Food and Agriculture Organization of the United Nations

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Background paper for *The State of Food Security and Nutrition in the World 2023*

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Abstract

This paper presents an innovative analysis of within-country variability of the cost and affordability of a healthy diet (CoAHD). The study uses an innovative spatial perspective by analysing the changes along the urban–rural catchment areas (URCA) and using the Living Standards Measurement Studies (LSMS) of 11 African countries. The results show that the cost of a healthy diet in peri-urban areas is lower than it is in urban areas, but the percentage of the population unable to afford a healthy diet is always higher in the surroundings of urban centres. The gap is particularly large between small cities and their surrounding areas, and the share of population unable to secure a healthy diet is disproportionally high in the more remote rural areas. The paper also investigates three methodological issues that were encountered during the analysis with the aim of providing evidence on the validity of the FAO Healthy Diet Basket (HDB) methodology for the estimation of subnational cost and affordability of a healthy diet. In particular, the paper shows that: 1) the HDB methodology combined with crowdsourced food prices allows for enough variation in item selection to reflect local consumption patterns; 2) to quantify the income that a person can credibly reserve for food in a subnational analysis, food expenditure shares of households in the bottom quintile of the subnational unit of analysis should be used; 3) when a subnational analysis is conducted, national estimation should be obtained as population-weighted averages of subnational estimations. Finally, the paper sheds some light on the apparent discrepancies between locally derived national estimates and global monitoring estimations of the cost and affordability of healthy diet.

Keywords: rural–urban continuum, cost, affordability, healthy diet, subnational

JEL codes: C81, I3, O18.

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1 Introduction

Since 2020, FAO has been publishing global, regional and country-level indicators on the cost and affordability of a healthy diet (CoAHD). The importance of a healthy diet in the fight against food insecurity and all forms of malnutrition is a well-established principle. Certainly, the determinants of consumption of healthy diets are highly complex and include behavioural and cultural factors. However, as a minimum to ensuring access to healthy diets, nutritious foods must be both available and affordable. The 2020 edition of *The State and Food Security and Nutrition in the World* showed the existence of within-country variations in the CoAHD, but it did not cover variations across the rural–urban continuum. Studies suggest that urbanization may directly exert upward pressure on food prices in poor countries (Stage, Stage and Mcgranahan, 2010). This is because most households now depend on food supplied by markets rather than their own food production (Dolislager *et al.*, 2023).

This paper presents a new descriptive analysis of the variability of the cost and affordability of a healthy across the rural–urban continuum in 11 sub-Saharan countries as background analysis for Section 4.2 of the global report *The State of Food Security and Nutrition in the World 2023* (FAO *et al.*, 2023). Following the narrative of the global report, the countries in this paper are classified into two groups (high-food-budget countries and low-food-budget countries) according to the market value of their total food consumption per capita per day. These strata allow for comparisons across broad levels of development.

As the global reports have identified, within-country variations are an important issue. While the global CoAHD indicators give national and local governments a starting point to evaluate whether their agrifood systems can secure physical and economic access to enough nutritious food to allow their populations to conduct active and healthy lives, these global indicators do not enable the identification of specific bottlenecks within national agrifood systems. The identification of such bottlenecks is necessary to inform national and subnational policies and programmes that aim to improve access to healthy diets for specific segments of the population. For this reason, many national governments have moved the focus to subnational estimations.

The use of the CoAHD indicators at the subnational level has prompted concerns on the validity of applying the FAO Healthy Diet Basket (HDB) methodology (FAO, 2023), which was developed to produce global estimations, to estimate subnational CoAHD indicators. Thus, in addition to the descriptive analysis conducted for *The State of Food Security and Nutrition in the World 2023* report, this paper aims to provide evidence on the validity of the FAO HDB methodology for estimating subnational CoAHD. In particular, the paper will investigate three methodological issues that were encountered during the analysis.

