

Inequality, Poverty and the Intra-Household Allocation of Consumption in Senegal

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Abstract

Intra-household inequalities have long been a source of concern for policy design, but there is very little evidence. The current practice of ignoring inequality within households could lead to an underestimation of both overall inequality and poverty levels, as well as to the misclassification of some individuals as regards to their poverty status. Using a novel survey for Senegal in which consumption data were collected at a disaggregated level, this paper quantifies

these various effects. In total, two opposing effects, one on mean and one on inequality, compensate each other in terms of the overall poverty rate, but individual poverty statuses are affected. Intra-household consumption inequalities accounts for 14 percent of inequality in Senegal. The authors uncover the fact that household structure and organization are key correlates of intra-household inequality and individual risk of poverty.

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1. Introduction

Inter-personal inequality in living standards within households is a largely uncharted territory. It is unlikely that individuals within the same household always have the same living standards as income and resources are not necessarily pooled, and members do not share in them equally. If this is the case, inequality levels might well be seriously underestimated. Further, this is a question of major policy relevance as unequal access to resources might push vulnerable household members to alarmingly low consumption levels. However, gauging the extent of intra-household inequality remains an empirical challenge, since adequate data are rarely at hand.

The purpose of this paper is to provide a measure and a description of intra-household inequality in the case of Senegal using a novel survey in which household consumption data were collected at a disaggregated level, evaluate how it alters our assessment of consumption distribution in the country and identify which categories of household members are most at risk to suffer from relative deprivation.

The distribution of consumption in West-African economies is often considered to be less unequal than in other parts of Africa and Latin America; the Gini indices are around 40%, while they reach the range 50 to 60% in many Austral African or Latin American countries (see fig 2.9, chap. 2; World Bank 2005). Still, not only is income inequality fairly high (Beegle et al. 2016), but, as pointed out by Cogneau et al (2006), it is accompanied by low intergenerational social mobility, suggesting that inequality is weighing on individual life trajectories.

The above inequality assessments are typically based on standard consumption surveys, which collect information at the level of the household as a whole, often by interviewing its head. Individual consumption levels are derived from this aggregate measure. This might be a poor approximation of reality in the context of Senegal, where households extend far beyond

the parents-children nucleus, and the chances for unequal distribution of resources among household members are particularly large. The household structure is in fact quite complex, due to polygamy, to the frequent presence of foster children (Beck et al 2015) and of extended family members.

Most of the empirical work attempting to exhibit intra-household inequalities concentrates on food consumption or health and education (see Haddad *et al.* 1997 for an excellent introduction to the early research on these topics). More recently, some works 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 rarely available. The only exceptions we know of are two recent papers, using Bangladeshi data and concentrating on food consumption (Bargain et al. 2018, Brown et al. 2019). The complex structure and budgetary organization of West-African households with separate spheres of spending suggest that the Pareto optimality assumption supporting those structural models is unlikely to be verified (see Baland and Ziparo 2018). Hence, this route might not be particularly promising in such context.

Recent attempts at describing intra-household resource allocation with non-monetary measures of poverty also exist. Klasen and Lahoti (2016) study inter-individual inequality in India using individual multidimensional poverty indices (MPI), compared with the distribution of a household-based MPI. They find that intra-household inequality accounts for 30% of total inequality. More relevant to our context, Brown, Ravallion and van de Walle (*forthcoming*) use nutritional status as a proxy for individual poverty and observe that in Africa, around one half of undernourished women and children are not found in the (asset-) poorest 40% of households.

In addition, we now have strong evidence that individuals within a household may not be equally vulnerable to shocks (Case, Paxson and Ableidinger 2004, Dercon and Krishnan 2000, De Vreyer and Nilsson 2019, Rose 1999).

Despite these efforts, since very few datasets permit researchers to measure individual consumption and thereby intra-household inequality, available estimates of poverty and inequality simply ignore this issue. 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). From the conceptual standpoint alone, viewing poverty as essentially an individual state requires us to go beyond this approach. From the policy point of view, neglecting intra-household inequality is likely to introduce biases in the poverty and inequality measures. Less obvious is the fact that household-based consumption data collection could also lead to an underestimation of mean consumption, which might in turn bias poverty estimates upwards.

We conducted an unusual survey aimed at better understanding household structure and intra-household resource allocation in Senegal (*Poverty and Family Structure* survey, hereafter PSF, see 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, and involved the interview of several household members.¹ The data can be used to construct a measure of consumption at the cell level, allowing a more precise assessment of individual consumption than permitted by traditional surveys.

These data are very revealing on intra-household inequalities. In general, food expenditures appear equitably distributed as far as their actual inter-individual allocation is observable (Meals are mostly collectively taken from a single dish, see section 2.3). Differences emerge

with respect to non-food expenditures. We evaluate intra-household inequalities to account for 14% of total inequalities in Senegal. This number is shown to be 42% of the maximum that could be reached given the very large share of common expenditures (including food) in this context. This might be an underestimation, given the difficulty to observe inequality in food consumption. The overall consumption inequality is much higher than what is commonly thought, with a Gini index estimated to reach 47.1%, before we even factor in intra-household inequality.² Further, holding account of the intra-household inequality we can observe leads to revise upward the overall level of consumption inequality, up to nearly 50% for the Gini coefficient.

We find poverty measures very comparable to those produced with a more standard household survey conducted only a few months earlier. On the one hand, the mode of data collection (more than one respondent per household in PSF) seems to allow for a more complete recording of consumption leading to a 15% higher level of average consumption. On the other hand, in this context, taking into account intra-household inequalities increases the share of individuals found below the poverty line. Remarkably, in the case of Senegal, these two differences compensate each other so that the overall evaluation of poverty level doesn't depend on the survey used. The poverty rate reaches about 43% at the time of our survey when using a basic needs poverty threshold. We further discuss how ignoring inter-personal inequality leads to flawed poverty diagnostics. We find that nearly 14% of non-poor households contain at least one poor cell. There are also non-poor cells in poor households.

We conduct a number of robustness checks. Worries that the inequality results could be in part driven by measurement errors are tackled with corrections of the inequality estimates as well as with simulation techniques. Qualitatively, all results stand for plausible levels of measurement errors. Further, poverty estimates are obviously dependent on the poverty line and

we explore sensitivity to this choice. We also examine how results are affected by the equivalence scale used to weigh individuals within households.

The paper is organized as follows. In Section 2, we present the data collected, and examine the likely implications of observing consumption at the level of small groups within the household on estimated inequalities and poverty levels. In section 3, we describe intra-household inequality and its contribution to overall inter-individual inequality. Section 4 is dedicated to the revision of poverty assessments brought about by the prevalence of intra-household inequalities, and Section 5 presents some robustness checks. Section 6 concludes.

2. The “Poverty and Family Structure” survey

2.1. The Survey

The PSF Survey was conducted in Senegal in 2006-2007. It results from the cooperation between the National Statistical Office of Senegal and a team of French researchers.³ 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 or incoherent records.⁴ We are left with a sample of 1762 households. Among them more than half live in rural areas, while 28% are in Dakar.

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

Household Structure

In the PSF survey, a household is defined as the set of co-residing individuals who recognize the authority of a given household head. Table 1 describes the main characteristics of Senegalese households. In the PSF sample they are large, with about eight members on average and a dependency ratio nearly equal to 50%. Households are typically multigenerational and extended both horizontally and vertically, with 28.2% of members that are neither the head, nor one of his wives or children.⁵ Two thirds of households include such “extended” family members.

