.504**	0.466*
		(-0.50)	(-2.09)	(-1.83)
Cell head is hhold head's child		1.596**	1.074	0.941
		(2.47)	(0.15)	(-0.11)
Cell head is hhold head's co-spouse		1.131	3.782	4.324
		(0.27)	(0.63)	(0.78)
Cell head is hhold head's parent		1.542	1.295	0.971
		(1.23)	(0.38)	(-0.04)
Cell head is hhold head's brother/sister		1.523**	0.737	0.790
		(1.97)	(-0.76)	(-0.45)
Cell head is hhold head's other parent		1.230	0.797	1.209
		(1.22)	(-0.75)	(0.50)
Cell head has no link with hhold head		0.964	0.530	0.558
		(-0.11)	(-0.77)	(-0.78)
Constant	0.102***	0.158***		
	(-7.41)	(-7.01)		
Observations	1,728	4,203	1,007	501
Pseudo R-squared	0.144	0.132	0.325	0.199

1. Observation unit: household, column (1); cell, columns (2), (3) and (4).
2. Estimated model: logit, columns (1) and (2); conditional logit (household fixed effects), columns (3) and (4). In column (3) all cells belonging to households in which some cells are poor but not all are included, no matter if the household is poor or not. In column (4), only cells belonging to non-poor households are included.
3. Reference category for relation of the cell head to household head: Cell head is the wife.
4. Odds ratios are presented. Robust z-statistics in parentheses *** p<0.01, ** p<0.05, * p<0.10.

Female headed household on the contrary are less often poor. Although this might seem counterintuitive, this finding is relatively general as discussed in van de Walle (2013). It hides massive heterogeneity between these households according to the marital status of the woman (married, widowed or divorced). Non cohabiting married woman and divorcee that head a household are likely to be non-poor, this living arrangement being a choice that can only be made by women who can afford it. As expected, household with a literate head are also less poor.

Of interest to our main point, household structure matters a great deal. In fact, bigger household with a higher dependency ratio tend to be more often poor. But at the same time, for a given household size, having more cells reduces the risk of poverty, by about 30% for each additional cell. This might be due to the fact that an additional cell induces an additional potential income earner.

The second column does the same exercise at the level of the cell. Interestingly, the characteristics of the household head seem to matter as much as that of the head of the cell himself. The cells that are headed by the wife of the household head (the reference category of relations to the household head in the table) are less likely to be poor than any more remote cells.

The last two columns of table 11 presents the results of a conditional logit estimation that allows removing household fixed-effects. It therefore indicates which characteristics of a cell are correlated with the probability of that cell being among the poor cells in a household where not all cells are poor (and in column 4 where the household as a whole is not poor). It confirms that the cell of the household head is the least likely to be poor and that larger cells incur more poverty risk.

e. *Are the poor in non-poor households as poor as other poor?*

How poor are the poor that live in non-poor households? A natural question is that of whether the intensity of poverty is lower for them than for those who live in households where everyone is poor. Table 12 gives some elements to answer this question by presenting the poverty gap for the poor who live in non-poor households (columns c1 and c2) and comparing it to that of the poor from homogeneously poor households (a1 and a2), and from poor households with non-poor members (b1 and b2).

Table 12: Poverty gaps for poor cells in poor and non-poor households

	Food poverty line			National poverty line		
	(a1)	(b1)	(c1)	(a2)	(b2)	(c2)
National	31.86	27.27	15.86	41.33	32.22	15.54
Dakar	31.77	28.66	10.22	34.98	28.33	17.78
Other urban areas	25.77	25.00	13.13	34.56	28.28	12.09
Rural areas	32.37	27.46	16.71	43.65	34.56	15.41

Columns (a1) and (a2) show the value of the poverty gap for poor cells in poor households in which all cells are found poor; columns (b1) and (b2) show the value of the poverty gap for poor cells in poor households, in which some cells are found not poor and columns (c1) and (c2) show the value of the poverty gap for poor cells in non-poor households.

Table 12 shows quite clearly that the poor in non-poor households are less poor than other poor. At the national level, the poverty gap for this group is only half that of the poor who live in poor households that contain non-poor members. It reaches only 37% of the poverty gap of the poor in poor households. This is understandable as within household inequality is more likely to push part of the household members on the other side of the poverty line if the household as a whole is not too far from the poverty line. It suggests that the "invisible poor" are likely to be among the least poor of the poor.

f. POVERTY AMONG CHILDREN

Since large cells, more at risk of poverty, are those in which the number of children is likely the largest, one can suspect that the gap in the estimated poverty rates following the aggregated and disaggregated approach will increase when looking at poverty amongst children aged less than 15 years old. This intuition is confirmed by the results presented in table 13 (exactly equivalent to table 9, but for children). Here the differences between the estimates obtained with the two measures of consumption are even greater than for the whole population. For example, at the national level, using the national poverty line, there is a more than 5 percentage points difference. This difference exceeds 7 percentage points in the case of Dakar. In other words, in Dakar, using per capita household consumption leads to an underestimation of the poverty rate of children of about 18%.