The first relates to the suitability of the HDB methodology for identifying the composition of the healthy diet basket in subnational estimations. The concern is that the method of selecting the food items in the HDB methodology does not allow for enough variation in the diet to reflect local consumption patterns, because the HDB food groups are fixed and the HDB is defined on the basis of 10 quantified national food-based dietary guidelines (FBDGs).

The second methodological issue relates to the measure of affordability. The FAO HDB methodology defines the indicator of affordability by comparing the income a person can credibly reserve for food to the cost of a healthy diet. To quantify this share of income, different

thresholds can be adopted. This paper explores and compares different options that are consistent with the FAO HDB methodology.

The third methodological issue pertains to the consistency between subnational, national and global monitoring estimations. Discrepancies between locally derived national estimations and global monitoring estimations of the CoAHD have already emerged, questioning the validity of the estimations themselves. This paper will shed some light on this matter, explaining the origin of the discrepancies. Similarly, inconsistencies between subnational and national estimations may emerge, thus calling attention to the issue of aggregability. Indeed, a minimum requirement for the validity of the methodology is the aggregability of the number of people who cannot afford a healthy diet, meaning that the number of people estimated at subnational levels should add up to the number of people obtained when assessing this at the national level. The paper discusses how subnational estimates should be aggregated to be consistent with national level estimates.

Using 11 subnational case studies from sub-Saharan Africa, the paper provides insights on these methodological issues, using as subnational units of analysis the FAO urban–rural catchment areas (URCA), which classify each latitude-longitude point in the world into either an urban area of a certain size or a travel time to an urban area (catchment area). Though not presented in this paper, a separate subnational analysis by administrative unit was conducted for 5 of the 11 case studies, with similar methodological results (Latino, Holleman and Cafiero, [forthcoming]).

Finally, drawing on the results of the analyses and exploring the challenges that must be addressed when dealing with existing data for food prices and income, the paper provides some guidelines on the critical elements that must be considered when performing subnational estimation of the cost and affordability of a healthy diet.

2 Methods

2.1 Cost of a healthy diet

The cost of a healthy diet is estimated applying the FAO HDB methodology, as described in FAO (2023). The food basket comprises six food groups (as shown in Table 1), sets a per capita daily caloric requirement of 2 330 kcal[1] and ensures macronutrient intake adequacy.[2]

Table 1. Healthy Diet Basket (HDB) composition by food group, by kcal and grams of reference food

Food group	Minimum number of food items selected for cost of a healthy diet	Total energy content (kcal)	Equivalent gram content, by reference food (edible portion)
Staple foods	2	1 160	322 g dry rice
Vegetables	3	110	270-400 g vegetables
Fruits	2	160	230–300 g fruits
Animal source foods	2	300	210 g egg
Legumes, nuts and seeds	1	300	85 g dry bean
Oils and fats	1	300	34 g oil

Source: Herforth, A., Venkat, A., Bai, Y., Costlow, L., Holleman, C., & Masters, W. 2022. *Methods and options to monitor the cost and affordability of a healthy diet globally*. Background paper for *The State of Food Security and Nutrition in the World 2022*. Rome, FAO.

In this paper, the composition of the food basket is fixed in terms of food groups and the same for all subnational units of analysis. This means that the basket in any URCA (that is, in any urban centre or rural catchment area) in any country always comprises two starchy staples, which contribute 1 160 kcal to the daily caloric intake; three vegetables, which contribute 110 kcal to the daily caloric intake; and so on. The specific food items that comprise the baskets, however, differ across countries and across the rural–urban continuum (URCA) within countries. In each catchment area of a specific country, the least-cost item (or items) in each food group is (or are) selected. In this way, the composition of a healthy basket is allowed to reflect the local prices, availability, and customs[3] of each URCA.