Polygamous unions are common, with 24.7% of married men and 38.7% 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 this work, we ignore the consumption of non-co-residing spouses of the household head.

Field 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 particular with respect to their budget management. To best capture intra-household structure and resource allocation, the survey was designed to record this internal household organisation. Each household was divided into groups, called “cells”, whereby the head forms a cell with unaccompanied dependent members (a widowed parent, a child whose mother is not present in the household, an unmarried sibling when no parent co-resides...); each wife of the head, 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). A similar approach had already been used to structure households in the 1988 Senegalese census (van de Walle and Gaye, 2006) and seemed very intuitive to enumerators

who had to implement the survey. In the PSF sample, more than a third of households contain at least three cells (see Table 1).⁶ Households have on average 2.5 cells, but that uncovers a wide diversity of situation. In fact, nearly 18% of the households have only one cell, while 38% have 3 cells or more. Nuclear households (composed of husband, wife and their unmarried children) account for about 40% of the households, while nearly 49% include some type of horizontal (siblings, but also uncles/aunts or nephews/nieces) or vertical extensions (parents, grand-parents, grand-children). The cohabitation of 3 generations or more is particularly frequent in rural areas, where it is the case for 44% of the households (vs 22% in Dakar). The remaining extended households include cousins or non-family members. Despite these frequent extensions, only in 15.8% of the households do we observe more than one married man with at least one wife present in the household. About one fifth of the households are headed by a woman and two-thirds by someone without any formal schooling (either no education at all or only koranic educations).

When zooming to the cell level, 40% are headed by the household head (a man in nearly 80% of the cases), 35% by his spouse, and 11% by one of his children or a son or daughter-in-law. Cells other than that of the household head are in vast majority (81%) headed by a woman. Nearly a third of the cells include at least two adults above the age of 21 (47% if considering individuals over 15), while the number of children below 15 varies from 0 (for nearly 44% of the cells) to 8, with an average of 1.36. Nearly half of the cells are those of a mother and her children. Women also tend to have under their responsibility grand-children, younger unmarried siblings or nephews and nieces.

Consumption

Contrary to traditional consumption surveys that only aim at estimating the level of household consumption, PSF is designed to approximate, as much as possible, individual access

to resources. To design the questionnaire, we built on the fact that consumptions common to various cells in the household appeared clearly defined, as well as the responsibilities for paying for those consumptions, while cells' own resources turned out to be not entirely pooled within the households. We conceived the survey so as to capture this detailed information.

Consumption data are collected in four distinct parts: food taken at home; household common consumption expenditures, including consumption of home-produced food; cell specific expenditures (such as expenses for clothing of the cell members, mobile phone, transportation, or food taken outside the home); 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 in proportion to the share of household members they include. 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.⁷ Each cell is ascribed its share in the food expenditures for the meals it joined in. For those meals, we have to assume food is shared evenly among participants. In fact, meals are often taken collectively from one common dish and individual food intakes are not observable. Though food expenditures for meals at home are often shared by the whole household, 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 meals outside the home. 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 this survey, only a very small share of the sample declares paying a rent for their dwelling. In fact, when everyone lives in adobe houses they built, as is the case in many parts of the country, the market price for the rental of such a dwelling simply doesn't exist. In such a situation, it is hardly possible to use the data to impute rents to home owners. We also exclude health expenditures, as inter

personal differences in this dimension could reflect differences in needs. Hence, the term “total consumption” used in this paper refers to total consumption except housing (rent) expenses and health expenditures.⁸

It is important to note that the survey is designed so that information collected at the cell level is not the expenses made by the cell members, but actually those made by anyone, whether a member of the cell or the household or not, to the benefit of cell members. Long training insured that enumerators understood the nuance and limited the risk of double counting⁹. For example, any expenses 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, distinct from the one of their father. In addition, the contributors to each of these expenditures are also registered.

A measure of total cell consumption is then constructed, adding expenditures specific to the cell and not shared with any other cell, plus the cell imputed part of the expenditures shared with other cells and of the household joint expenditures. This allows us to detect unequal consumption levels within households. Our most individualized measure of consumption is then the per capita cell consumption (or per adult equivalent consumption, if equivalence scales weighing children less than adults are used).¹⁰

In what follows, we therefore talk of *per capita (or per adult equivalent) cell consumption* when we measure consumption per capita at the cell level, while the term *per capita (or per adult equivalent) household 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. Note nevertheless that the *household consumption* obtained by aggregating consumption of all cells is not similar to what would have been observed if consumption had been recorded directly at

the household level. This point is detailed in the Supplementary Appendix S1. The comparison between the inequality and poverty assessments reached when using one or the other measure of consumption is central for the analysis presented in this paper.

2.2. Implications for poverty and inequality measurement

In this section we examine how the specific design of the PSF survey may impact the measurement of consumption compared to that of regular surveys, and how it may change inequality and poverty estimates based on household consumption levels.

Collecting data at the cell level implies that several members of the household are contributing information to the consumption survey. Since the household head doesn't directly observe all individual expenditures, in particular in a context where individual resources are not public knowledge within the household (see Boltz, Marazyan and Villar, 2015, Ziparo, 2014, Baland, Guirkinger and Mali, 2011), interviewing other household members allows to record expenditures that might otherwise have gone unnoticed. Proxy reporting as a potential source of underestimation was mentioned by Deaton (2005). Furthermore, the sheer fact that consumption is recorded in a more disaggregated manner might allow for a better recall (see Deaton 1997; Beegle *et al.* 2012). However, adding more respondents could also increase the amount of noise. If noise dominates, that should not introduce any systematic difference with regular household consumption surveys. Otherwise, increasing the number of respondents should lead to a more exhaustive recollection of consumption, and the consumption measured in PSF should be greater than in regular surveys, the more so for more complex households. One then expects the differences to increase with the number of cells.

We use data from the *Enquête Suivi de la Pauvreté au Sénégal* (ESPS) collected in 2005 to explore this conjecture. Since this survey is the one used by the Senegalese Government and

international agencies to compute poverty and inequality statistics for the country, it is worth examining how the measures obtained from PSF differ from those obtained from ESPS. The comparison is far from trivial, however, because both surveys differ by many aspects that could be of consequences. Indeed, differences in design are well known to engender divergence in consumption measures, and it is important to try to assess the extent to which divergence between surveys is due to intra-household inequality rather than to any other source of disparity.

Appendix S1 details the comparison. First, stratification of the samples is different, with in particular a greater share of observations from the Dakar region in PSF than in ESPS. Sampling weights can be used to recover nationally representative samples from both surveys. But important differences persist even between weighted samples, and in order to improve comparability we chose to reweight ESPS observations using propensity scores obtained from regressions of the probability for a given observation to be in the PSF sample rather than the ESPS one, so as to make both samples exactly similar. Second, ESPS and PSF differ in their expenditure coverage, as ESPS includes taxes and ceremonial expenses that PSF does not collect. We therefore limit the comparison to the consumption of goods and services listed in both surveys. Further, for reasons explained in section 2.1, rents are also excluded. The final lists cover the exact same categories of goods but divided in 59 items in ESPS and 55 in PSF. Now, while ESPS treats food expenditures in the same way as any other expenses, the PSF questionnaire replicates the food spending patterns of Senegalese households by recording separately the DQ (“dépenses quotidienne”) spent on fresh food often on a daily basis, and the bulky purchases of staple food made less frequently by the household head. Finally, recall periods are also different, as ESPS imposes recall period that vary with the type of goods (from 1 month to 1 year) while PSF lets the respondent choose the recall period he feels corresponds best to the rhythm of purchase (12 modalities are proposed, from 1 day to 1 year). Despite the restriction to strictly comparable sets of expenditures, the differences in the detail of the lists

and in the recall periods can induce divergence in the measured consumption levels, as is now well documented in the literature (see Beegle *et al.* 2012 for a survey). In total, in this case, it is unclear whether any systematic divergence can be expected (Appendix S1 discusses this in more detail).

