



# Relative deprivation in Tanzania: Relative concerns and empathy

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## ARTICLE INFO

### Article history:

Received 5 November 2019

Revised 8 November 2021

Accepted 4 April 2022

### JEL codes:

D63

D64

I32

O12

### Keywords:

Africa

Financial satisfaction

Life satisfaction

Relative deprivation

Reference income

## ABSTRACT

This paper examines the importance of relative deprivation in Tanzania, a poor African country, using three waves of the Tanzanian National Panel Survey. We contribute to earlier literature in Africa by controlling for time persistent unobservable individual characteristics (panel data) and, most important, by using two measures of satisfaction (life and financial satisfaction), two definitions of the reference group, and testing different hypothesis. By comparing results between satisfaction measures and across definitions of reference groups we can understand the mechanisms through which comparisons work in a poor setting. In contrast with earlier literature, we find strong evidence of relative deprivation in financial satisfaction of all individuals in Tanzania, and evidence for life satisfaction only for individuals with weaker ties with their community. For those with strong ties (45% of our total sample; 52% of the rural sample), we find evidence of a positive correlation between life satisfaction and the leave-out mean consumption of close neighbors and argue that this can be explained by feelings of empathy. We argue in favor of taking comparisons to others into account when assessing and introducing welfare policies, also in less developed countries.

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## 1. Introduction

Empirical evidence using subjective data as a proxy measure for utility shows a negative and statistically significant correlation between reported life satisfaction and the income of the reference group in Western countries (Clark and Oswald, 1996; Luttmer, 2005; Ferrer-i-Carbonell, 2005), as well as in various Latin American countries, China, and Nepal (e.g., Fafchamps and Shilpi, 2008; see Clark and Senik 2011, for an overview). In other words, empirical evidence points at the importance of relative concerns (or relative deprivation) for individuals' satisfaction with own life. The definition of the reference group varies across papers: while some of them focus on a geographical definition (from close neighbors to larger areas) others also include individual characteristics, such as age and education. The evidence in Africa however is scarce, based on (repeated) cross-section data, and uses life satisfaction only. Up until now this literature points to a positive

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relative income effect on life satisfaction (Ravallion and Lokshin, 2010; Kingdon and Knight, 2007; Bookwalter and Dalenberg, 2010) and on living conditions satisfaction (Clark and D'Ambrosio, 2019) for some individuals in Africa. In concrete, these papers find that comparisons to others have a positive effect on life satisfaction in rural areas of Africa, for the poorest, and when the reference group is defined as close neighbors; while the effect is negative for urban households or when the reference group is defined as those living further away. Ravallion and Lokshin (2010) find that the positive relative income effect applies to the poorest of the sample (79%), and specially to those in rural areas. Kingdon and Knight (2007) find evidence of relative concerns when the comparison group is defined as individuals living in larger geographical areas. This literature has pointed to four main reasons for this positive effect: information effect (reference group income contains relevant information about own future prospects); risk sharing (richer neighbors can help in times of hardship in societies where formal credit is scarce); positive externalities of living in a richer neighborhood; and empathy or altruism (feeling well if your close neighbors do well).

This paper contributes to this literature in various ways. First, and in contrast with the current literature in Africa, it does not only focus on self-reported life satisfaction, but it also includes financial satisfaction. We argue that these two satisfaction measures represent two different proxies for utility and thus they can bring different results that in turn might help to understand the mechanisms behind relative concerns. Second, this paper uses also for the first time panel data in an African country and we can thus control for individual fixed effects, which has been proven of crucial importance in the context of subjective questions, as its exclusion leads to biased results (Ferrer-i-Carbonell and Frijters, 2004). The within individual estimates partially address causality concerns by estimating the effect of changes in the consumption of the reference group on changes on satisfaction, while maintaining individual unobservable characteristics constant. For example, it might well be that optimistic or high self-esteem individuals have both a larger probability to be happier, richer, and to care less about relative consumption. Appendix E in the paper shows the differences between including or not individual fixed effects. Third, the richness of our data allows to control for a larger range of individual and household characteristics than previous studies, such as household assets and appliances, climate, distance to the major road or larger town, and whether the households have faced some shock over the last year or have received formal or informal assistance. Although their inclusion reduces the coefficient and precision of own consumption as well as the consumption of the reference group, it is important to control for these variables.

Fourth, we use two different definitions of the reference group. In line with the literature in African countries, we define the reference group at the geographical level, but use two different geographical areas so that we can examine whether results change if the reference group includes only close neighbors or individuals living further away. Defining the reference group using individual characteristics is difficult in rural Tanzania, where measures of education and employment are not well defined and show little variation. We thus do not follow this avenue. In short, the paper defines the reference group as those individuals living (i) in the same enumeration area (our data contains 3180 EAs, 1433 if we drop those with fewer than five observations) and (ii) in the same ward (our data contains 1380 wards, 885 if dropping those EAs with fewer than five observations). The first measure defines the reference group as close neighbors and is the same as used in Ravallion and Lokshin (2010), while the second includes those living further away. Since the literature has argued that the positive reference income effect found in rural Africa is due to close neighbors acting as positives and providing financial assistance in time of need (e.g., Ravallion and Lokshin, 2010), we would expect different coefficients for the two definitions of reference group. Although Kingdon and Knight (2007) also use different geographical definitions for the reference group, their smaller geographical definition of the reference group is larger than our definition of the reference group as close neighbors.

This paper finds, aligned with earlier literature, important heterogeneity on the role of relative concerns for life satisfaction: while we find evidence of relative concerns for non-rural individuals if the reference group is defined as those living further away (as in Kingdon and Knight 2007, for income), individuals in rural areas do not show any correlation between life satisfaction and the reference consumption. This is, we find a zero coefficient while Ravallion and Lokshin (2010) find a positive effect. In contrast, we find strong evidence of relative concerns on financial satisfaction of all individuals in Tanzania, regardless of the geographical size of the reference group and whether they live in rural or urban areas. This result is new in the literature and shows that individuals in a poor setting also experience feelings of relative deprivation in terms of their financial satisfaction. This is the first time that relative concerns in Africa are examined through a financial (and not a life) satisfaction question. Since we find a negative effect of the reference group consumption on financial satisfaction in all individuals (also in rural areas), it is hard to argue that the previously found positive effect of close neighbors' consumption on life satisfaction in rural areas is due to the positive externality of having richer neighbors who can help you in time of hardships (risk sharing) (Ravallion and Lokshin, 2010). If this were the case, i.e., the positive relationship was due to economic reasons, we would expect to also find a positive effect of average consumption of close neighbors on financial satisfaction. In addition, we perform other tests to reject the hypothesis that assistance in time of hardships from richer neighbors is driving the earlier results. For example, we look for heterogeneous effects depending on the inequality in the region or on whether the households had received assistance or credits in the previous year. An alternative explanation put forward in the literature for non-African countries (nullK; Ifcher et al., 2016) is the positive externalities (other than financial help) of living in a richer neighborhood, such as better schools and roads, or having networks with higher human capital. Since our set of controls include a large set of variables related to the welfare level in the community for which other papers could not control, we believe that this argument plays less of a role in our analysis. In addition, excluding these controls do not change our results.

Finally, it might also be that individuals are happier to have richer neighbors due to pure empathy generated by proximity to each other, as already argued in [Kingdon and Knight \(2007\)](#) for South Africa. This last argument is aligned with the literature on social distance and generosity (see, for example, [Charness and Gneezy 2008](#), [Burnham 2003](#), [Hoffman et al. 1996](#)) that argues that generosity increases with decreasing social distance. Consistent with this argument, in the paper we find a positive effect of close neighbors' average consumption on life satisfaction for those individuals who have lived 25 years or more in the community (45% of our sample) and the effect increases with the number of years that the individual lives in the community. In rural Tanzania, it is easy to assume that social distance depends on geographical residence, as people living in the same area are likely to come from the same ethnic group or family. This might be less the case in urban areas. For financial satisfaction, the average consumption of the reference group defined as close neighbors only turns into positive for the 5.3% of the sample who lives 62 or more years in the community, and is always negative when the reference group is defined as those living further away.

Our analysis confirms the importance of distinguishing among different reference group in terms of geographical proximity as well as distinguishing between financial and life satisfaction measures. The combination of the two contributes to understanding the mechanisms and the importance of taking comparisons into account when assessing and introducing welfare policies, also in very poor contexts.

## 2. Previous literature

The importance of relative preferences dates back to [Veblen \(1909\)](#), [Knight \(1922\)](#), [Clark \(1918\)](#), and [Duesenberry \(1949\)](#), but only over the last two decades there has been a growing empirical literature to test for the interdependence between each other's' income and utility proxied with a self-reported measure of life satisfaction or happiness. This literature estimates the importance of the income of the relevant others (reference group) on self-reported measures of life satisfaction and happiness (see [Clark and Senik 2011](#) for an overview). This literature points unequivocally to a negative correlation between the income of the reference group and self-reported satisfaction in Western countries and argue about the importance of the feelings of relative deprivation or relative concerns ([Blanchflower and Oswald, 2004](#); [Card et al., 2012](#); [Clark and Oswald, 1996](#); [Ferrer-i-Carbonell, 2005](#); [Graham and Felton, 2006](#); [Luttmer, 2005](#); [Ifcher et al., 2016](#); [Vendrik and Woltjer, 2007](#)). In more volatile economies, however, the literature finds (Russia and Poland until year 2000) a positive correlation between life-satisfaction and the income of the reference group ([Senik, 2004 2008](#)) and argues ([Senik, 2004](#)) that in transition countries the income of the reference group plays an informational role, as individuals form their future income expectations based on the income of their reference group. In other words, the income of the reference group is understood as a sign of own income prospects, which outweighed the negative effect of relative concerns. In developing countries outside Africa, the evidence also points to a relative deprivation model. The existing evidence in Latin American and Asian countries shows a negative correlation between income or consumption of the reference group and own life satisfaction, for example: [Fafchamps and Shilpi \(2008\)](#) for Nepal; [Appleton and Song \(2008\)](#), [Knight et al. \(2009\)](#), and [Smyth and Qian \(2008\)](#) for China; [Carlsson et al. \(2009\)](#) for India; and [Graham and Felton \(2006\)](#) and [Rojas \(2007\)](#) for various Latin American countries.