[1] Active adults (excluding pregnant and lactating women) require 2 330 kcal per day. However, Bai, Herforth and Masters (2022) show that least-cost diets to meet energy and nutrient requirements for people in this reference group (median adult, excluding pregnant and lactating women) are approximately the median level of least costs for all sex-age groups over the entire life cycle. Furthermore, this level of dietary energy is very close to the unweighted mean energy requirement for all sex-age-year groups age three years and older. This reference group/dietary energy requirement is therefore a good representation of the population as a whole (Herforth *et al.*, 2022).

[2] The HDB was developed to ensure nutrient adequacy and empirical testing was conducted on various possible HDB variants. The HDB variant that provides empirical evidence that meets nutrient needs was selected as the HDB. See discussion and empirical evidence in Herforth *et al.* (2022). However, the calculation of the nutrient adequacy of the specific HDB obtained in the analysis could be undertaken.

[3] The method does not account for household preferences in a systematic way, as for example is done by Mahrt *et al.* (2019). However, by allowing different items to be selected in each subnational unit of analysis, within-country variation in food consumption habits can be captured.

The least-cost item is the item whose price paid to buy enough quantity to meet the HDB food group caloric requirement is the lowest in that food group.[4]

The two elements needed to compute the cost of an item are the nutrient conversion table and the market price. In this paper, the prices are derived from the food expenditure module of household surveys, as described in Section 3.2, while the nutrient conversion tables were specifically prepared by the FAO Statistics Division for each survey, based mainly on the data included in the FAO/INFOODS Food Composition Table for Western Africa (Vincent *et al.*, 2020) and following FAO/INFOODS guidelines for food matching (FAO and INFOODS, 2012).

As prices are derived from self-reported expenditure, the assumption is that in each subnational unit of analysis, prices of the most commonly consumed items are reported, and food items not reported are considered not available or not common in that subnational unit. In other words, the use of revealed prices from household surveys means that the basket composition reflects local consumption patterns.

To calculate the cost of each item, first the amount of each food that would need to be purchased to satisfy the recommended calories for the entire food group of the HDB was calculated, accounting for the edible portion of the food. Then, the cost per day of each food item was computed by multiplying the price by the quantity to be purchased and dividing that by the number of items per group, as specified in Table 1. Furthermore, to ensure intragroup food diversity, when different varieties of the same food (such as imported rice, local rice and long-grain rice) are available, only the least-cost variety is included in the selection. Once the least-expensive foods – in terms of cost per day – are identified, the cost of the 11 items in the basket are then summed to obtain the cost of a healthy diet in each URCA of each country.

2.2 Affordability of a healthy diet

The affordability of a healthy diet refers to people's financial capacity to acquire sufficient nutritious food to have a healthy life. The indicator is a measure of economic access and quantifies the number of people who do not have enough economic resources to acquire a healthy diet, rather than the number of people who do not eat a healthy diet (FAO *et al.*, 2023).

While Hirvonen *et al.* (2020) and Bai *et al.* (2021) estimate the number of people who could not afford a healthy diet by comparing the cost of the diet with household total income, the healthy diet affordability estimates in *The State of Food Security and Nutrition in the World* reports account for a budget for non-food items. In this paper, similar to what is proposed by FAO (2023), to compute the affordability indicator the daily cost of a healthy food basket is compared with the income a household can credibly reserve for food. In fact, in identifying a person's or households' economic capacity to afford a healthy diet, it is important to consider that every day a person resorts to the market to satisfy all or part of their essential needs. Essential needs refer to a set of goods and services such as food, clothing, housing, health and education, required on a regular basis to ensure a minimum living standard. Food is only one of those needs; thus, to estimate the affordability indicator, one must consider that part of a person's income must be used for basic needs other than food.

[4] A consequence of this methodology is that often energy-dense food will be chosen, unless the price of non-energy-dense food is extremely low. Nevertheless, this is not considered a shortcoming as the objective of the HDB methodology is to identify a least-cost diet that meets the daily caloric requirement. HDB is not meant to suggest a list of items that should be consumed.