We observe that the total amount of annual expenditures per capita in PSF is significantly higher than in ESPS (328000 FCFA versus 285000, a difference of 15%). We can compare how this varies by household structure (appendix Table S1.3) and we show that for individuals living alone and for single cell households there are no significant differences to speak of, while households composed of more cells display larger differences. Distance between consumption estimates of the two surveys is maximal for households with the most complex structure, those with several cells among which at least one contains members that are neither a spouse, nor a child or a grand-child of the household head. This pattern is very consistent with the idea that the share of the consumption directly observed by the household head decreases when the number of potential decision makers in terms of consumption increases. Mobilizing several respondents would then allow a better measure of actual household consumption. When concentrating on food, PSF records higher consumption for most types of households, consistent with the fact that the decomposition between DQ and infrequent food purchases permits a better recall of food spending (appendix Table S1.2).¹¹

This difference in consumption estimates is in itself an important result. It suggests that traditional surveys in countries where individuals within the household do not fully share the information on their resources and on their expenditures are indeed likely to seriously underestimate consumption. In addition to varying with household structure, such underestimation is probably 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. Figure S1.6 in appendix S1 confirms that the differences are more important at higher levels of consumption.¹²

As may be expected, we find more inequality in PSF than in ESPS data. Using per capita household expenditures, the Gini index is 47.1%, quite a bit higher than what we find in ESPS (38.9%) (using the series restricted so as to be comparable to PSF) and in the WDI (40.3% for 2011).¹³ With such level of inequality, Senegal would be placed about 37 ranks higher in the ranking of countries by inequality level (computed from standard consumption data), from the 62nd position to the 25th one, between Venezuela and Chile.¹⁴¹⁵ As we shall see in the next section, factoring in intra-household inequality will push Senegal even upward on the ladder of inequalities.

How does PSF modify the assessment of poverty? In order to answer this question we first need to define poverty. Two poverty lines are selected, following the basic needs approach. The lowest, nutrition, line corresponds to the cost of the food basket that provides at least 2400 kcal per day. The second line is a basic needs poverty line, used as the national poverty threshold 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 established through the observation of the average non-food consumption of households for which food consumption per adult equivalent belongs to an interval of plus or minus 5% around the food poverty threshold (see Appendix S1).

Values of the two poverty lines for Dakar, other towns and rural areas separately are reported in table 2. The nutrition 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). A \$2 line would correspond to 586 CFA francs.

Appendix Table S1.5 shows the values of the FGT indices (headcount, poverty gap and squared poverty gap) obtained with both surveys and poverty lines. Not much difference is found between the two surveys. PSF finds more people under the nutrition threshold (16.7% versus 12.5%), but less under the basic needs one (42.8% versus 45%). Using the Datt and Ravallion decomposition framework (Datt and Ravallion 1992), we can decompose the difference in the poverty measures from the 2 surveys into its “growth” (difference in mean consumption) and “redistribution” (difference in inequality) components, and a residual. The fact that mean consumption is higher in the PSF data should lead to a decrease in poverty relative to ESPS, but the higher inequality plays in the opposite direction. Which of these components plays most is not a priori obvious. It happens that in our context, these two opposite biases happen to nearly exactly compensate each other.

3 Intra-Household Inequalities

3.1 How Important are Intra-Household Inequalities?

Table 3 reports various measures of inequality, first on total consumption and then on food and non-food consumption separately. The top panel of the table shows inequality statistics, computed across individuals, assigning them per capita *household* consumption, while the bottom part displays those obtained using per capita *cell* consumption.

As expected, the Gini index of inequality in the distribution of per capita household food expenditures is much lower than that of non-food spending, reaching 39.2% vs. 62.7%.

Using per capita cell consumption rather than per capita household consumption, inequality levels are revised upward.¹⁶ 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 nearly 50% when each individual is attributed their cell per capita consumption level (and that of non-food consumption to 67.2%). This level of inequality would place Senegal just below Honduras in the countries ranking, another 8 ranks hike from where the country stands when intra-household inequalities are not accounted for.

How important are intra-household inequalities in the building of inter-personal inequalities? To answer this question we compute the Theil T index, which we decompose between intra- and inter-household inequalities (Table 4). The decomposition indicates that more than 18% of total inequalities in non-food expenditures occur within households. As expected, in the case of food expenditures the share of intra-household inequality is much lower, reaching only 6% of the total.

Assuming equal sharing of food between household members eating together underestimates actual intra-household inequality in food consumption. In fact, although we cannot directly observe it, there are some indications in the literature that in developing countries contexts there exist intra-household inequalities in the access to nutritional inputs (see e.g. Dercon and Krishnan, 2000, D'Souza and Tandon, forthcoming, or Brown et al., forthcoming). Further, the intra-household inequality we measure is also likely to be underestimated by the fact that vulnerable household members are assigned the per capita consumption level of the cell they belong to, even though it is likely they consume less than other members of the cell. This could for example be the case of the elderly widowed mother of the household head, attached to his cell for the purpose of our consumption survey.

For total consumption, the share of intra-household inequality is nearly 14% of total inequality, and, as explained above, this should be considered a lower bound. Whether this is a large share or not is difficult to assess without a comparison point. We can think of one external comparison, that given by Klasen and Lahori (2016), who estimate intra-household inequality

at about 30% of total inequality in India. This comparison is interesting, but not conclusive since these authors base their analysis on multidimensional poverty indices, not on consumption measures, so that the comparison cannot be done directly. Moreover, Klasen and Lahori estimates refer to India, a country that has an income per capita much greater than Senegal (1750US\$ vs. 1042US\$, in 2010 constant dollars, according to the World Development Indicators), leaving a larger margin for non-subsistence consumption expenditures that are likely to be more unequally shared than those expenditures dedicated to subsistence needs (unless the household is so poor that it has to engage into a lifeboat strategy, insuring enough resources to its income earning members – section 3.2. suggests this doesn't apply in our context).

To obtain a comparison point, it is possible to construct a counterfactual situation from our data that maximizes intra-household inequality. In order to do this, we simulated a distribution where everyone gets his observed share of food consumption and of consumption common to the household (such as electricity, water, furniture...). Note that this shared consumption amounts to 68% of total consumption on average. We then imagine an extremely unfair household head capturing any extra resource and attribute all the remaining consumption to his/her cell, thereby maximizing intra-household inequality. When doing this, the Theil index of this distribution reaches 0.69, and the within-household component amounts to 0.23, that is 33% of total consumption inequality. Gauging our result by this hypothetical counterfactual situation, it seems that the observed within-household inequality is very significant, reaching 42% of this maximum.