In contrast, the current literature on few African countries shows a positive correlation between the income (often proxied with consumption) of those individuals living close by (reference group) and own life satisfaction, at least in rural areas or for poorer individuals. This literature is based on cross-section data and uses life satisfaction as a proxy measure for utility. We contribute to this literature by using panel data as well as two measures of satisfaction (financial and life) and, as in some of the previous literature, we compare the results using two different geographical definitions of the reference group. In addition, our data has a large set of controls.

[Ravallion and Lokshin \(2010\)](#) use cross-section data for Malawi and find a positive effect on life satisfaction of the average consumption of fairly close neighborhoods (enumeration area level) for the 79% poorest individuals and for the rural sample. They argue that in poor contexts in which there is no access to formal credit, the income of the neighbors represents an insurance against difficult times, especially for poorer individuals with stronger credit constraints. This might outweigh the negative effect that income of the others has on those individuals who experience relative concerns. This paper is arguably the most comparable to our study, as Malawi is fairly similar to Tanzania in terms of demographics (both countries are largely rural) and geographic location, although the GDP per capita (2017) in Tanzania is larger (1005US\$) than in Malawi (497US\$)<sup>1</sup>. In our sample, we only find a positive, but very imprecisely estimated coefficient for the effect of neighbors' mean consumption on financial satisfaction for poor individuals living in rural areas when the reference group is defined at the enumeration area level. [Lentz \(2017\)](#) uses subjective wellbeing and finds that in Ghana there is relative deprivation when the reference group is spatially defined. Another relevant paper for our analysis is [Kingdon and Knight \(2007\)](#) who find in South Africa a positive effect of the income of close neighbors, but a negative effect when the reference group is defined at a larger geographical area. Consistent with these results, [Bookwalter and Dalenberg \(2010\)](#) find a positive correlation between individual subjective satisfaction and median income at the cluster level in South Africa. These last two papers however are much less comparable to ours. First, South Africa is a substantially richer economy with a GDP per capita (6160.7US\$ in 2017) more than six times that of Tanzania and more similar to many Latin American countries. In addition, South Africa

<sup>1</sup> Current US\$. World Bank: <https://data.worldbank.org/indicator/NY.GDP.PCAP.CD>

is much more urbanized (65% of population is urban) than Tanzania (32% urban) and Malawi (17% urban). Second, their geographical smallest area to define the reference group as very close neighbors is substantially larger than ours. Finally, Clark and D'Ambrosio (2019) use various African countries (repeated cross-sections from the Afro-barometer) and find a positive effect of deprivation on satisfaction with living conditions (not self-reported life or financial satisfaction). There are few other papers on Africa, but those are all based on very small samples of cross-section data survey or experimental data (e.g., Akay et al., 2012).

In other words, the literature on relative consumption and life satisfaction of people in Africa indicates that relative concerns in Africa depend on (i) the definition of the reference group, in terms of the geographical proximity of the reference group, (ii) their income level, and (iii) whether the individual lives in an urban or rural area. This literature, as discussed above, argues that the positive effect of average consumption of the reference group (defined as close neighbors) on life satisfaction might be explained by various factors: (i) the role of the community in providing social and financial assistance (risk sharing) in contexts where people do not have easy access to formal credit (Ravallion and Lokshin, 2010), (ii) the existence of stronger networks when looking for employment or other amenities and positive externalities from living in a richer community (e.g., Fafchamps and Gubert, 2007; Ligon et al., 2002); (iii) pure empathy motives, which might specially apply in smaller communities with stronger ties (Kingdon and Knight, 2007); or (iv), in volatile economies, due to the informational role of income of the reference group as an indication of own future prospects (Clark and D'Ambrosio, 2019 for Africa; and Senik 2004, 2008 for Easter Europe). These explanations are also consistent with the literature in Western countries (e.g., Ifcher et al., 2016 in the US) in which the authors typically argue that this is explained by the better provision of public goods, more human capital accumulation, and helpful networks in rich areas that benefit all families, also those relatively worse off (Clark et al., 2009 and Ifcher et al., 2016).

### 3. Empirical strategy

The empirical model uses self-reported satisfaction with life and with own financial situation as proxy measures for utility. There is now enough empirical evidence to be confident that individuals are able and willing to provide a meaningful answer when they are asked to value on a finite scale their satisfaction level with their own life or financial situation. In the data at hand individuals are asked “few questions about [their] level of satisfaction with various components of [their] life”. In this paper we use the answer to the questions on satisfaction with their “financial situation” and “their life as a whole”. Respondents can cast their answer on a scale from very satisfied (1) to very dissatisfied (7), and we recoded them to go from very dissatisfied (1) to very satisfied (7). Cantril (1965), Wilson (1967), and Bradburn (1969) are considered the fathers of subjective measures of satisfaction, for they developed and first introduced such questions in large questionnaires. The validity and meaningfulness of these satisfaction measures have been largely discussed in the literature and we refer to different surveys for an overview of its validity as well as the use of these measures for, among others, understanding individuals’ preferences (Ferrer-i-Carbonell, 2013; Clark et al., 2008; van Praag and Ferrer-i-Carbonell, 2004; Frey and Stutzer, 2002).

We estimate the following equation:

$$U_{itar} = \alpha + \beta'X_{itar} + \gamma C_{itar} + \delta \bar{C}_{tar} + \lambda'W_{itar} + \theta_r + t + \sigma_i + \varepsilon_{it} \tag{1}$$

where  $U_{itar}$  is the utility level of individual  $i$  in year  $t$  in area  $a$  in region/district  $r$ . Area  $a$  refers to the geographical area used to define the reference group, while region  $r$  refers to the largest region where the individual lives. Utility is proxied by the answer to the self-reported satisfaction questions and we refer to it as financial and life satisfaction. The main parameters of interest are  $\gamma$  and  $\delta$ , i.e., the coefficients for own consumption and leave-out mean consumption of the reference group, respectively. Consumption  $C$  is the log adult equivalent annual household consumption in real terms (using regional prices). The equation includes as controls individual and household characteristics ( $X$ ) as well as location variables ( $W$ ). Some location variables  $W$  only change over time ( $t$ ) for those individuals who move (e.g., distance to a market or to the main road), while others do change over time and are common to all individuals living in the same area  $a$  at the same moment of time (e.g., rain fall in a particular time and year). Given the characteristics of the country, the regression analysis includes a fairly large set of variables that are typically not included in these regressions, both the variables included in  $W$  and  $X$ . For example,  $X$  includes the possibility of receiving assistance in case of need, whether the individual has experience some shocks, and ownership of a large set of durable goods and appliances. Although the inclusion of these variables reduces the coefficient of own consumption, their inclusion is crucial in a context in which consumption (often imprecisely estimated) is used as a proxy for income. In order to account for time-persistent regional characteristics, our regressions include 8 district dummy variables that we call districts ( $\theta_r$ ) (North, Central, Eastern, South, Southern Highlands, West, Lake, and Zanzibar); and three wave dummies ( $\rho_t$ ) to take into account shocks that effect all regions in a given year. Our results are robust to including interaction terms between district and time fixed effects ( $\theta_r * \rho_t$ ) as well as to including 26 regional fixed effects, instead of the 8 district fixed effects we use.<sup>2</sup>

In contrast with the existing literature for African countries, the data at hand is a panel and we can therefore control for individual fixed effects ( $\sigma_i$ ). This means that our identification of relative concerns comes, in contrast with the earlier

<sup>2</sup> Our fixed effect results are also consistent to control for dummies at the same regional level as the reference group, but most of these dummy variables dropped out when defined at the Enumeration Area.

literature, from within individual variation. This is, from individuals who move to another region (i.e., change the reference group) or from individuals who do not move, but nevertheless see the reference group consumption changing over time. One concern with the within estimates is that few individuals drive the results. In our case, one might worry that individuals who move to another region (around 6% in our data) are the ones who might experience the larger changes in reference consumption and are thus driving our results. This however does not seem a concern in our analysis, as our data shows significant changes of the reference group consumption across waves that are fairly similar across movers and stayers, although of course are smaller for those individuals who do not move. In addition, we test robustness of our results to estimate Eq. (1) only for those individuals who do not change location in all waves (stayers) and see that the coefficients are virtually the same as those for the total sample. This regression of course needs to exclude the location variables that do not change over time. Given this result, the small number of movers, the use of individual fixed effects, and the fact that reference consumption changes are similar across movers and stayers, we argue that our estimates of relative deprivation are fairly causal and that we can safely assume that individuals do not move to choose the reference group that maximizes their happiness level. In Appendix E we present the pooled OLS results.

Ferrer-i-Carbonell and Frijters (2004) show that assuming cardinality or ordinality of satisfaction questions does not change the results in terms of trade-offs between variables. Therefore, and for easiness of interpretation and imposed assumptions, the results presented in the paper are obtained from linear models (OLS with individual fixed effects). Since the reference group is defined as the leave-out mean consumption (i.e., does not include own consumption), we do not need cluster errors at the regional level at which the reference income is measured. Our results however are consistent to cluster errors at the geographical level  $a$ . Our final data contains 1433 enumeration areas (of a total of 3180 in Tanzania) and 885 wards (of a total of 1380), and therefore  $a$  is always sufficiently large to cluster standard errors with a standard procedure ( $a$  is recommended to be above 50). Since our dependent variable is defined at the individual level and the consumption (as well as other variables) is defined at the household level, we cluster errors at the household level. Our results are also consistent to a two-way cluster, at the household and at the  $a$  regional level.