Accordingly, the indicator of affordability must compare only the income that a person can credibly reserve for food to the cost of a healthy diet. However, there is not an obvious and straightforward way to quantify the income that can be credibly reserved for food, as different methods can be adopted. For example, following Ravallion (1998), who suggests that if a household's total income is just enough to reach the food thresholds, anything that they can spend on non-food items or services can be considered an absolute basic non-food need, there are examples in the literature where the non-food component of a poverty line is set by observing the share of non-food expenditure of households whose total expenditure is equal to (or close to) the food poverty line. Similarly, the World Food Programme, in their guidance note on building a minimum expenditure basket, suggests identifying a reference household cohort by combining different criteria such as households with acceptable food consumption scores who do not adopt negative coping strategies and do not receive in-kind food assistance. Another approach, known as the cost-of-basic-needs approach, stipulates a consumption bundle (including allowances for non-food goods) deemed to be adequate for certain basic consumption needs, and then estimates its cost. For example, Allen (2017) includes in the non-food bundle only housing, fuel, lighting, clothing and soap, intentionally leaving out education and medical care. Headey, Hirvonen and Alderman (2023) propose an extension of Allen's method to predict non-food expenditure requirements more systematically across countries and show why it may potentially be problematic to assume that non-food costs are a fixed portion of food costs.

This paper assumes that poor households are "just" able to meet their essential needs. As such, their expenditure patterns can reveal what share of their income is used to cover essential food needs and therefore can be used to quantify the income than can credibly be reserved for food. However, which exact segment of the population should be used as a reference cohort is subject to discussion. Here, four different cohorts are identified and the corresponding thresholds are computed to define the portion of income that can credibly be reserved for food: 1) 52 percent – which equals the average share of food expenditure in low-income countries;[5] 2) the average food expenditure share of households belonging to the bottom quintile of the national income distribution; 3) the average food expenditure share of households belonging to the bottom quintile of each URCA income distribution; and 4) the average food expenditure share of each national income quintile.

The first threshold is the same for all URCA and countries analysed, and it is used as a benchmark, given that it is the threshold adopted by the FAO HDB methodology (FAO, 2023). The second threshold varies by country, but it is equal across the rural–urban continuum (URCA) within a country. The third threshold varies by country and URCA; that is, in each URCA of each country the average food expenditure share of households in the bottom quintile of that URCA and country is used to derive the income a household can credibly reserve for food. Finally, in the last case, household income is defined by using the average food expenditure share of the national income quintile the household belongs to.

The percentage of people who cannot afford a healthy diet in each URCA is calculated as a poverty headcount ratio; that is, the fraction of people whose share of income that can be credibly reserved for food is below the cost of a healthy diet in the URCA they live in. The

[5] Calculation is based on the 2017 ICP national accounts household expenditure data.

number of people who cannot afford a healthy diet is simply obtained by multiplying these proportions by the survey-estimated population in that URCA.

2.3 From subnational to national estimation

When a subnational analysis of the cost and affordability of a healthy diet is conducted, national-level estimates are also usually presented, and these may be compared with the FAO global monitoring estimations.

Though discrepancies may emerge when comparing different studies, one would expect that in the same analysis the number of people who cannot afford a healthy diet in subnational units would add up to the number of people obtained when assessing this at the national level. To explore the issue of aggregability, we compute national-level estimates following two different approaches.

In the first approach, the national cost of a healthy diet is computed following the methodology described in Section 2.1. Thus, a national HDB is defined by selecting the least-cost item(s)[6] in each food group at the national level and then the cost of the 11 items selected are summed. The cost of the national basket just defined is then compared with the income households can credibly reserve for food[7] in order to identify the percentage of people who cannot afford a healthy diet. Finally, these percentages are multiplied by the survey-estimated national population to obtain the number of people who cannot afford a healthy diet.