3.2 The correlates of intra-household inequality

Which households are more likely to be unequal? Is it related to the total amount of expenditure? To the household structure? To the head's characteristics? In this section, we examine the correlates of being an unequal household focusing on the household structure, and show how the specificity of the PSF questionnaire allows to gain new insights on the determinants of intra-household inequality.

In table 5, we present the correlates of the within household Theil index, both for consumption as a whole and then separately for food and non-food expenditures.

Household structure clearly plays a role in explaining intra-household inequality. It is worth noting that this might be difficult to pin down with standard household surveys that only record the relationship of each household member to the household head. The first 2 columns of table 5 compare the description of the relation between inequality and household structure obtained from a regression using only variables that could be retrieved from a traditional survey, to what can be exhibited with the more detailed information on household structure that PSF contains. Column (1) describes household structure with variables counting the number of children below age 5, those between 5 and 15, the number of adult women between 15 and 65 years of age, and the number of elderly members. It also includes a dummy variable if the household doesn't embrace any horizontal extension, i.e. if all members are either the wife, the parents, the children or the grand-children of the household head. The first column only indicates that the level of intra household inequality increases with the number of children aged 5 to 14. As this might reflect difference in needs that are not captured by the per capita measure of individual consumption, it is not very revealing. The second column makes clear that, even controlling for the size and the age-gender composition of the household, its precise organisation matters. Extended households with more than two cells, whether they are polygamous households or include cells headed by relatives in addition to the head's conjugal unit, have more unequal resource allocation than any other household types. On the other hand,

when the household head has no spouse in the household, resource allocation appears less unequal.^{17 18} Note also that, even though there is very little inequality in food consumption that we can measure, households in which meals taken at home are not shared in by all members are significantly more unequal overall than those where everyone eats together. Interestingly, in addition to the fact that eating together mechanically reduces intra-household inequality in food consumption, it is also correlated to lower inequality in non-food consumption, suggesting that taking all meals together is a symptom of a higher level of resource pooling.¹⁹ Adding this variable doesn't affect the correlation of the household structure variables with the within household inequality level. Results are reported in column (3).

Finally, it appears that intra-household inequality increases with household total consumption, suggesting that it is not driven by lifeboat strategies.²⁰ Further, it is worth noting that this result doesn't support one of the key assumptions made in the literature on estimating individual shares of total spending from household aggregates (following Dunbar et al. 2013²¹), backing up the idea that collective household models might not be well adapted to the context under study.

When looking separately at food and non-food expenditures, the aggregate pattern appears very close to that of non-food consumption. In fact, hardly anything explains inequality in food consumption, apart, in a rather mechanical way, from the observation made above that all household members take all their meals together²². Within household Theil of food expenditures is also lower for households with more adult women and for large households with more than 3 cells, none of them headed by a spouse of the head.

In total, household structure (beyond and above its age-gender composition) and household living arrangements are strongly correlated with the observed intra-household inequality.

4 Impact on Poverty Diagnostic

4.1 Do Intra-Household Inequalities Modify the Extent of Poverty?

Computing poverty estimates using per adult equivalent *cell* rather than *household* consumption allows factoring in intra-household inequality. How does it impact poverty? As shown in table 6, using per adult equivalent cell rather than household consumption leads to revise poverty levels upwards, both for the headcount and the poverty gap.

The results show that the household level approach leads to an underestimation of poverty rates by 0.3 to 3.6 percentage points, depending on the poverty line and the residential area.

As seen in Table 6, the difference in poverty measures based on per adult equivalent household or cell consumption depends on the choice of poverty line. In appendix S4 we assess the sensitivity of the results to this choice. We find that the difference between poverty rates is significant for a large range of poverty lines.

4.2 Being poor among the non-poor.

The evidence of intra-household inequality raises the possibility 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 assessments of consumption levels. In fact, poor cells can be found within non-poor households and, inversely, non-poor cells within poor households.²³ This is documented in figure 1 and table 7. In figure 1 we plot the ranking of cells depending on whether one uses household or cell level per adult equivalent consumption for the first two quartiles of the distribution. The vertical and horizontal lines in the graphic shows the rank of the cell that is just at the nutrition (left panel, first quartile) or basic need threshold (right panel, second quartile). The figure shows that there is a substantial

reordering of cells depending on how consumption is measured. This has implications on the identification of the poor, with all cells located in the top left and in the bottom right parts of both panels being misclassified, when using household level consumption, as being either non-poor, while being poor (top left) or poor while being non-poor (bottom right). Table 7 ventilates the distribution of households in 4 categories according to the poverty status of the household and the presence or not of cells with a different poverty status (columns 1 and 2). The distribution of cells and individuals according to their poverty status and that of their household is given in columns 3 to 6. We observe that the proportion of poor cells belonging to a non-poor household varies between 2.6% and 5.1% of cells depending on the poverty threshold (4th column). Comparing with the population percentages (6th column), we observe that poor cells in non-poor households seem to be large cells.

In total, using the basic needs poverty threshold, 13.7%²⁴ of non-poor households include at least one poor cell, which means that 10.8% of the members of non-poor households are, in fact, poor, or that 13.4% 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 an underestimation of the extent of poverty, but more importantly, to serious miss-identification of the poor.

In non-poor households that include at least one poor cell, investigating who is particularly at risk of being poor could be of first order policy relevance. A simple logit estimate of the probability for non-poor households of comprising at least one poor cell shows unsurprisingly that richer households are less likely to be in this case, and, controlling for household per adult equivalent consumption, complex households, in urban areas, whose head has no formal schooling are more likely to have some poor members. This is mitigated if they take together all the meals eaten at home (see table S5.2 in appendix). An analysis of the probability of being the head of a poor cell in a non-poor household, taking household fixed-

effect into account (conditional logit) is presented in Table 8. Column 1 shows that large cells, those headed by the wife of the head and with many young children, are more likely to be in this situation. Some of it might be driven by differences in needs not properly accounted for by the equivalence scales. Generally, the cell of the household head is the least likely to be a poor cell in a non-poor household. More interesting is the fact that cells headed by distant family members are more vulnerable. Most of those factors are particularly important for household whose consumption places them in the bottom quintile of the distribution of non-poor household (column 3). In richer households (in the top 4 quintiles – column 2), apart from female headed cells, those at risk of poverty are only those headed by a distant relative of the household head.

4.3 Are the poor in non-poor households as 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 9 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 9 clearly shows 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. At the basic needs threshold, it reaches only 35% of the poverty gap of the poor in poor households. This is understandable, as intra-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 it. It suggests that the “invisible poor” are likely to be among the least poor of the poor.

5 Robustness checks

5.1 Sensitivity to Measurement Error

We assess the robustness of the above estimates to various amounts of measurement error, as inequality measures can be particularly sensitive to this source of bias. Following Chesher and Schluter (2002), we first produce overall inequality estimates correcting for some amount of measurement error. Assuming an error to signal variances ratio of 10% (resp. 20%) would decrease the estimated Gini from 47.1 to 45.3% (resp. 43.6%) and the Theil-T from 42.8 to 39.5 (resp. 36.1).²⁵ The assumed variance of measurement error needs to reach 40% of that of the signal for the Gini to go down to a level comparable to the uncorrected published statistics (40 instead of a published 40.3). Such level of measurement error is highly unlikely. Bound et al., 2001, give much lower orders of magnitude for measurement error in income, closer to 20%, and this is the range considered by Chesher and Schluter, 2002 in their application to Indonesian data. Hence, it is unlikely that measurement error explains the high observed inequality in the PSF survey. In addition, given ESPS data is as likely to be error-ridden as PSF, measurement errors certainly cannot account for the difference in the inequality estimates.