#### 4. The context (Tanzania) and data description

##### 4.1. The context (Tanzania)

Tanzania is located in East Africa with a population of 53 million, 68% of which (2015) lives in rural areas. Tanzania GDP per capita is 1076 current US\$ (World Bank, 2020), while the average in sub-Saharan Africa is 1574US\$ (World Bank, 2018).<sup>3</sup> Tanzania is the 30th's poorest country in the world (among the 14% poorest countries), according to the World Bank (same source). Using the same data as in this paper, the National Bureau of Statistics of Tanzania estimates that poverty incidence, measured through basic needs, has increased substantially from 14.8% in wave 1 to 17.9 and 21% in waves 2 and 3, respectively.<sup>4</sup> While in urban areas poverty has remained around 5% (5.7% in the last wave), in rural areas it has increased from 17.3% in wave 1 to 26.5% in the last wave. According to the same source, and using the Household Budget Survey poverty in rural areas was 33.3% in 2011/2012.<sup>5</sup> The average happiness in Tanzania, according to the World Happiness Report (Helliwell et al., 2019) was 3.231 on a 0 to 10 scale, which placed Tanzania as the fourth unhappiest country in the world (153/156). According to Veenhoven (2016) data the average happiness in sub-Saharan Africa in 2011 was 4.37 on a 0 to 10 scale, which is substantially below the average in Western Europe (7.48 in 2005), North America (7.29), and Latin America (6.35) and similar to regions such as East Asia (4.86) (see also Moller et al. 2017 on the unhappiness in Africa and its evolution over time). In sum, this paper studies the feelings of relative deprivation for own life and financial satisfaction in a setting of a poor and unsatisfied country and region.

##### 4.2. Data description

The paper uses the Tanzania National Panel Survey (TNPS), a representative household survey implemented by the National Bureau of Statistics of Tanzania and with the technical support from the LSMS team of the World Bank. The data has a panel structure and although there are currently four waves available: 2008/2009; 2010/2011; 2012/13; and 2014/2015, the last wave is a complete refreshed sample and therefore cannot be used in the empirical analysis, as we aim at controlling for individual fixed effects. The first wave included 3265 households, the second one 3924, and the third wave included 5010 households. The total number of observations in our regressions is much larger, as the data includes all members of the household. Our final data includes all individuals older than 16 living in an interviewed household. Of all individuals in wave 1 (7515 in our sample of individuals older than 16 with no missing information on satisfaction), around 4800 are present in all three waves and about 1075 are only interviewed in 2 waves. In wave 2 the sample is refreshed and while 324 are only present in wave 2, more than 1800 are re-interviewed again in wave 3. In short, we have about 4800 individuals (adults) present in all years (about 14,400 observations) and about 2900 individuals present in two waves (5800 observations).

<sup>3</sup> Current US\$. World Bank: <https://data.worldbank.org/indicator/NY.GDP.PCAP.CD>

<sup>4</sup> NPS\_Wave\_3%20\_Final%20\_Report.pdf

<sup>5</sup> [https://www.nbs.go.tz/nbs/takwimu/references/Tanzania\\_in\\_Figures\\_2018.pdf](https://www.nbs.go.tz/nbs/takwimu/references/Tanzania_in_Figures_2018.pdf)

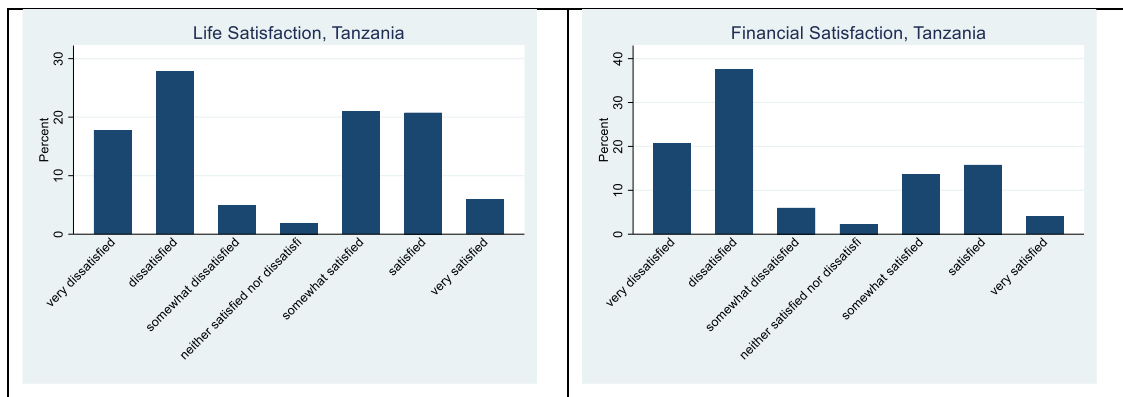


Fig. 1. Life and Financial Satisfaction, Tanzania NPS, average over the first three waves.

Tanzania is divided in various administrative levels and the sampling of the data was based on the list of enumeration areas of the 2002 Population and Housing Census. In the data, and following the census of the Tanzania Bureau of Statistics, households' addresses are classified into, districts, regions, ward, villages, and enumeration areas (EA). The EAs are the primary sampling unit of the Tanzania census and our smaller definition of the reference group. In the 2002 Tanzania Census an EA was designed to have between 60 and 100 households.<sup>6</sup>

The distribution of the answer to the life and financial satisfaction question for our sample is, in contrast with most Western countries, fairly polarized, especially for life satisfaction. While in most Western countries life satisfaction is skewed to the left, in our sample financial satisfaction is skewed to the right and life satisfaction is polarized. In our data, the average life satisfaction is 3.67 on a 1 to 7 scale and 3.14 for financial satisfaction (Fig. 1).

The data set includes information on total annual household consumption, which is our proxy measure of income. Consumption includes in kind income, which might be substantial in Tanzania. In concrete, the data includes information on total consumption that includes both, market and non-market transactions, as well as food and non-food consumption. Food consumption includes consumption from purchases in the market and from meals eaten away, as well as from own production or received as a gift (there are 59 key food items in the questionnaire). Non-food consumption includes a large range of items, such as utilities, health, transportation, communications, recreation, education, furnishings, and personal care. The non-food consumption includes only purchases and it is thus assumed that non-food consumption cannot come from own production. The methodology of the data does not include durable goods and housing as consumption, but we include its ownership in the regression separately. The information is all provided in prices, adjusted (over time and across regions) for the cost of living. Finally, the data provided adult- equivalent scale by gender and age in which, for example a kid younger than 2 weighted 0.4, while a male 19 to 59 weighted 2 and a female of the same age 0.88. We take this total consumption measure (in real and household size equivalent terms) provided by the data organizers as our measure of household consumption, which is expressed in Tanzanian Shillings. At the current exchange rate, the average household consumption in real terms is 817,974 (see Table 1), which is equivalent to about 310 euros or 355 US dollars (1 Tanzanian Shilling is about  $4.10^{-4}$  US dollars). In order to account for decreasing marginal utility of consumption, we introduce this variable in logarithm terms.

Table 1 shows the descriptive statistics for some of the controls variables<sup>7</sup> and for the same sample as the regressions. Our satisfaction regressions includes a large set of individual and household characteristics: a dummy for the gender of the head of the household; household size; number of elders (individuals older than 65) in the household; number of workers in the household; a set of age dummy variables if the respondent was 16 to 25 (38% of the sample), 26–40 (29% of the sample), 41–55 (15% of the sample), and older than 55 (13% of the sample); education level (no-education, primary, secondary –reference–, tertiary education, or still in school); marital status (divorced, married, single, or widow –reference–); main occupation (employed, student, looking for a job–reference–, disable, does not have a job), disabled or inactive; whether the respondent visited the doctor over the last 4 weeks; number of years in the community (village or neighborhood communities); whether the individual has recently received some assistance (financial or in-kind) by governmental or non-governmental institutions (e.g., food or school scholarships) or received a (micro) credit from the community or from a financial institution and its money value; whether the household has gone through some recent shocks (e.g., drought or floods, severe water shortage, or death of household member); ownership of household assets or appliances (mobile phone, freezer, computer, motorcycle, bicycle, vehicle, land, agricultural tools, etc.); distance to the nearest major road, larger town (+20,000), and market; climate and temperature. The regression includes some dummy variables for missing observations in which case the original variable is replaced with the mean value.

<sup>6</sup> In our data the largest enumeration area has 48 individuals and the largest ward 118.

<sup>7</sup> For reasons of space, the full list of descriptive statistics is not printed, but available upon request.

**Table 1**  
Descriptive statistics LSM-Tanzania.

Variable	Mean	Std. Dev.	Min	Max
Life Satisfaction	3.656	2.05	1	7
Financial Satisfaction	3.145	1.96	1	7
Consumption in real terms	817,974	698,660.50	43,481	15,200,000
Mean consumption ref. group (EA)	812,140	525,028.00	100,181	6423,196
Mean consumption ref. group (Ward)	830,588	502,789.30	138,138	4978,549
Head of household is a man	0.797	0.40	0	1
Household size	3.933	2.35	1	25
Number of workers in household	2.995	1.93	0	23
Number of elder in household	0.302	0.58	0	3
Age of the respondent	37.021	16.99	16	108
Respondent is a male	0.450	0.50	0	1
Respondent main occupation:				
Works	0.853	0.35	0	1
Looking for a job	0.005	0.07	0	1
Student	0.085	0.28	0	1
Disable	0.017	0.13	0	1
Has not job	0.040	0.20	0	1
Respondent's education:				
Still in school	0.077	0.27	0	1
No education	0.002	0.04	0	1
Primary education	0.540	0.50	0	1
Secondary education	0.134	0.34	0	1
University education	0.005	0.07	0	1
Missing info in education	0.242	0.43	0	1
Respondent marital status:				
Single	0.261	0.44	0	1
Married	0.602	0.49	0	1
Divorced	0.067	0.25	0	1
Widow	0.070	0.25	0	1
Individual visited doctor last 4 weeks	0.163	0.37	0	1
Number of observations	22,023			

Note: mean consumption is the leave-out mean.

#### 4.3. Reference group definition

A key issue in this literature is how to define the reference group of each individual. While some authors define the reference group using individual characteristics (notably age, gender, education, or employment status or occupation) (e.g., Clark and Oswald, 1996 and Ferrer-i-Carbonell, 2005), in this paper we follow the literature that defines the reference group using geographical proximity (e.g., Ifcher et al., 2016; Luttmmer, 2005; Ravallion and Lokshin, 2010). On the one side, in rural Tanzania there is little variation in individuals' education, occupation, or employment. On the other side, mobility of poorer individuals is very limited, which makes the links within the community strong, rather than within socio-economics groups that might live elsewhere. Therefore, and like most other papers in Africa, we use geographical proximity to define the reference group. In other words, we assume that individuals compare themselves to those living in the same area ( $a$  in Eq. (1)).