In the second approach, national-level estimates of the cost of a healthy diet are obtained as a population-weighted average of the costs of healthy diet basket in each URCA. Similarly, in this approach, the percentage of people who cannot afford a healthy diet at country level is obtained as a population-weighted average of the percentages estimated in each URCA; while the number of people who cannot afford a healthy diet is calculated simply by summing the estimations in each URCA.

[6] Food item prices are a geometric mean of unit prices reported in the entire country when at least three observations are reported.

[7] The food expenditure share of households in the bottom quintile of the national income distribution is used to identify the income that can be credibly reserved for food.

3 Data

3.1 Household surveys and URCA dataset

The analysis in this paper is based on datasets of 11 national representative household surveys[8] from the Living Standards Measurement Studies (LSMS) and the FAO Urban-Rural Catchment Areas (URCA) dataset.

Household surveys were conducted between 2018 and 2019, except for Malawi, where data was collected in 2019 and 2020. The datasets include a detailed food expenditure module that allows for deriving revealed prices for a large number of food items (see Section 3.2 for details), total household expenditure and share of food expenditure.

For alignment with the food demand analysis in Section 4.1 of *The State of Food Security and Nutrition in the World 2023*, for the analysis of the variability of cost and affordability of a healthy diet across the rural–urban continuum, countries are classified into two groups according to the market value of their total food consumption[9] per capita per day: high-food-budget countries (average 2.3 purchasing power parity, or PPP, dollars per capita per day) and low-food-budget countries (average 1.6 PPP dollars per capita per day).[10] The grouping is meant to reflect different levels of development. The assumption behind this is that the differences in food budgets lead to different patterns of food consumption (FAO *et al.*, 2023).

All households were mapped against the URCA dataset. This is a raster dataset that maps world populations across 30 urban–rural catchment areas using travel time to cities of different sizes. The dataset identifies seven urban agglomerations based on population size: 1) large cities with populations greater than 5 million; 2) large cities with populations between 1 and 5 million; 3) intermediate cities with 500 000 to 1 million people; 4) intermediate cities with 250 000 to 500 000 inhabitants; 5) small cities with populations between 100 000 and 250 000; 6) small cities with 50 000 to 100 000 people; and 7) towns with 20 000 to 50 000 people. For rural areas, the dataset assigns each rural pixel to a defined travel-time category: less than one hour, one to two hours, or two to three hours travel time to the closest urban centre. The remaining pixels that are more than 3 hours from any urban agglomeration of at least 20 000 people are considered either hinterland or dispersed towns.

Using the georeferenced longitudinal data available in the household survey dataset, each household is assigned to a specific URCA.[11] Given that household surveys were not meant to

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[8] The nationally representative household surveys applied were the 2018–2019 *Enquête Harmonisée sur le Conditions de Vie des Ménages* for Benin, Burkina Faso, Côte d'Ivoire, Mali, Niger, Senegal and Togo; the 2018–2019 *Inquérito Harmonizado sobre as Condiçöes de vide dos Agreagados Familiares* for Guinea-Bissau; the Ethiopia Socioeconomic Survey Panel II, 2018-19; the Malawi Fifth Integrated Household Survey, 2019–20; and the Nigeria General Household Survey-Panel, Wave 4, 2018/2019.

[9] Total food expenditure is defined as the sum of purchases, home consumption of own production and food received as a gift or as in-kind payment for labour.

[10] The high-food-budget countries are: Côte d'Ivoire. Ethiopia, Mali, Nigeria and Senegal. The low-food-budget countries are: Benin, Burkina Faso, Guinea-Bissau, Malawi, Niger and Togo.