In the case of the PSF survey, because consumption data are collected at the cell level, measurement error will take place at that level. In such a case, working at the household level would help to average out some of this noise, while it would be maximal when working at the cell level. That would suffice to induce some intra-household inequality even if the true distribution is egalitarian. Although we already know, thanks to the analysis of section 3.2, that this within-household inequality is not pure noise, as it correlates with a number of observable characteristics of the households, it is important to evaluate the sensitivity of our estimates to measurement error at the cell level. We will again resort to simulations. Assuming measurement

error takes the form of a white noise, the idea is to assess how large it should be to explain the whole of the observed share of intra-household inequality.

Appendix S6 details the procedure. To summarize, under the assumption that there is no intra-household inequality, but that cell consumption is measured with error, we simulate the observed distribution of per capita cell consumption, varying the magnitude of measurement error as a proportion of the variance of the original distribution of log consumption. We then assess the level of error that is needed to reproduce the observed amount of intra-household inequality. Results are shown in appendix table S6.1. It appears that it requires an error term with a variance fixed at 70% of the variance of the original distribution of log-consumption for the decomposition of the Theil index to indicate a within-household share of total inequality of 14%. At 40%, the Gini index for the distribution of per capita cell consumption is 2.75% higher than the one for the per capita household consumption, as we actually observe in our data (2.56%). In both cases, such levels of measurement error are unrealistically large compared to the 20% benchmark mentioned above, so that we are confident measurement error is not the only force driving our results.

5.2 Other robustness checks

Individual consumption can be measured *per capita* or per adult equivalent. The use of *per capita* consumption to assess the extent of inequality is likely to yield a higher level of inequality than the use of per adult equivalent consumption, if there is a positive correlation between the risk of poverty and the number of children in a household. This is true between households, and also within households and between cells, if poor cells have more children than non-poor ones. Hence, using an equivalence scale may provide a different picture on inequality. In Appendix Table S3.1, we compute the same inequality measures as those presented in Table 2, this time based on consumption per adult equivalent, where a weight of 1 is given to adults,

and children between 0 and 14 are weighted 0.5. As can be seen from this table, the difference with *per capita* estimates is in line with what was expected: inequality based on per adult equivalent consumption is indeed found lower. But the difference is not very high, and the gap between household and cell consumption estimates remains of the same order of magnitude as that of Table 2. As for intra-household inequality, appendix Table S3.2 shows the inequality decomposition obtained when using per adult equivalent consumption with three different equivalence scales: Scale A is the same as that employed in Table S3.1, while Scale B puts a reduced weight on very young children (0.2 for children less than age 4). Scale C applies different weights depending on the kind of commodities. For food, weights are chosen in order to hold account of estimated caloric needs for moderately active people, depending on age and gender, and based on tables provided by the U.S. Department of Health and Human Services.²⁶ Results are hardly impacted by the reduced weight given to children: intra-household inequality still accounts for about 13% of the total (or 43% of the maximal intra-household inequality simulated taking these equivalence scales into account). Finally, so as to ensure that the results are not driven by education expenditures, an important child specific spending unevenly distributed in the population, we replicate the exercise on consumption aggregates net of education expenditures (school fees, furniture, and transportation). Results are shown in the bottom part of Appendix Table S3.2. They are not significantly altered.²⁷

Poverty measures are likely to be more sensitive to the choice of equivalence scale, if the risk of poverty depends on household or cell size. In table S3.3 we repeat the same exercise as in table S3.2 this time for FGT indices. As we can see the estimated poverty rates are a bit higher when scale C is used due to the higher weight given to children between 5 and 14 in the equivalence scale for food consumption, but the gap between FGT indices based on per adult equivalent cell and household consumption persists.

6 Conclusion

This paper uses a novel survey designed to measure intra-household consumption inequalities. Gaining a thorough understanding of these issues is all the more crucial that a number of new redistributive public policies are developed today, such as the Programme National de Bourses de Sécurité Familiale, PNBSF, a large conditional cash transfer scheme meant as the stepping stone of a broader social safety net. Whether and how the choice of the beneficiary within the household matters is a central question for the design of such program.

This new survey allows us not only to reevaluate the level of inter-personal inequality in Senegal and to reveal the extent of intra-household inequality, but also to analyze how this leads to a reassessment of the poverty diagnostic for the country.

The consumption survey we designed innovates by collecting information at the level of sub-groups within the household, using different respondents for different household cells. A first consequence of this approach is that it allowed us to collect more complete consumption data. Total consumption is measured to be higher than what was obtained with a classical consumption survey at the same period, as well as more unequally distributed. This could have an a priori ambiguous impact on global poverty assessment, since the two effects--one on the mean and one on inequality--should impact poverty estimates in opposite directions. In the context studied here, these two contrary effects seem to compensate each other so that the overall bias is rather small. Now, inequality is shown to be much higher than what was previously thought, with a Gini coefficient reaching 47.1%, while international statistical yearbooks give a Gini of 40.3.

Our results suggest that the more complex the household structure, the bigger the household size, and 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 these differences in family structure and organisation.

Within-household inequality accounts for nearly 14% of inter-personal inequality in Senegal, which we evaluate to be 42% of the level that would be reached if household heads captured the entire private consumption in households. 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. Taking intra-household unequal access to resources into account, we assess that as many as 13.4% 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.

When households are large and of a complex structure, as in Senegal and in many sub-Saharan African countries, where several somewhat 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.

Endnotes

¹ The way these subgroups have been defined is described in detail in section 2.1.

² The Gini index published by the World Bank reaches 40.3% in 2011 (World Development Indicators).

³ Momar B. Sylla and Matar Gueye of the Agence Nationale de la Statistique et de la Démographie of Sénégal (ANSD), as well as Philippe De Vreyer (University of Paris-Dauphine and IRD-DIAL), Sylvie Lambert (Paris School of Economics-INRA), and Abla Safir (World Bank), all 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.

⁴ Details are given in Appendix S1.

⁵ Vertical extensions refer to the cases where the household includes more than 2 generations of members, i.e. presence of grand-parents or grand-children. Horizontal extensions subsume situations where several family members pertaining to the generation of the head cohabit. It could be for example married siblings of the head or of his wife.

⁶ Half of the households with 3 cells or more are headed by a polygamous household head.

⁷ 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. See Appendix S1 for more details on PSF survey design.

⁸ According to ANSD (2007), in 2005-2006, more than 80% of households in Senegal were owners of their housing. Less than 16% were renting it, and only 2.6% in rural areas. This leaves a very small number of observations to compute meaningful imputed rents, unless a very large

sample is available. Even in the ESPS sample (see *Appendix S1*), which includes 13559 households, the imputed rent for owner households in rural areas is based on the observation of rents paid by 171 households (on a total of 4987 rural households).

⁹ In addition, data cleaning systematically tracked potential double counting to correct it.

¹⁰ To maintain comparability with existing works on poverty in Senegal, we use the same equivalence scale as that of Ndoye et al. (2009): one consumption unit for each adult, and one half for each child less than 15 years old. We test for the robustness of our results to this choice in section 5.