As discussed earlier, and in order to shed some light on the mechanisms that drive relative income concerns (ranging from feelings of deprivation to positive externalities of close neighbors or feelings of empathy), we define two different reference groups: close neighbors (1433 Enumeration Areas in our final data) and those living in a larger geographic area (885 wards in our final data). We drop from our analysis those Enumeration Areas in which there are fewer than five households in the data, as there is little information to estimate the leave-out mean consumption of the reference group. Our results are robust to dropping from the regression those EAs that have in our data fewer than 10 and 15 households, but the coefficients become imprecisely estimated for the rural sample, as we drop a larger percentage of the observations.

The first definition of reference group (close neighbors) is similar to Ravallion and Lokshin (2010 in Malawi) who also use EAs, but it is a smaller geographical area than the definition of close neighbors used in Kingdon and Knight (2007 in South Africa). The EAs, which were created and defined for census purposes, are designed to have an average population of 60 to 100 households in Tanzania,<sup>8</sup> and therefore represent fairly small areas, where most people know each other. The smaller reference group in Kingdon and Knight's (2007) study for South Africa is significantly larger than our definition, having 2900 individuals or 580 households, on average.

Our second definition of the reference group uses the ward, an administrative division in Tanzania that can include part of a large city, an entire village, or more than one village in rural areas. We can thus test whether relative concerns

<sup>8</sup> [https://ihi.eprints.org/2169/1/Age\\_Sex\\_Distribution.pdf](https://ihi.eprints.org/2169/1/Age_Sex_Distribution.pdf)

change when reference groups do not consist only of those individuals with whom the respondent might have stronger ties, but they include a larger population. A ward is the lowest administrative structure in Tanzania and it usually includes less than 20,000 people, although some are as small as 2500 individuals. For example, Daar es Salaam area, which has 4.3 million inhabitants according to the 2012 census and is the largest city of Tanzania, is divided into 73 wards, while Arusha, with 416,000 inhabitants, is divided into 18 wards. This is the largest geographical area we use to define the reference group, as our next geographical division we could use are the 26 regions, with many of them having more than one million individuals. Using such large regions to define the reference group might pick up other confounding factors, such as the development level of the region, for which we control in our analysis by means of district and region fixed effects.

Since wards are larger areas than EAs, the positive externalities from having richer neighbors notably through risk sharing should be less important in wards than in EAs. Therefore, the different sizes of these two areas, in combination with the use of financial and life satisfaction, will contribute to understand the motives behind relative concerns in poor Africa. We expect the leave-out mean consumption of those individuals living in the same enumeration area to have a positive effect on life satisfaction, if relative concerns of deprivation are outweighed by empathy or by the positive externalities of having richer neighbors.

## 5. Results: relative deprivation and empathy

### 5.1. Baseline specification and robustness analysis

We first present the results of Eq. (1) for the total sample with the two reference groups and the two satisfaction measures (Table 2). The regressions include individual, district, and time fixed effects; a large set of controls as described in Section 4.2; and errors are clustered at the household level. In Appendix E we present robustness of our results with pooled OLS; and Table A1 in Appendix A show robustness to different number of controls. In concrete, Table A1 shows the results with no controls or with a smaller set of controls, as standard in the literature; as well as to including Regional (there are 26 regions in Tanzania) instead of District fixed effects. Including fewer controls increases the coefficient for own consumption as well as the precision of some of our estimates. However, we opt for presenting the results with the long list of controls, as their inclusion is very relevant in a context in which we need to proxy income with consumption. Since consumption is only a proxy for income, the longer set of controls reduces a possible bias due to omitted variables. For example, two households with a similar yearly consumption, might have a different economic status depending on whether they have certain durable goods accumulated over time or whether they have access to credit.

Table 2 specifications (1) and (3) present the results when the reference group is defined as those living in the same Enumeration Area (EA) (the smaller geographical unit that aims at capturing the role of relative deprivation within close neighbors); and specifications (2) and (4) define the reference groups as those living in the same ward (the larger geographical unit). As expected, own consumption positively correlates with financial and life satisfaction and the coefficients are precisely estimated. The coefficient of own consumption on life and financial satisfaction is very similar in size and precision, and the differences between the four coefficients are not statistically significant. Table A2 in the appendix shows the results for the other coefficients.

The results show that individuals' financial satisfaction is negatively (and statistically significant) correlated with the leave-out mean consumption of their reference group, regardless of how we define the reference group. The negative coefficient of the reference consumption is twice as large when the reference group is defined at the ward (larger) geographical level (-0.201 vs -0.413), although the two coefficients are not statistically different. This negative effect is negative indicates that individuals in a poor African country do have strong feelings of deprivation in terms of their financial satisfaction. We cannot compare this finding with earlier literature, as none of the previous articles had used financial satisfaction to examine relative deprivation in Africa. The size of the reference consumption coefficient is similar to that of the own consumption. For example, a one standard deviation increase in own consumption has a similar effect on financial satisfaction

**Table 2**  
Satisfaction and relative consumption, with individual fixed effects.

	(1) Financial Satisfaction		(3) Life Satisfaction	
	Ref: EAs	Ref: Ward	Ref: EAs	Ref: Ward
$\ln(\text{consumption}) \ln C_{it,ar}$	0.130** (0.060)	0.147** (0.059)	0.131** (0.065)	0.164*** (0.063)
$\ln(\text{leave-out mean cosump.ref.group}) \ln \bar{C}_{it,ar}$	-0.201** (0.093)	-0.413*** (0.110)	0.040 (0.103)	-0.132 (0.124)
Number Observations	22,023	22,023	22,223	22,223

Standard errors in parentheses are clustered at the household level.

\*  $p < 0.1$ .

\*\*  $p < 0.05$ .

\*\*\*  $p < 0.01$ . Regressions include the long set of controls; and individual, district, and time fixed effects. The longer version is printed in Table A2 and the full version is available upon request.



( $0.13 \times 0.68 = 0.09p$ ) as a one standard deviation decrease in the leave-out mean consumption of the reference group when defined at the enumeration area ( $0.201 \times 0.53 = 0.11$  points), and about 4% of one standard deviation of satisfaction. A one standard deviation increase of the reference group defined at the ward level however impacts financial satisfaction twice as much ( $0.22p$  vs  $0.1p$ ). Moving from being the poorest to the richest individual in our sample, measured with own consumption, increases financial satisfaction by 0.6 to 0.8 points on a 1 to 7 scale. This effect is similar, for financial satisfaction, to moving from the richest to the poorest reference group defined at the enumeration area, while keeping own consumption constant. Again, the effect is twice as large if the reference group is defined at the ward level.

For life satisfaction, instead, we find very imprecise estimates that are also smaller in size than those for financial satisfaction, both in absolute terms as well as relative to the coefficient of own consumption. These results contrast with the literature that finds an average positive effect of the income of close neighbors in Africa with cross-section data. When we present the analysis separating the urban and rural sample and allowing an interaction term with the number of years the individual lives in the community, we will see that the imprecise estimates for life satisfaction are the result of heterogeneous effects.

Next we perform a series of tests to check the robustness of our results to different specifications and definitions of the reference group. As discussed above, [Table A1](#) presents robustness of our estimates to the inclusion of different controls. Second, in [Appendix B](#) we show the results with two different approaches to estimate the importance of relative concerns. [Table B1](#) shows the results when we use the rank the individual occupies within the consumption distribution of the reference group, instead of the leave-out mean consumption. In the African context, however, the leave-out mean consumption is more relevant as it can capture possible externalities of living in rich neighborhoods (including risk-sharing). Rank instead ranges from 0 to 1 independently of the level of consumption or of the absolute difference across individuals. In [Appendix B](#) we present the results and show that the results using rank are consistent with those in [Table 2](#), although the precision of the estimates gets reduced substantially. [Table B2](#) presents the results when relative concerns are measured as the difference between the leave-out mean consumption and own consumption. These results are consistent with [Table 2](#) and the coefficients for the difference are precisely estimated for financial satisfaction, as in [Table 2](#).

Third, we use alternative definitions of the reference group that included individual characteristics to the geographically defined groups. In concrete, we define the reference group as those individuals living in the same EA or Ward that, in addition, are of the same gender or age group. [Table C1](#) in [Appendix C](#) presents and shows that including individual characteristics to define the reference group does not change the results presented in [Table 2](#).

Fourth, we present the results when we increase the size of the geographic area to define the reference groups. In [Table C2](#) ([Appendix C](#)) we present results when the reference group is defined as those living in the same district, which is the largest area for which we have information. These regressions show that using the ward or the district as the reference group does not change the results, which seems to indicate that once we move beyond the definition of the reference group as close neighbors (enumeration areas in specification 1 and 3, [Table 2](#)), the results remain similar as we increase the size of the regional definition.

Fifth, we check whether individuals also show relative concerns with respect to other variables that also capture economic prosperity or wealth. While we find small and imprecisely estimated coefficients when we examine the effect of durable goods owned by the reference group on own satisfaction, we find interesting results for health measures related to wealth. In [Table C3](#) ([Appendix C](#)) we present results with the leave-out mean average height and weight of the reference group. The results are consistent with [Table 2](#): there is a negative and well precisely estimated coefficients for the leave-out mean height and weight of the reference group (with the two reference group definitions) on financial satisfaction, while the coefficients are smaller and imprecisely estimated for life satisfaction.