[11] Latitude and longitude available in the household surveys were spatially anonymized. LSMS adopts a masking technique which randomly offset precise enumeration area coordinates by zero to two kilometres in urban areas and two to five kilometres in rural areas. Michler *et al.* (2022) explores the extent to which spatial anonymization methods to preserve privacy in large-scale surveys such as LSMS introduce measurement error in econometric estimates when that survey data is integrated with remote sensing weather data. They found that such methods have limited to no impact on estimates.

be representative at URCA level, and to ensure that there are a sufficient number of households to conduct a meaningful analysis in each URCA, the 30 catchment areas are aggregated into ten categories (Table 2).[12] Furthermore, to facilitate the presentation and discussion of the results, a further aggregation of the URCA to identify urban, peri-urban and rural zones is used (Table 2).

Table 2. Rural–urban continuum defined by Urban-Rural Catchment Area (URCA) categories

	URCA
Urban	Large city (>1 million people)
	Intermediate city (0.25–1 million people)
	Small city (50–250 thousand people)
	Town (20–50 thousand people)
Peri-urban	<1 hour to a large city
	<1 hour to an intermediate city
	<1 hour to a small city
Rural	<1 hour to a town
	1–2 hours to a city or town
	>2 hours to a city or town

Notes: The time intervals are to be considered as closed intervals on the right, that is: "<1 hour" to any urban centre includes areas located 1 hour or less to a city of any size or to a town (≤1 hour); "1–2 hours" to any urban centre includes areas located more than 1 hour but less than or equal to 2 hours to a city of any size or to a town (1 hour < area ≤2 hours), ">2 hours" to any urban centre includes areas located more than 2 hours to a city of any size or to a town (areas >2 hours).

Source: Dolislager, M.J, Holleman, C., Liverpool-Tasie, L.S.O. & Reardon, T. 2023. *Analysis of food demand and supply across the rural–urban continuum for selected countries in Africa – Background paper for The State of Food Security and Nutrition in the World 2023.* FAO Agricultural Development Economics Working Paper 23-09. Rome, FAO.

Households for which georeferenced variables were not available, and thus could not be mapped with an URCA, households with no data on expenditure, and households in URCA with less than 30 households were removed from the analysis. A total of 79 646 households remained, as reported in Table 3.

[12] Surveys are all representative at the national level and the first geopolitical subnational unit, but they are not meant to be representative at the URCA level. For this reason, the distribution of population surveyed across the rural–urban continuum (URCA) was compared with the actual population distribution (estimated based on the 2020 Global Human Settlement Population [GHS-POP] dataset and the URCA dataset), and it was found to be sufficiently similar so as to indicate that catchment areas were accurately represented in each survey (Annex 1).

Table 3. Number of households across the rural–urban continuum (URCA) by country

Country	Large city (>1 million people)	Intermediate city (0.25–1 million people)	Small city (50–250 thousand people)	Town (20–50 thousand people)	<1 hour to a large city	<1 hour to an intermediate city	<1 hour to a small city	<1 hour to a town	1–2 hours to a city or town	>2 hours to a city or town	Total
Benin	1 167	497	552	360	1 361	442	2 866	96	659	n.r.	8 000
Burkina Faso	588	275	969	324	755	443	2 050	84	1 031	132	6 651
Côte d'Ivoire	671	348	828	468	635	815	3 806	492	3 442	84	11 589
Ethiopia	704	517	837	158	362	944	1 770	58	752	411	6 513
Guinea-Bissau	n.a.	1 066	236	n.r.	118	637	611	36	1 527	965	5 196
Malawi	n.a	637	285	302	194	3 662	2 136	320	3 666	80	11 282
Mali	810	120	720	312	480	216	816	612	1 870	562	6 518
Niger	320	283	465	144	311	668	1 151	84	1 332	1 137	5 895
Nigeria	630	353	387	141	1 331	1 108	872	36	220	38	5 116
Senegal	1 079	743	991	394	636	948	1 188	n.r.	780	60	6 819
Togo	1 093	60	706	141	729	192	2 579	n.r.	567	n.r.	6 067
Total	7 062	4 899	6 976	2 744	6 912	10 075	19 845	1 818	15 846	3 469	79 646

Notes: n.a. = not applicable; n.r. = not reported. Guinea-Bissau and Malawi do not have cities that meet the population criteria for a large city. Sample in URCA with fewer than 30 observations are not reported here and are excluded from the analysis.