¹¹ Clearly, collecting data at a more disaggregated level also induces a risk of additional measurement error. We will therefore assess the sensitivity of the results of our analysis to measurement errors.

¹² The fact that the underestimation of consumption is not distribution neutral pleads against anchoring poverty measure to National Accounts estimates of consumption, as it is likely to result in an overestimation of poor household consumption levels, following an argument made by Ravallion (2000).

¹³ It is slightly lower when using per adult equivalent measure of consumption. See Table S3.1 in the Appendix.

¹⁴ Country ranking by GINI index (Most recent World Bank estimate).

¹⁵ The measure of inequality of comparison countries (Venezuela and Chile) is based on data from standard household consumption surveys. Changing the survey methodology to collect consumption data at the level of subgroups in the households might affect the inequality assessment also for those countries. Given that households in Venezuela and Chile are more likely to be nuclear, they are potentially less affected by such change in methodology. The comparison remains illustrative of the fact that Senegal is as unequal as we currently believe Venezuela and Chile to be.

¹⁶ Standard errors in Table 3 cannot be used to assess the significance of the differences between inequality indices, since household and cell level indices are computed on the same sample. In order to account for the resulting correlation between indices, standard errors of differences have been computed using 250 bootstrap replications. Results are presented in Appendix S2, Table S2.1. Since all inequality indices used in this paper can be shown to be asymptotically normally distributed (see references in Appendix S2), the usual t tests can be used to assess significance.

¹⁷ 83% of households headed by a head without a co-residing spouse are female headed.

¹⁸ Whether the household head has ever been to formal school or not doesn't appear to be correlated with the within-household Theil in any of the specifications. The same holds for the polygamy of the household head. (Results not reported here).

¹⁹ Systematic meal sharing is more frequent for the poorest households (see table S5.3, appendix S5).

²⁰ Appendix S5 reports the results using deciles of per capita household consumption rather than log per capita household consumption, and the relationship with inequality seems rather linear.

²¹ To solve identification issues, Dunbar et al (2013) need to impose some parametric restrictions to the Engel curves they estimate, among those, the fact that the resource share functions are assumed independent of household expenditures.

²² Without this variable, the R-square of the corresponding regression is 0.016, instead of 0.155.

²³ See Brown et al., (forthcoming) for similar findings based on nutrition.

²⁴ 158/(158+996) from Column 1.

²⁵ Error to signal variances ratio is given by $\nu = \frac{Var(logZ)}{Var(logX)}$, where Z is the error contaminated measure of consumption and X the error-free measure of consumption.

²⁶ <https://health.gov/dietaryguidelines/2015/guidelines/appendix-2/>

²⁷ Note that health expenditures are not included in the consumption aggregate we are using.

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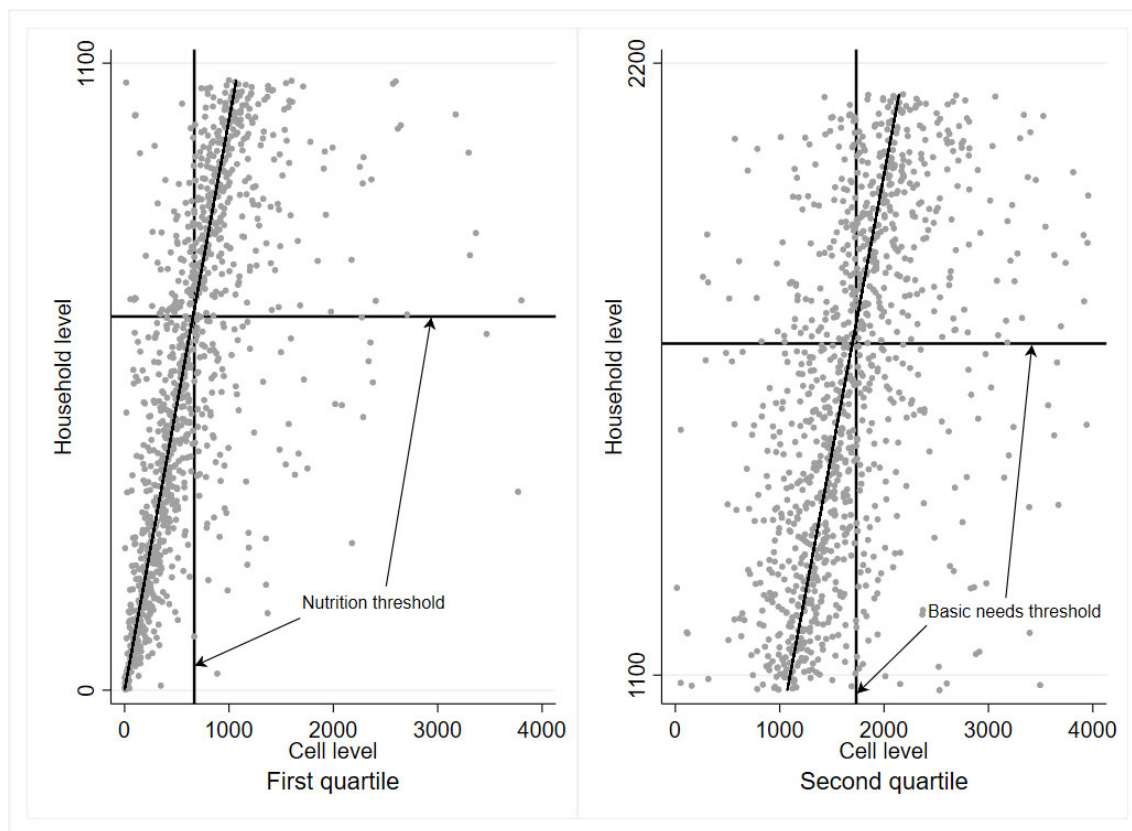
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Figure 1: Reordering of cells depending on consumption measurement level by quartile of p.a.e. household consumption



Source: "Pauvreté et Structure Familiale" (PSF) survey, authors' calculations.

Note: For each graph, horizontal axis shows the ranking of cells based on cell level consumption aggregate, while vertical axis shows the ranking based on household level consumption aggregate. Equivalence scale: 1 for adults, 0.5 for children less than 15. N=1070 (first quartile) and 1072 cells (second quartile).

Table 1a: Household characteristics

	N	mean	Min	max
Household size	1,762	8.09	1	44
number of cells	1,762	2.49	1	12
single cell household	1,762	17.70	0	100
hh with 3 cells or more	1,762	37.82	0	100
hh with 2 couples of more	1,762	15.76	0	100
nb of children 0 - 4 y.o.	1,762	1.23	0	10
nb of children 5 - 14 y.o.	1,762	2.15	0	13
nb of elderly over 66 y.o.	1,762	0.30	0	4
nuclear household	1,762	40.55	0	100
hh include vertical extensions	1,762	35.12	0	100
hh includes horizontal extensions	1,762	27.41	0	100
hh includes vertical and/or horizontal ext.	1,762	48.93	0	100
hh includes other types of member	1,762	30.31	0	100
share of non nuclear hh members	1,762	28.22	0	96
hh includes non nuclear hh members	1,762	66.07	0	100
Dakar	1,762	28.13	0	100
Other urban area	1,762	19.78	0	100
Rural	1,762	52.09	0	100
Female hh head	1,762	20.59	0	100
hh head is polygamous	1,762	29.44	0	100
hh head is polygamous man	1,762	23.51	0	100
hh head is polygamous woman	1,762	5.93	0	100
hh head has no formal schooling	1,762	64.68	0	100
age of hh head	1,761	49.85	18	93

Source: "Pauvreté et Structure Familiale" (PSF) survey, authors' calculations using sampling weights.