## 5.2. Rural and urban samples

If the positive sign of leave-out mean consumption on life satisfaction that some studies find is due to positive externalities from close neighbors (risk sharing, neighbors' income as a source of insurance, public goods in the neighborhood, empathy, etc.), we would expect the size of the positive effects to depend on the strength of the ties between members of the reference group. Since rural households typically live in closer communities with stronger ties, we expect them to benefit more from having richer neighbors than urban households. In other words, while we might expect urban individuals to show a negative coefficient for the leave-out mean consumption of their reference group (relative concerns), the opposite might be true for rural households for which the relative deprivation feelings might be outweighed by the positive externalities of living close to rich people. In fact, the existing literature using African data finds that the positive correlation between the income or consumption of those individuals living close by and own life satisfaction is stronger or only appears for the rural or the poorest sample ([Bookwalter and Dalenberg, 2010](#); [Kingdon and Knight, 2007](#); [Ravallion and Lokshin, 2010](#)). To test for this in our data we introduce an interaction term between the leave-out mean consumption of the reference group and a dummy variable that takes value 1 if the individual lives in a rural area. Please note that the dummy variable for living in a rural area was also included as a control in our baseline specification ([Table 2](#)). In our data, and as expected, the rural sample is also much poorer (55% of the average urban consumption) than the urban sample, although consumption is more equally distributed (urban consumption standard deviation is twice as large). [Table 3](#) shows the results for financial and life satisfaction. In [Appendix D](#) ([Table D1](#)) we show robustness of our results to introducing

**Table 3**  
Heterogeneity in relative deprivation: rural vs urban households, with individual FE.

	(1)	(2)	(3)	(4)
	Financial Satisfaction		Life Satisfaction	
	Ref: EAs	Ref: Ward	Ref: EAs	Ref: Ward
Ln(consumption)	0.129** (0.060)	0.147** (0.059)	0.128** (0.065)	0.163*** (0.063)
Ln(leave-out mean cosump.ref.group) $Ln\bar{C}_{tar}$	-0.265** (0.123)	-0.384*** (0.148)	-0.164 (0.144)	-0.314* (0.165)
Rural* $Ln\bar{C}_{tar}$	0.089 (0.130)	-0.041 (0.148)	0.281* (0.147)	0.254 (0.161)
Rural	-1.219 (1.769)	0.539 (2.014)	-3.797* (1.989)	-3.429 (2.178)
Number of Observations	22,023	22,023	22,223	22,223

Standard errors in parentheses clustered at the household level; \*  $p < 0.1$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$ . Same specification as the baseline regressions in Table 2, but with an interaction term between the consumption of the reference group and whether the individual lives in a rural area.

an additional interaction term between own consumption and whether the individual lives in a rural area. In other words, Table D1 introduces heterogeneity of preferences not only on relative concerns, but also on own consumption.

Individuals show clear relative feelings of deprivation in terms of financial satisfaction, regardless of how we define the reference group and whether they live in rural or urban areas. For the urban sample, the coefficient of the leave-out mean consumption of the reference group is larger when defined at the ward level (larger geographical area), but both coefficients are large and negative (-0.265 and -0.384) and the difference is not statistically different, as it was not in Table 2. The interaction between the leave-out mean consumption and whether the individual lives in a rural area is very small and very imprecisely estimated. The lineal combination of the two coefficients (-0.265 + 0.89 and -0.384 and -0.041) is statistically different from zero. In other words, individuals living in rural areas (with stronger social ties) also have a negative coefficient of the leave out mean consumption of the reference group on financial satisfaction, regardless of whether reference groups are defined as close neighbors or those living in larger areas (speculations 1 and 2 in Table 3). The negative coefficients of reference consumption for financial satisfaction seems to indicate that any positive effect of the reference group consumption and life satisfaction does not run through economic reasons, such as richer neighbors acting as a source of insurance in time of hardship.

Instead, individuals living in rural areas show a not statistically different from zero coefficient of the leave-out mean consumption on life satisfaction neither when the reference group is defined as close neighbors (-0.164 + 0.281) nor when defined at the Ward level (-0.314 + 0.254). When individuals compare with close neighbors, the coefficient for the interaction term with living in a rural area is positive, large, and precisely estimated, but the coefficients for the reference consumption is very imprecisely estimated (-0.164, se = 0.144). Table D1 shows the results when own consumption is also interacted with between living in a rural area. In this case, individuals living in a rural area show a positive coefficient for the reference consumption (-0.264 + 0.423), which significant only at the 17%. These results might point to some heterogeneity across individuals that we have not been able to capture with this specification and which we will address in the next section. Individuals living in urban areas (32% of the sample) have a negative imprecisely estimated coefficient when the reference group is defined as close neighbors, but a negative, large, and precisely estimated coefficient when the reference group is defined at the Ward level.

### 5.3. Relative concerns and empathy

The always negative effect of the reference group consumption on financial satisfaction, which is fairly similar regardless of the definition of the reference group or whether the individual lives in a rural or urban area, makes it hard to argue that any positive effect of close neighbors' consumption on life satisfaction is due to the positive externality of having richer neighbors who can help you in time of hardships (risk sharing) (Ravallion and Lokshin, 2010). In addition, we perform other tests to reject the hypothesis that assistance in time of hardship is driving the earlier results. For example, we look for heterogeneous effects depending on the inequality in the region or on whether households received assistance or credits in the previous year. All tests are rejected. Therefore, we argue that having richer neighbors might have other positive externalities that are not strictly related to financial, but rather to life satisfaction.

There are two main additional arguments the literature has put forward to a positive effect of neighbors' income on life satisfaction or happiness: (i) positive externalities in terms of a better public environment (e.g., better public services –schools, roads,...- or access to a higher educated network) (see e.g., Clark et al. 2009 and Ifcher et al. 2016) or (ii) pure empathy generated by proximity (see also the literature on social distance and generosity, e.g., Charness and Gneezy, 2008; Burnham, 2003; Hoffman et al., 1996). Since our regression includes variables related to the welfare level in the community (five climate variables and distance to major road, large town, or market) for which other papers could not control, we think that it is difficult to argue that the first explanation is playing an important role. For example, a regression of these variables (five climate variables and distance to major road, large town, or market) explains 18% of the variance of the leave-out mean

**Table 4**  
Heterogeneity in relative deprivation: years in the community, with individual FE.

	(1)	(2)	(3)	(4)
	Financial Satisfaction		Life Satisfaction	
	Ref: EAs	Ref: Ward	Ref: EAs	Ref: Ward
Ln(consumption)	0.129** (0.060)	0.146** (0.059)	0.129** (0.065)	0.161** (0.063)
Years in the community	-0.080** (0.035)	-0.066* (0.039)	-0.173*** (0.041)	-0.204*** (0.044)
Ln(leave-out mean cosump.ref.group $Ln\bar{c}_{tar}$ )	-0.372*** (0.119)	-0.551*** (0.139)	-0.319** (0.134)	-0.547*** (0.152)
Years in the community* $Ln\bar{c}_{tar}$	0.006** (0.003)	0.005* (0.003)	0.013*** (0.003)	0.015*** (0.003)
N	22,023	22,023	22,223	22,223

Standard errors in parentheses clustered at the household level; \*  $p < 0.1$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$ . Same specification as the baseline regressions in Table 2, but with an interaction term between the consumption of the reference group and the number of years the individual lives in the community.

consumption of the reference group. In addition, many of the positive externalities are related to the welfare and if this was playing an important role, we should also not expect a negative effect of the reference group consumption on financial satisfaction.

Finally, and in line with Kingdon and Knight (2007), we test whether empathy with those with whom individuals have stronger ties can explain the different average consumption of close neighbor's coefficients on life and financial satisfaction. It might also be that households receive financial help only from family members rather than neighbors and better-off family members often migrate to urban areas or abroad. Therefore, we cannot capture these positive externalities by looking at neighbors' income. In order to test for the hypothesis that empathy plays a role in explaining the differences between life and financial satisfaction we interact the leave-out mean consumption of the reference group with the number of years that the individual lives in the community. As in Table 2 we use the total sample, not distinguishing by place of residence. The results are presented in Table 4. In Appendix D (Table D2) we present robustness of these estimates to introducing an additional interaction term between own consumption and the number of years that the individual lives in the community.

In Table 4 all the coefficients of the leave-out mean consumption of the reference group are negative, both for financial and life satisfaction, regardless of the definition of the reference group. Nevertheless, its interaction with the number of years in the community turns the coefficient to positive for some sub-samples. Let us first look at the results for financial satisfaction. The linear combination of both coefficients implies that the consumption of the reference group defined at the EAs level only turns into a small and positive coefficient for the 5.3% of the sample who have lived 62 years or more in the same community ( $0.01 = -0.362 + 0.006 \times 62$ ), and the coefficient increases with the number of years. This means that it is also a very old sample. When the reference group is defined at the ward level, the reference effect never turns positive within the sample, as it only does when age is larger than 127. In short, and consistently with all the previous results, all individuals in Tanzania show relative concerns in terms of financial satisfaction regardless of how we define the reference group.

For life satisfaction instead, interesting results appear, and these are again consistent with the idea that the positive coefficient of leave-out mean consumption of close neighbors on life satisfaction runs through empathy and therefore depend on the strength of the ties between members of the same community (same reference group). The effect of the leave-out mean consumption on life satisfaction is negative (individuals show relative concerns), large and precisely estimated. The interaction coefficient, which is small and precisely estimated, turns the feelings of relative deprivation into positive for those individuals living more than 24 years in the community, when the reference group is defined as close neighbors, and 36 years when we take the ward as the reference group. In our sample, 45% of the population has been living for more than 24 years in the community, and this percentage goes from 52% for the rural population to 30% for the urban population. In Table 4 all coefficients are fairly precisely estimated (very precisely for life satisfaction), which means that we might have detected the variable defining the heterogeneity that shapes relative concerns in life satisfaction. Although one could argue that these results point towards an age rather than an attachment to the community effect (it might be that older individuals are more emphatic), the interaction of the reference group with the age of the respondent leads to extremely small and imprecisely estimated coefficients (the interaction terms are equal to 0.001 or smaller, with standard deviations of 0.001). In addition, the interaction with age leads again to a leave-out mean consumption coefficient imprecisely estimated for life satisfaction, as opposed to the well estimated coefficient found in the model in which we interact leave-out mean consumption with the number of years in the community.

The precisely and well estimated coefficients, especially for life satisfaction, seem to indicate that the specification is explaining the data well and therefore we argue in favor of the model presented in Table 4. In addition, the Akaike and Bayesian information criteria are smaller for the specifications of Table 4, compared to the baseline specification (Table 2), except for Financial Satisfaction when the reference group is defined at the Ward level.