For rural areas and the food poverty threshold, the difference between both poverty rates reaches 3.6 percentage points and for urban areas outside Dakar and the national poverty line 4.4 percentage points. As a consequence, anti-poverty policies targeted on poor households identified as such by their average expenditure by adult equivalent will miss between 9.3% (national poverty line) and 13.9% (food poverty line) of poor children at the national level, because of lack of precision in the measurement of individual consumption levels.

Table 13: Children Poverty estimates PSF 2006/2007 - different poverty lines

	Food poverty line		National poverty line	
	FGT(0)	FGT(1)	FGT(0)	FGT(1)
Per adult eq. household consumption:				
National	19.80	5.09	51.39	18.11
Dakar	1.70	0.32	32.14	9.01
Other urban areas	7.34	1.30	39.32	10.97
Rural areas	28.54	7.53	60.35	22.75
Individual consumption:				
National	23.01	6.35	56.65	20.93
Dakar	2.48	0.49	39.36	11.79
Other urban areas	10.15	2.09	43.76	13.06
Rural areas	32.57	9.24	65.28	25.78

PSF2006/2007, authors' calculations, using sampling weights.

Table 14 underlines that 12.8% of poor children live in non-poor households when using the national poverty line (and over 18% of the "food-poor" children live in non-food-poor households). Policies aiming at improving children welfare are hence likely to be partly ill-targeted if ignoring those children.

Table 14: Distribution of the poor children by Poverty Status of their household

	Households		Cells		Individuals	
	N	%	N	%	N	%
National poverty line:						
Poor in non-poor household	95	6.59	163	6.76	413	7.05
Poor in poor household	584	40.53	1,068	44.28	2,799	47.79
Non-poor in poor household	20	1.39	47	1.95	94	1.60
Non-poor in non-poor hhold.	742	51.49	1,134	47.01	2,551	43.55
Food poverty line:						
Poor in non-poor household	45	3.12	78	3.23	219	3.74
Poor in poor household	182	12.63	363	15.05	970	16.56
Non-poor in poor household	12	0.83	32	1.33	60	1.02
Non-poor in non-poor hhold.	1,202	83.41	1,939	80.39	4,608	78.68

PSF2006/2007, authors' calculations.

5. CONCLUSION

This paper uses a novel survey to reveal the extent of within household consumption inequalities. We show that within household inequality accounts for as much as 15% of total inequality in Senegal. One of the consequences of such unequal repartition of resources within households is the potential existence of "invisible poor" in households classified as non-poor. Our assessment is that as many as 12.5% of the poor individuals live in non-poor households. They are therefore ignored when the poverty status of the household is supposed to apply uniformly to all household members. This could have important consequences for the effectiveness of anti-poverty policies.

To uncover these facts, we innovated by designing a consumption survey that collects information at the level of sub-groups within the household, using different respondents for different cells. This allowed us collecting more complete consumption data, so that total consumption is measured to be higher than what was obtained with a classical consumption survey at the same period. More centrally to this paper, this approach permitted to measure consumption at a relatively individualized level and thereby to exhibit the within household unequal access to consumption.

When households are large and of a complex structure, as in Senegal and in many sub-Saharan African countries, where several relatively autonomous budgetary units cohabit, it is not the case that everyone has access to the same level of resources. In these contexts, coming as close as possible to the individual when measuring welfare is crucial in order to obtain adequate measures of poverty and help anti-poverty policies to efficiently target the poor.

Our results suggest that the more complex the household structure, the bigger the household size, the more inequality is likely to be underestimated when computed using standard consumption surveys. This would imply that cross-country comparisons of inequality levels should take into account that difference in family structure will translate into artificial differences in inequality levels.

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Table A1: Inequality measures, on per adult equivalent consumption.

	Gini	90/10	75/25	mean log dev	theil
per adult equivalent household's total consumption	51.96	7.28	2.82	0.46	0.64
per adult equivalent hhold's non-food consumption	70.33	18.62	4.71	0.97	1.26
per adult equivalent food hhold's food consumption	37.64	5.47	2.33	0.24	0.25
per adult equivalent cell's total consumption	53.97	7.72	2.87	0.51	0.75
per adult equivalent cell's non-food consumption	73.61	22.77	5.26	1.11	1.52
per adult equivalent food cell's food consumption	38.71	5.88	2.40	0.25	0.26