Note: Summary statistics of households' characteristics. Nuclear households are households containing only the head, his wife (wives) and their children (biological, adopted or fostered). Vertical extensions designate parents, grand-parents, grand-children. Horizontal extensions include sibling, nephew and uncles of the household head. "Households with two couples or more" indicates that the household contain at least two married men accompanied by at least one wife each.

Table 1b: Cell characteristics

	N	mean	Min	max
Cell size	4,293	3.25	1	15
nb of children 0 - 4 y.o. in cell	4,293	0.49	0	4
nb of children 5 - 14 y.o. in cell	4,293	0.86	0	7
nb of children less than 15 y.o. in cell	4,293	1.36	0	8
nb of elderly over 66 y.o. in cell	4,293	0.12	0	3
cell with 2 adults (15+) or more %	4,293	46.69	0	100
cell with 2 adults (21+) or more %	4,293	31.02	0	100
cell without any children %	4,293	43.69	0	100
cell with mother + children only %	4,293	47.44	0	100
cell head is a woman %	4,293	56.81	0	100
Excl. household head	2,531	81.19	0	100
cell head is the hh head %	4,293	40.23	0	100
cell head is a male hh head%	4,293	31.95	0	100
cell head is the spouse of hh head %	4,293	35.43	0	100
cell head is a child of hh head %	4,293	8.86	0	100
cell head is son/daughter in law of hh head %	4,293	2.15	0	100
cell head is a sibling of hh head %	4,293	4.46	0	100
cell head is a remote parent or non related %	4,293	5.48	0	100
cell head is polygamous man %	4,293	10.55	0	100
Excl. household head	2,531	1.83	0	100
cell head is polygamous woman %	4,293	22.18	0	100
Excl. household head	2,531	33.11	0	100
cell head has no formal schooling %	4,293	67.00	0	100
Excl. household head	2,531	68.57	0	100
age of cell head	4,292	42.18	0	98
Excl. household head	2,530	37.03	0	98

Source: "Pauvreté et Structure Familiale" (PSF) survey, authors' calculations using sampling weights.

Note: Summary statistics of cells' characteristics.

Table 2: Value of the poverty thresholds

	Nutrition poverty line	Basic needs poverty line
Dakar	396	835
Other towns	369	647
Rural areas	356	558

Source: "Pauvreté et Structure Familiale" (PSF) survey, authors' calculations.

Note: Poverty lines per urbanization strata in Senegal. Values are given in CFA francs. Numbers correspond to daily expenditures per adult equivalent. Equivalent scale: 0.5: children 0 to 14 years old; 1: adults.

Table 3: Inequality measures

	Gini	90/10	75/25	Mean log dev	Theil-T
<i>Per capita household consumption</i>					
Total consumption	47.11 (1.06)	7.70 (0.36)	3.02 (0.13)	0.38 (0.02)	0.43 (0.03)
Non-food consumption	62.72 (1.21)	19.48 (1.10)	5.23 (0.28)	0.77 (0.03)	0.82 (0.05)
Food consumption	39.17 (0.71)	5.93 (0.29)	2.44 (0.07)	0.26 (0.01)	0.27 (0.01)
<i>Per capita cell consumption</i>					
Total consumption	49.67*** (1.02)	8.72*** (0.42)	3.12 (0.09)	0.42*** (0.02)	0.50*** (0.03)
Non-food consumption	67.16*** (1.09)	26.39*** (1.54)	5.91*** (0.27)	0.92*** (0.03)	1.00*** (0.05)
Food consumption	40.39*** (0.69)	6.48*** (0.26)	2.54** (0.08)	0.27*** (0.01)	0.29*** (0.01)

Source: "Pauvreté et Structure Familiale" (PSF) survey, N=1762, authors' calculations.

Note: The first panel presents inequality measures computed using per capita household consumption as a measure of individual consumption. The second panel presents inequality measures computed using per capita cell consumption. Bootstrap standard errors (250 replications) between parentheses. *, **, ***: difference with per capita household consumption inequality measure is significant at the 10%, 5% or 1% level (see Note 16 and Appendix S2 for details).

Table 4: Inequality decomposition

	Theil T within	Theil T between	Share within
All consumption	0.07 (0.01)	0.43 (0.03)	13.85 (1.34)
Non-food consumption	0.18 (0.02)	0.82 (0.05)	17.78 (1.54)
Food consumption	0.02 (0.00)	0.27 (0.01)	6.26 (0.63)

Source: "Pauvreté et Structure Familiale" (PSF) survey, N=1762 households.

Note: Theil decomposition into a within household component and a between household one.
Bootstrap standard errors (250 replications) between parentheses.

Table 5: Correlates of Within household Inequality

VARIABLES	(1) Theil T within	(2) Theil T within	(3) Theil T within	(4) Theil T within - food	(5) Theil T within - nonfood
Dakar	-0.0230* (0.0128)	-0.0177 (0.0127)	-0.0208* (0.0125)	0.00223 (0.00741)	-0.107*** (0.0219)
Other urban areas	-0.0171 (0.0106)	-0.00960 (0.0107)	-0.0110 (0.0105)	0.00395 (0.00528)	-0.0668*** (0.0198)
Log per cap. hh cons.	0.0379*** (0.00860)	0.0380*** (0.00862)	0.0369*** (0.00844)	-0.00425 (0.00283)	0.0533*** (0.0116)
Household size	0.00168 (0.00186)	0.000615 (0.00181)	0.000128 (0.00171)	0.00141 (0.00150)	-0.00237 (0.00315)
Nb of cells in the hh		-0.00218 (0.00545)	-0.000857 (0.00560)	0.00353 (0.00245)	0.00104 (0.0124)
Nb of children 0-4 y.o	0.00512 (0.00320)	0.00512 (0.00329)	0.00439 (0.00326)	-0.00127 (0.00271)	0.0138** (0.00659)
Nb of children 5-14 y.o	0.00454* (0.00270)	0.00515* (0.00268)	0.00558** (0.00266)	-0.00197 (0.00190)	0.0165*** (0.00583)
Nb of women 15-65 y.o.	-0.00391 (0.00301)	-0.00337 (0.00310)	-0.00422 (0.00316)	-0.00492** (0.00202)	-0.00322 (0.00608)
Nb of elderly 66+ y.o	0.00626 (0.00597)	0.00449 (0.00617)	0.00412 (0.00620)	-0.00126 (0.00315)	9.53e-05 (0.0117)
2-cell hh, head + other		-0.0219*** (0.00748)	-0.0229*** (0.00756)	-0.000136 (0.00575)	-0.0791*** (0.0152)
3+-cell hh: head and wives.		0.0232** (0.0109)	0.0225** (0.0107)	0.00328 (0.00811)	0.0644** (0.0276)
3+-cell hh: head, wife (wives), + other		0.0208* (0.0106)	0.0208* (0.0108)	-0.00210 (0.00417)	0.0308 (0.0219)
3+-cell hh: head + others (no spouse)		-0.0159* (0.00853)	-0.0217** (0.00913)	-0.0186*** (0.00560)	-0.0425** (0.0198)
HH without horizontal extensions	0.00737 (0.00612)				
All meals taken together			-0.0538*** (0.0129)	-0.0786*** (0.0145)	-0.0395* (0.0202)
Constant	-0.432*** (0.102)	-0.423*** (0.101)	-0.360*** (0.0997)	0.125*** (0.0421)	-0.440*** (0.141)
Observations	1,426	1,426	1,426	1,426	1,426
R-squared	0.067	0.080	0.109	0.155	0.105

Source: "Pauvreté et Structure Familiale" (PSF) survey, authors' calculations.