## 6. Conclusions

This paper finds evidence of relative concerns on financial satisfaction of all individuals in Tanzania, regardless of the definition of the reference group, whether the individual lives in a rural or urban environment, and quite independently of the number of years in the community, a variable that proxies for the strength of the ties with the reference group. In short, we find important feelings of relative deprivation (comparisons) in a poor context in terms of financial satisfaction. This finding is robust to controlling for different regional fixed effects, individual fixed effects, and a large set of controls. This is the first paper that tests for relative concerns using a financial and not life satisfaction question and therefore it is the first one to find relative deprivation in a poor context once we examine financial and not life satisfaction. For life satisfaction, however, we find important heterogeneity: we find a positive effect of leave-out mean consumption of the reference group on life satisfaction depending on the strength of the ties that individuals have with their reference group, measured with years living in the same community. In particular, for 45% of our sample who has lived for more than 24 years in the community (this percentage is 52% for the rural population and 30% for the urban population), the effect of the leave-out mean consumption is positive on life satisfaction, when we define the reference group as close neighbors. When the reference group is defined as a larger geographical area (ward) this percentage goes to 25%. Since we find an always negative effect of the reference group consumption on financial satisfaction, it is hard to argue that the positive effect of the reference consumption on life satisfaction is due to the positive externality of having richer neighbors who can help in times of hardship (Ravallion and Lokshin, 2010). We perform different tests and argue that the positive effect of reference consumption on life satisfaction might be due to empathy, a feeling that increase with closeness to the other members of the reference group (years in the community and size of the area over which we define the reference group).

Our analysis confirms the importance of distinguishing among different reference group in terms of geographical proximity as well as distinguishing between financial and life satisfaction measures. These distinctions contribute to understanding the importance of taking comparisons to others seriously when assessing and introducing welfare policies, also in less developed countries. The importance of examining not only life, but also financial satisfaction to assess relative concerns in relation to poverty and economic welfare seems straightforward. In fact, our data shows a low correlation (0.55) between those two measures. If we are concerned not only about absolute poverty, but also about subjective poverty (financial satisfaction) and well-being, this paper points to the importance of relative concerns to assess and evaluate welfare policies, also in less developed countries. The results are robust to the inclusion of a larger or smaller set of controls as well as to the size of the regional fixed effects. Finally, this paper uses panel data and can thus control for individual time fixed effects, which helps address causality and has proven to change the results (Ferrer-i-Carbonell and Frijters, 2004).

### Declaration of Competing Interest

None.

### Acknowledgments

Ada Ferrer-i-Carbonell acknowledges financial support from the Spanish Ministry of Economy and Competitiveness through the Severo Ochoa Programme for Centres of Excellence in R&D [SEV-2015–0563]; the AEI/FEDER, UE [PID2020–114251GB-I00]; and the AGAUR-Generalitat de Catalunya [SGR2017–1359]. We gratefully acknowledge the comments from two anonymous referees, as well as from Scott Kostyshak, Joan Lluall, and the participants of the micro seminar at the University of Florida.

### Appendix A: satisfaction regressions without relative concerns

Table A1 shows robustness of the baseline results presented in Table 2 to including only a short set of controls, as standard in the literature, or with no individual or household controls other than own consumption and consumption of the reference group. Table A1 also shows robustness to controlling for two different levels of regional fixed effects: 8 districts or 26 regions.

### Appendix B: satisfaction and rank

Appendix B presents the results for two different alternative specifications to measure relative concern. First, in Table B1 we use the rank that the individual has within the consumption distribution of their reference group to capture individuals' relative concerns. Most of the coefficients are very imprecisely estimated, except for the positive coefficient on financial satisfaction of the rank when the reference group is defined at the Ward level. This lack of precision of the rank coefficient might be due to the fact that estimating the rank with a small number of households can lead to larger errors than leave-out mean consumption. The imprecision however might also be due to the fact that, in a poor context, leave-out mean consumption is more relevant than the rank, which ranges from 0 to 1 independently of the level of consumption or of the absolute difference across individuals. The results in Table B1 however are aligned with those in Table 2:

**Table A1**  
Satisfaction and relative consumption, robustness to controls, with individual FE.

	(1) Financial Satisfaction		(3) Life Satisfaction	
	Ref: EAs	Ref: Ward	Ref: EAs	Ref: Ward
<b>Short list of controls</b>				
District (8) FE				
Ln(consumption) $LnC_{itar}$	0.162*** (0.062)	0.171*** (0.060)	0.170*** (0.066)	0.192*** (0.064)
Ln(leave-out mean cosump.ref.group) $Ln\bar{C}_{tar}$	-0.222** (0.094)	-0.396*** (0.110)	0.014 (0.104)	-0.102 (0.125)
Region (26) FE				
Ln(consumption) $LnC_{itar}$	0.165*** (0.062)	0.174*** (0.060)	0.183*** (0.066)	0.204*** (0.064)
Ln(leave-out mean cosump.ref.group) $Ln\bar{C}_{tar}$	-0.218** (0.095)	-0.392*** (0.112)	0.021 (0.105)	-0.088 (0.127)
<b>No additional controls</b>				
District (8) FE				
Ln(consumption) $LnC_{itar}$	0.149** (0.061)	0.156*** (0.059)	0.159** (0.066)	0.179*** (0.064)
Ln(leave-out mean cosump.ref.group) $Ln\bar{C}_{tar}$	-0.236** (0.095)	-0.406*** (0.111)	0.010 (0.105)	-0.097 (0.126)
Region (26) FE				
Ln(consumption) $LnC_{itar}$	0.152** (0.061)	0.158*** (0.059)	0.172*** (0.066)	0.191*** (0.064)
Ln(leave-out mean cosump.ref.group) $Ln\bar{C}_{tar}$	-0.235** (0.095)	-0.404*** (0.112)	0.016 (0.106)	-0.085 (0.128)
Number of observations	22,023	22,023	22,223	22,223

Standard errors in parentheses are cluster at the household level.

\*  $p < 0.1$ .

\*\*  $p < 0.05$ .

\*\*\*  $p < 0.01$ . All specifications include region or district as well as individual and time fixed effects.

Second, in [Table B2](#) we measure relative deprivation as the distance between own consumption and that of the reference group. To ease interpretation, we introduce consumption as the absolute amount divided by 100,000. The results show again precisely estimated coefficients for our measure of relative deprivation in financial satisfaction, while these coefficients are very small and imprecise for life satisfaction when the reference group is defined as close neighbors, and negative and imprecisely estimated when the reference group is defined at the ward level. These results are consistent with our baseline regression ([Table 2](#)).

**Appendix C: baseline regressions: robustness tests**

In this Appendix we present the different robustness tests, as described in the main text.

*C.1. Including individual characteristics in the definitions of the reference group*

We present results when we add age and gender to the reference group. We define age in three groups younger than 26 (39% of the sample), from 26 to 60 (51% of the sample), and older than 60 (10% of the sample). We cannot split the sample further, as we decrease the number of individuals in each reference group very much. In fact, splitting the sample for age groups already reduces a lot the number of individuals in each reference group and might explain some imprecision of our estimates. The results, which are presented in [Table C1](#) are consistent with [Table 2](#). The results are shown in one single table for reasons of space, but they represent three different specifications.

*C.2. Reference group with three geographical definitions*

In [Table C2](#) we present the results when the reference group is defined not only at the Enumeration Area and Ward, but also at the district level (specifications 3 and 6). The results show that increasing the size of the reference group does not bring new insights.

*C.3. Height and weight*

[Table C3](#) presents the results in which the leave-out mean height and weight of the reference group are used as proxy measure of wealth. The results are consistent with [Table 2](#).

**Table A2**  
Same results as Table 2.

	(1) Finance Satisfaction		(3) Life Satisfaction	
	(2)		(4)	
	EA	Ward	EA	Ward
Ln(consumption) $Ln\bar{C}_{itar}$	0.130**	0.147**	0.131**	0.164***
	-0.06	-0.059	-0.065	-0.063
Ln(leave-out mean cosump.ref.group) $Ln\bar{C}_{itar}$	-0.201**	-0.413***	0.04	-0.132
	-0.093	-0.11	-0.103	-0.124
Head of the household is a male	0.226*	0.222*	0.112	0.111
	-0.13	-0.13	-0.131	-0.131
Number of elder in household	0.032	0.031	0.052	0.052
	-0.086	-0.086	-0.089	-0.089
Number of workers in household	0.003	0.003	-0.029	-0.03
	-0.032	-0.032	-0.037	-0.037
Household size	0.003	0.005	0.049	0.049
	-0.03	-0.03	-0.034	-0.034
Age of the respondent (Refs. Clark (1918);Helliwell et al., 2019)				
Age 26–40	-0.198***	-0.198***	-0.036	-0.035
	-0.072	-0.072	-0.075	-0.075
Age 41–55	-0.046	-0.048	-0.151*	-0.153*
	-0.082	-0.081	-0.088	-0.088
Age 56*	0.107	0.108	0.202	0.203
	-0.14	-0.139	-0.142	-0.142
Education (ref. secondary educ.)				
Respondent still in school	0.285	0.285	0.248	0.244
	-0.208	-0.208	-0.21	-0.21
Less than primary education	-0.104	-0.091	-0.105	-0.106
	-0.427	-0.426	-0.46	-0.46
Primary education	-0.116	-0.122	-0.236**	-0.239**
	-0.107	-0.107	-0.113	-0.112
University education	0.704*	0.683*	-0.025	-0.036
	-0.389	-0.39	-0.406	-0.405
Missing information on educ.	-0.135	-0.138	-0.221*	-0.222*
	-0.123	-0.122	-0.127	-0.126
Individual status (ref. widowed)				
Single	0.474***	0.476***	-0.155	-0.155
	-0.157	-0.157	-0.175	-0.176
Married	0.281**	0.281**	0.016	0.015
	-0.141	-0.141	-0.155	-0.155
Divorced	0.158	0.155	0.017	0.014
	-0.143	-0.143	-0.164	-0.164
Health poverty	-0.029	-0.029	0.006	0.005
	-0.051	-0.051	-0.052	-0.052
Years in the community	0.001	0.001	-0.003	-0.003
	-0.002	-0.002	-0.002	-0.002
Working status (ref. looking for a job)				
Individual has no job	-0.252	-0.253	0.065	0.067
	-0.235	-0.236	-0.247	-0.248
Individual is student	-0.133	-0.143	0.105	0.108
	-0.284	-0.285	-0.299	-0.299
Individual is working	-0.145	-0.155	0.063	0.06
	-0.234	-0.235	-0.243	-0.243
Disable	-0.149	-0.165	-0.206	-0.21
	-0.289	-0.29	-0.322	-0.322
Household lives in a rural area	-0.016	-0.01	0.004	0.006
	-0.092	-0.091	-0.105	-0.105
Number of observations	22,023	22,023	22,223	22,223

Same regression as in Table 2 with a longer list of controls printed. The full table is available upon request.

### Appendix D: allowing for interactions with own consumption

Tables D1 and D2 show the results in which we allow heterogeneity not only in the impact of the reference consumption on satisfaction (Tables 3 and 4), but also on own consumption. This is, in addition to the interaction term between the consumption of the reference group and whether the individual lives in a rural area (Table 3) and the number of years the individual lives in the community (Table 4), results in Tables D1 and D2 also include and interaction between own consumption and these two variables, respectively. The results are consistent with Tables 3 and 4 and, if anything, Table D1 makes our conclusions stronger.

**Table B1**  
Satisfaction and relative consumption: rank, with individual FE.

	(1) Finance Satisfaction		(3) Life Satisfaction	
	(2)		(4)	
	Ref: EAs	Ref: Ward	Ref: EAs	Ref: Ward
Ln(consumption) $LnC_{itar}$	0.030 (0.073)	-0.072 (0.084)	0.188** (0.077)	0.157* (0.089)
Individuals Rank within the group	0.117 (0.118)	0.336** (0.141)	-0.118 (0.125)	-0.034 (0.152)
Number of observations	22,023	22,023	22,223	22,223

Standard errors in parentheses clustered at the household level.

\*  $p < 0.1$ .

\*\*  $p < 0.05$ .

\*\*\*  $p < .01$ . Same specification as the baseline regressions in Table 2, but relative deprivation measured with the rank.

**Table B2**  
Satisfaction and relative consumption, differences, with individual FE.

	(1) Finance Satisfaction		(3) Life Satisfaction	
	(2)		(4)	
	Ref: EAs	Ref: Ward	Ref: EAs	Ref: Ward
Own consumption $C_{itar}$	-0.000 (0.000)	-0.000 (0.000)	0.000 (0.000)	-0.000 (0.000)
$\bar{C}_{itar} - C_{itar}$	-0.017* (0.010)	-0.027** (0.012)	-0.000 (0.011)	-0.015 (0.014)
Number of observations	22,023	22,023	22,223	22,223

Standard errors in parentheses clustered at the household level.

\*  $p < 0.1$ .

\*\*  $p < 0.05$ .

\*\*\*  $p < 0.01$ . Same specification as the baseline regressions in Table 2, but relative deprivation measured as the difference between the average consumption of the reference group and own consumption.

**Table C1**  
Reference group includes individual characteristics, with individual FE.

	Finance Satisfaction		Life Satisfaction	
	Ref: EAs	Ref: Ward	Ref: EAs	Ref: Ward
<b>Ref. group includes gender</b>				
Ln(consumption) $LnC_{itar}$	0.102* (0.057)	0.109* (0.057)	0.137** (0.061)	0.154** (0.060)
Ln(leave-out cosump.ref.group) $Ln\bar{C}_{itar}$	-0.149** (0.069)	-0.279*** (0.087)	0.027 (0.077)	-0.100 (0.098)
<b>Ref group includes age</b>				
Ln(consumption) $LnC_{itar}$	0.121* (0.063)	0.137** (0.061)	0.116* (0.068)	0.162** (0.065)
Ln(leave-out cosump.ref.group) $Ln\bar{C}_{itar}$	-0.121 (0.084)	-0.234** (0.093)	0.069 (0.091)	-0.077 (0.101)
Number of observations		-0.234**		-0.077

Standard errors in parentheses clustered at the household level. \*  $p < 0.1$ .

\*\*  $p < 0.05$ .

\*\*\*  $p < 0.01$ . Same specification as the baseline regressions in Table 2, but the reference group includes gender (first panel) and age (second panel).

**Appendix E: pooled OLS data**

In this Appendix we present results when we estimate our regressions with pooled OLS, i.e., we exclude individuals fixed effects. Although our main contribution comes from comparing life and financial satisfaction, using different reference groups, and including interactions to proxy for empathy; we argue that including fixed effects is also an important contribution of this paper. In fact, including fixed effects changes the results of some of our regressions. When we replicate Table 2 with pooled OLS (Table E1) we find a negative and precisely estimated effect of reference consumption both for life and financial satisfaction, while the negative effect only appears for financial satisfaction when we include individual fixed effects (Table 2).

Before moving to explaining the difference between our OLS and individual FE results, we examine first how our OLS results compare to the earlier literature. The paper that comes closer to ours is Ravallion and Lokshin (2010) for Malawi. These authors only show the results in which there is an interaction between own consumption and consumption of the

**Table C2**  
Table with three geographic definitions of the reference group, with individual FE.

	(1) Financial Satisfaction			(4) Life Satisfaction		
	Ref. EAs	Ref. Ward	Ref. District	Ref. EAs	Ref. Ward	Ref. District
Ln(consumption) $LnC_{tar}$	0.130** (0.060)	0.147** (0.059)	0.103* (0.056)	0.131** (0.065)	0.164*** (0.063)	0.157*** (0.060)
Ln(leave-out mean cosump.ref.group) $LnC_{tar}$	-0.201** (0.093)	-0.413*** (0.110)	-0.487*** (0.164)	0.040 (0.103)	-0.132 (0.124)	-0.284 (0.182)
Number Observations	22,023	22,023	22,023	22,223	22,223	22,223

Standard errors in parentheses clustered at the household level. \*  $p < 0.1$ .  
\*\*  $p < 0.05$ .  
\*\*\*  $p < 0.01$ . Same specification as the baseline regressions in Table 2.

**Table C3**  
Relevance of height and weight for relative concerns, with individual FE.

	(1) Financial Satisfaction		(4) Life Satisfaction	
	Ref. EAs	Ref. Ward	Ref. EAs	Ref. Ward
Height relative concerns				
Leave-out mean height of the reference group	-0.002* (0.001)	-0.003** (0.001)	-0.000 (0.001)	-0.001 (0.002)
Height	0.001 (0.001)	0.001 (0.001)	0.001 (0.001)	0.001 (0.001)
Weight	-0.003 (0.003)	-0.003 (0.003)	0.000 (0.002)	0.000 (0.002)
Number of observations	22,023	22,023	22,223	22,223
Weight relative concerns				
Leave-out mean weight of the reference group	-0.006** (0.003)	-0.009** (0.004)	0.001 (0.003)	-0.004 (0.004)
Height	0.001 (0.001)	0.002 (0.001)	0.001 (0.001)	0.001 (0.001)
Weight	-0.003 (0.003)	-0.003 (0.003)	0.000 (0.002)	0.000 (0.002)
Number of observations	22,023	22,023	22,223	22,223

Standard errors in parentheses clustered at household level; \*  $p < 0.1$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$ . Same specification as the baseline regressions in Table 2, but includes leave-out mean height and weight in the region as a proxy for relative concerns.

reference group, and define the reference group at the Enumeration Area. Table E2 specification (1) reproduces their baseline regression for Tanzania.

Our results show, as theirs, a positive precisely estimated coefficient for the leave-out mean consumption of the reference group (3.043), and a negative and also precisely estimated coefficient for the interaction of the reference consumption with own income (-0.25). The size of the coefficients however is different: while in Malawi (Ravallion and Loskhin, 2010) the reference consumption coefficient is 10.2 times (1.48/-0.145) larger than the interaction term, in our regressions this ratio is 12.2. In addition, our coefficients imply that the reference consumption coefficient becomes positive only for very few individuals.

The earlier literature has mainly distinguished the effect of the reference consumption between the rural and the urban sample, using the life satisfaction question, and defining the reference group as the EA level (as close neighbors). Therefore, and to compare our results to earlier findings, we estimate with pooled OLS the regression with an interaction term between the reference consumption and whether the individual is rural (specification 2 in Table E2). Consistent with the earlier literature, we find that only individuals living in an urban environment show feelings of relative deprivation in terms of life satisfaction. Instead, we find that individual living in the rural areas show a very small and very imprecisely estimate coefficient for the reference consumption (specification 2). In comparison with earlier literature, the effect of the reference group consumption on life satisfaction is positive (-0.693 + 0.617), but statistically not different from 0 ( $F = 1.27, p = 26\%$ ). This result is consistent with the results with individual fixed effects (Table 3).

Let us now examine the differences between our baseline specification with individual fixed effects (Table 2) and without (Table E1). The results for financial satisfaction with pooled OLS are similar and not statistically different from the within estimators in Table 2. Introducing individual fixed effects however turns the precisely estimated negative coefficient of the reference group (Table E1, specifications 3 and 4) into a small and imprecisely estimated coefficient (Table 2). There are two



**Table D1**  
Heterogeneity in relative deprivation and consumption: rural vs urban households, with individual FE.

	(1)	(2)	(3)	(4)
	Financial Satisfaction		Life Satisfaction	
	EA	Ward	EA	Ward
Ln(consumption)	0.159 (0.104)	0.122 (0.103)	0.251** (0.111)	0.247** (0.110)
Ln(leave-out mean cosump.ref.group) $Ln\tilde{C}_{tar}$	-0.290** (0.138)	-0.363** (0.163)	-0.264* (0.160)	-0.382** (0.181)
Rural* $Ln\tilde{C}_{tar}$	0.123 (0.163)	-0.070 (0.179)	0.423** (0.183)	0.349* (0.194)
Rural* Ln(consumption)	-0.040 (0.119)	0.034 (0.115)	-0.164 (0.126)	-0.110 (0.123)
Rural	-1.151 (1.791)	0.481 (2.023)	-3.515* (2.002)	-3.242 (2.184)
Number of Observations	22,023	22,023	22,223	22,223

Standard errors in parentheses clustered at the household level; \*  $p < 0.1$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$ . Same specification as in Table 3, but with an additional interaction between own consumption and whether the individual lives in a rural area.

**Table D2**  
Heterogeneity in relative deprivation and consumption: Number of years in the community, with individual FE.