Note : Correlates of intra-household inequality. Sample of households with at least two cells, N=1426. OLS regressions. Additional controls: religion and ethnicity of the household head. Reference category for household structure is a household with two cells: head and spouse. "2-cell hh: head + other" refers to households composed of 2 cells, where the second cell is not that of the head's spouse. "3+-cell hh: head and wives" refers to polygamous households, where all the cells are headed by members of the conjugal unit. "3+-cell hh: head, wife (wives) + other" refers to households with at least 3 cells and where at least one of the cells is not headed by a spouse of the head. "3+-cell hh: head+others (no wife)" refers to households with more than 3 cells and where none of them is headed by a spouse of the household head.

Robust standard errors in parentheses, clustered at the PSU level, *** p<0.01, ** p<0.05, * p<0.1

Table 6: Poverty estimates

	Nutrition poverty line		Basic needs poverty line	
	Headcount Index	Poverty gap Index	Headcount Index	Poverty gap index
<i>Per adult equivalent household consumption</i>				
National	16.69 (1.11)	4.24 (0.38)	42.78 (1.33)	14.26 (0.64)
Dakar	1.78 (0.80)	0.32 (0.13)	25.57 (2.37)	6.31 (0.67)
Other urban	9.16 (2.05)	1.98 (0.58)	33.69 (2.93)	9.99 (1.19)
Rural	29.81 (2.04)	7.81 (0.71)	58.09 (2.12)	21.36 (1.02)
<i>Per adult equivalent cell consumption</i>				
National	18.24*** (1.00)	5.12*** (0.37)	46.29*** (1.26)	16.04*** (0.64)
Dakar	2.07 (0.61)	0.47*** (0.17)	29.14*** (2.02)	7.94*** (0.70)
Other urban	11.23** (1.95)	2.93*** (0.66)	37.12*** (2.53)	11.61*** (1.11)
Rural	32.00*** (1.87)	9.15*** (0.70)	61.60*** (1.82)	23.31*** (0.99)

Source: "Pauvreté et Structure Familiale" (PSF) survey, authors' calculations.

Note : First panel presents poverty estimates using per capita household consumption, second panel presents poverty estimate using per capita cell consumption. Sample sizes are 1762 households and 4293 cells. Bootstrap standard errors (250 replications) between parentheses. Equivalent scale: 0.5: children 0 to 14 years old; 1: adults. *, **, ***: difference with per adult eq. household consumption poverty measure is significant at the 10%, 5%, or 1% level (see Note 12 and Appendix S2 for details).

Table 7: Distribution of the poor by Poverty Status of their household

	Households		Cells		Individuals	
	N	%	N	%	N	%
	(1)	(2)	(3)	(4)	(5)	(6)
<i>Basic needs threshold</i>						
Poor in non-poor households	158	8.97	219	5.10	865	6.18
Poor in poor households	446	25.31	1,514	35.27	5,610	40.11
Non-poor in poor households	162	9.19	181	4.22	374	2.67
Non-poor in non-poor households	996	56.53	2,379	55.42	7,139	51.04
<i>Nutrition threshold</i>						
Poor in non-poor households	79	4.48	110	2.56	419	3.00
Poor in poor households	136	7.72	556	12.95	2,133	15.25
Non-poor in poor households	84	4.77	100	2.33	201	1.44
Non-poor in non-poor households	1,463	83.03	3,527	82.16	11,235	80.32

Source: "Pauvreté et Structure Familiale" (PSF) survey, authors' calculations. Poverty status based on per adult equivalent consumption. Equivalent scale: 0.5: children 0 to 14 years old; 1: adults.

Note: The line "poor in non-poor households" gives the number (and share) of non-poor households containing at least one poor cell; then, the number of poor cells found in non-poor households; and finally, the number of poor individuals found in non-poor households. Following lines are to be read in a similar way. The second line gives numbers for poor households where everyone is poor, the third line for poor households containing at least one non-poor cell, and the fourth line for non-poor households where all the cells are non-poor.

Table 8: Probability of being a poor cell in a non-poor household (household fixed effects).

VARIABLES	(1) _All	(2) _80% richest hh – non-poor	(3) 20% poorest hh – non-poor
Cell head is a woman	1.860* (0.658)	2.475** (1.035)	1.226 (0.915)
Age of cell head	1.032** (0.0147)	1.021 (0.0172)	1.061* (0.0342)
Cell size	1.174* (0.105)	1.135 (0.116)	1.508* (0.342)
Nb of children 0 - 4 y.o. in cell	1.640** (0.325)	1.536* (0.380)	1.462 (0.566)
Nb of children 5 - 14 y.o. in cell	0.981 (0.144)	0.967 (0.165)	0.826 (0.279)
Cell head is a child of hh head	2.114 (1.134)	1.484 (1.008)	6.139 (7.006)
Cell head is parent or grand-parent of hh head	0.964 (0.726)	1.079 (0.893)	1.051 (1.885)
Cell head is a sibling of hh head	2.341 (1.323)	2.017 (1.262)	2.229 (2.884)
Cell head other family link to hh head	2.830** (1.231)	2.382* (1.220)	3.505 (3.475)
Cell head is the spouse of hh head	2.134* (0.843)	1.656 (0.777)	4.328* (3.619)
Cell head is literate	0.864 (0.302)	0.939 (0.396)	0.857 (0.545)
Cell head has no formal schooling	1.447 (0.548)	1.114 (0.498)	5.132* (4.693)
Observations	501	338	163
Pseudo-R2	0.23	0.22	0.34

Source: "Pauvreté et Structure Familiale" (PSF) survey, authors' calculations.

Note: Conditional logit estimates (household fixed effects) of the probability of being a poor cell in a non-poor household.

Odds ratio reported. Coefficient standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1. Cell head's relation to the

household head reference category: cell head is the household head.

Table 9: Poverty gaps for poor cells in poor and non-poor households

	Nutrition poverty threshold			Basic needs poverty threshold		
	(a1)	(b1)	(c1)	(a2)	(b2)	(c2)
National	32.22 (1.66)	28.15 (1.93)	14.39 (2.08)	40.50 (1.00)	30.48 (1.38)	14.17 (0.84)
Dakar	29.98 (10.07)	30.14 (5.97)	9.62 (3.25)	31.13 (2.02)	26.84 (2.09)	17.96 (1.71)
Other urban areas	28.88 (3.11)	29.80 (6.63)	17.04 (3.68)	37.00 (2.55)	32.07 (3.78)	10.53 (2.07)
Rural areas	32.61 (1.75)	27.75 (1.96)	14.19 (2.69)	43.48 (1.14)	31.31 (1.77)	13.13 (1.24)

Source: "Pauvreté et Structure Familiale" (PSF) survey, authors' calculations.

Note : Poverty status based on per adult equivalent cell consumption. Bootstrap standard errors are between parentheses (250 replications). Equivalent scale: 0.5: children 0 to 14 years old; 1: adults. 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.