	(1)	(2)	(3)	(4)
	Financial Satisfaction		Life Satisfaction	
	EA	Ward	EA	Ward
Ln(consumption)	0.116 (0.081)	0.098 (0.080)	0.151* (0.083)	0.176** (0.080)
Years in the community	-0.081*** (0.031)	-0.068** (0.034)	-0.172*** (0.037)	-0.204*** (0.040)
Ln(leave-out mean cosump.ref.group) $Ln\tilde{C}_{tar}$	-0.362*** (0.113)	-0.510*** (0.127)	-0.338*** (0.129)	-0.560*** (0.151)
Years in the community* $Ln\tilde{C}_{tar}$	0.006* (0.003)	0.004 (0.003)	0.013*** (0.003)	0.015*** (0.004)
Years in the community * Ln(consumption)	0.000 (0.002)	0.002 (0.002)	-0.001 (0.002)	-0.001 (0.002)
Number of Observations	22,023	22,023	22,223	22,223

Standard errors in parentheses clustered at the household level; \*  $p < 0.1$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$ . Same specification as in Table 4, but with an additional interaction between own consumption and the number of years the individual lives in the community.

**Table E1**  
Satisfaction and relative concerns, with pooled OLS.

	(1)	(2)	(3)	(4)
	Finance Satisfaction		Life Satisfaction	
	Ref: EAs	Ref: Ward	Ref: EAs	Ref: Ward
Ln(consumption) $LnC_{itar}$	0.280*** (0.040)	0.274*** (0.038)	0.266*** (0.043)	0.261*** (0.041)
Ln(leave-out mean.cosump.ref.group) $Ln\tilde{C}_{tar}$	-0.276*** (0.055)	-0.359*** (0.060)	-0.314*** (0.059)	-0.415*** (0.064)
Number Observations	22,023	22,023	22,223	22,223

Standard errors in parentheses clustered at the household level. \*  $p < 0.1$ . \*\*  $p < 0.05$ .

\*\*\*  $p < 0.01$ . Same specification as the baseline regression, Table 2, but without individual fixed effect. Instead, the regressions include gender, height and weight, although its exclusion does not change our estimates of interest.

plausible explanations for this difference. One, it could be that individual life (and not financial) satisfaction is correlated with some unobservable variable (for example, individuals' self-esteem) that affects the correlation between reference consumption and life satisfaction (envy). Its exclusion would then bias the coefficient for reference consumption. In Table E3 we explore this explanation by including the individual mean satisfaction over the three waves into the pooled regression to capture for this unobservable factors. This is, we introduce a "permanent" satisfaction component into the regression that is correlated with the unobservable variables (in our example, envy). In other words, we assume that the individual average satisfaction over time is correlated with these individual personal permanent traits and thus solves the omitted variable bias in Table E1. In contrast with a fixed effect model (Table 2), including this individual average satisfaction does not estimate the other coefficients from the within individual variation. This means that the model is less demanding.

**Table E2**  
Life Satisfaction and relative concerns, Enumeration Area, with pooled OLS.

Ref group at the Enumeration Area	(1) Life Satisfaction	(2)
$\ln(\text{consumption}) \ln C_{itar}$	3.630*** (0.610)	0.261*** (0.043)
$\ln(\text{leave-out mean.cosump.ref.group}) \ln \bar{C}_{tar}$	3.043*** (0.609)	-0.693*** (0.079)
$\ln C_{itar} * \ln \bar{C}_{tar}$	-0.250*** (0.045)	
Rural* $\ln \bar{C}_{tar}$		0.617*** (0.085)
Number Observations	22,223	15,200

Standard errors in parentheses at the household level. \*  $p < 0.1$ .

\*\*  $p < 0.05$ .

\*\*\*  $p < 0.01$ . Same specification as in Table E1, but including an interaction term between own consumption and the leave-out mean consumption of the reference group.

**Table E3**  
Satisfaction and relative concerns, with pooled OLS, controlling for individual average satisfaction.

	(1) Financial Satisfaction	(2)	(3) Life Satisfaction	(4)
	EA	Ward	EA	Ward
$\ln(\text{consumption}) \ln C_{itar}$	0.048** (0.021)	0.048** (0.020)	0.053** (0.023)	0.058*** (0.021)
$\ln(\text{leave-out mean.cosump.ref.group}) \ln \bar{C}_{tar}$	-0.077*** (0.026)	-0.103*** (0.026)	-0.018 (0.029)	-0.044 (0.028)
Individual Financial Sat. Mean	0.988*** (0.002)	0.988*** (0.002)		
Individual Life Sat. Mean			0.987*** (0.002)	0.986*** (0.002)
Number Observations	22,023	22,023	22,223	22,223

Standard errors in parentheses at the household level. \*  $p < 0.1$ .

\*\*  $p < 0.05$ .

\*\*\*  $p < 0.01$ . Same specification as in Table E1, but including individual mean satisfaction over all the waves.

Although the estimated size of the coefficients is, as expected, different than those with individual fixed effects, the results in Table E3 are aligned with our main results in Table 2. This is, we find a negative and precisely estimated coefficient for the reference consumption on financial satisfaction, and a smaller and imprecisely estimated coefficient for the life satisfaction. The size of the coefficients reduces substantially from Tables E1 to E3, and the inclusion of the mean satisfaction to proxy for the “unobservables” increases the fit of the model considerably. The  $R^2$  increases from 0.1070 (financial satisfaction, specification 1) to 0.64 and from 0.1132 (life satisfaction, specification 2) to 0.64. The Oster (2019) delta value is 0.2594 for financial and 0.0358 for life satisfaction, which, together with the large  $R^2$ , indicates that the role for unobservables in the specification shown in Table E3 is small. Therefore, we expect that our coefficients would not get reduced substantially if we were to be able to include all unobservable variables.

Another explanation on the difference between the two methods is that there is spatial correlation on satisfaction. This is, individuals in the same reference group also share other characteristics that makes their satisfaction correlated with each other. To control for this, Table E4 includes the leave-out mean average of the reference group life and financial satisfaction into the regression. Table E4 results do not differ much from those in Table E3, but the regional leave-out mean satisfactions show a well precisely and positive coefficient, indicating that there is a positive spatial correlation in satisfaction. For financial satisfaction however we find a much smaller correlation (statistically different) between own satisfaction and the Ward leave-out mean financial satisfaction. If we introduce the leave-out mean satisfactions in the estimation with individual fixed effects (Table 2), our coefficients change very little (at the second or third decimal point) and the differences are not statistically different.

Tables E5 and E6 test consistency of our interaction results in Tables 3 and 4 using the pooled OLS specification of Table E4. While the life satisfaction results in Table E5 are not consistent with those in Table 3 (allowing differences between the rural and the urban sample), our results for the interaction with years in the community are consistent. Table 4 therefore remains our main result of the paper and we argue therefore that it is the ties that the individual has with the members of their reference group what explains the coefficients of relative consumption on life satisfaction. For financial satisfaction, we find a consistent negative coefficient of the reference group with all specifications, estimation methods, and for all individuals.

**Table E4**  
Satisfaction and relative concerns, with pooled OLS, controlling for individual and regional average satisfaction.

	(1)	(2)	(3)	(4)
	Financial Satisfaction		Life Satisfaction	
	EA	Ward	EA	Ward
Ln(consumption) $Ln\bar{C}_{tar}$	0.060*** (0.021)	0.051** (0.020)	0.065*** (0.022)	0.067*** (0.021)
Ln(leave-out mean.cosump.ref.group) $Ln\bar{C}_{tar}$	-0.088*** (0.026)	-0.101*** (0.025)	-0.021 (0.028)	-0.028 (0.028)
Individual Financial and life Sat. Mean	0.961*** (0.002)	0.981*** (0.002)	0.955*** (0.003)	0.958*** (0.003)
Region Financial and life Sat. Mean	0.226*** (0.013)	0.101*** (0.013)	0.226*** (0.013)	0.224*** (0.013)
N	22,023	22,023	22,223	22,223

Standard errors in parentheses at the household level. \*  $p < 0.1$ .

\*\*  $p < 0.05$ .

\*\*\*  $p < 0.01$ . Same specification as Table E3, but including the regional leave-out mean satisfaction.

**Table E5**  
Heterogeneity in relative deprivation: rural vs urban households, pooled OLS.

	(1)	(2)	(3)	(4)
	Financial Satisfaction		Life Satisfaction	
	Ref: EAs	Ref: Ward	Ref: EAs	Ref: Ward
Ln(consumption)	0.060*** (0.021)	0.051*** (0.020)	0.066*** (0.022)	0.068*** (0.021)
Ln(leave-out mean cosump.ref.group) $Ln\bar{C}_{tar}$	-0.059* (0.031)	-0.055* (0.033)	0.011 (0.035)	0.036 (0.035)
Rural* $Ln\bar{C}_{tar}$	-0.048 (0.036)	-0.079** (0.040)	-0.052 (0.040)	-0.109*** (0.041)
Rural	0.595 (0.484)	1.035* (0.538)	0.635 (0.536)	1.424** (0.562)
Number of Observations				

Standard errors in parentheses at the household level. \*  $p < 0.1$ .

\*\*  $p < 0.05$ .

\*\*\*  $p < 0.01$ . Same specification as in Table E4, but allowing for an interaction between reference consumption and whether the individual lives in a rural area.

**Table E6**  
Heterogeneity in relative deprivation: years in the community, pooled OLS.

	(1)	(2)	(3)	(4)
	Financial Satisfaction		Life Satisfaction	
	Ref: EAs	Ref: Ward	Ref: EAs	Ref: Ward
Ln(consumption)	0.060*** (0.021)	0.066*** (0.022)	0.053*** (0.020)	0.065*** (0.021)
Years in the community	-0.008 (0.010)	-0.028** (0.012)	0.002 (0.011)	-0.025** (0.012)
Ln(leave-out mean cosump.ref.group) $Ln\bar{C}_{tar}$	-0.102*** (0.031)	-0.070** (0.034)	-0.092*** (0.032)	-0.067** (0.034)
Years in the community* $Ln\bar{C}_{tar}$	0.001	0.002**	-0.000	0.002**
Number of Observations	22,023	22,223	22,023	22,223

Standard errors in parentheses at the household level. \*  $p < 0.1$ .

\*\*  $p < 0.05$ .

\*\*\*  $p < 0.01$ . Same specification as Table E4, but allowing for an interaction between reference consumption and the number of years the individual lives in the community.

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