Source: Author's own elaboration.

3.2 Food price: variable construction and descriptive statistics

Food prices used for the calculation of the cost of a healthy diet were derived from the expenditure modules of the 11 household surveys listed in Table 3.

Households were asked to report, for each food item consumed, the quantity purchased and the amount spent the last time the item was purchased in the previous 30 days (Benin, Burkina Faso, Côte d'Ivoire, Guinea-Bissau, Mali, Niger, Nigeria, Senegal and Togo) or in the previous 7 days (Ethiopia and Malawi). For each household purchase, a revealed price was estimated by simply dividing the amount spent by the quantity purchased. Revealed prices were then temporally deflated using the monthly food Consumer Price Index (CPI) before running the outlier detection, as data was collected in different months of the year. The outlier detection was performed in two steps: first at the item and unit of measure level (that is, grouping purchases reported with the same unit of measure) and second at the item level (after all quantities purchased were converted into a standard unit of measure).

For each URCA, as well as at the national level, a food-item price was obtained as a geometric mean[13] of the revealed prices of each URCA, provided there was a minimum of three observations of the same item. If only one or two observations were available in the URCA, the revealed prices from smallest possible geographic level above that URCA[14] containing at least three observations were used to compute the geometric mean. Food items not reported in an URCA were not imputed using observation from a larger spatial unit; rather, they were considered not available in that area. Finally, items whose matching with food composition tables was considered poor[15] according to FAO/INFOODS guidelines for food matching (2012) were excluded from the computation of the cost of a healthy diet.

Table 4 reports summary statistics on the number of food items available for the calculation of the cost of a healthy diet, while Figure 1 shows the price variability within each food group. Figure 1 reflects both the intragroup variability (that is, in each food group it is possible to find food items with different prices) and within-country variability (that is, the same food item may be more or less expensive in different URCA). Animal source foods always emerge as the group with the highest variability, and according to Latino, Holleman and Cafiero (forthcoming) this variability is mainly explained by the intragroup price variations.

Note that data was collected across different months, thus the effect of seasonality on the price level is averaged out. The least-cost items chosen for the healthy food basket are therefore the least-cost items in each URCA during the year. A seasonality analysis is undoubtedly important, particularly in contexts where food prices are highly volatile. However, this type of analysis was not feasible here as only a few observations were available by season, or not even collected for all seasons,[16] thus impeding obtaining robust estimates for the prices.

[13] The geometric mean was chosen because of the high fluctuation in the distribution of the revealed price of a food item across households in a specific spatial unit of analysis, and geometric mean is less sensitive to the introduction or elimination of new values. It gives less weight to each observation and, thus, it also gives less weight to extreme values. Furthermore, in a preliminary analysis, the use of the geometric mean was compared with the use of the median for a subset of countries. The food basket composition when using the median or the geometric mean was not changed. The final cost of the healthy food basket was always higher when the geometric mean was used to derive the prices from the revealed prices. However, the differences were relatively small. Finally, the geometric mean is used by many National Statistical Offices to aggregate prices collected in different retail stores or markets for the calculation of the Consumer Price Index (CPI).

[14] For example, if only one revealed price is available in the URCA “town”, prices from the URCAs “small city” and “town” are used to compute the geometric mean if there are at least three observations. Otherwise, all the observations in all urban centres are used.

[15] Level C2 as defined in FAO and INFOODS (2012).

[16] For example, in Ethiopia, data on food expenditure were collected only during the planting season.

Table 4. Minimum, average and maximum number of food items across the rural–urban continuum (URCA) by food group

Country	National	URCA																				
	All food items	All food items				Staple foods			Vegetables			Fruits			Animal source foods			Pulses, seeds and nuts			Fats and oils		
	Total	min	mean	max	min	mean	max	min	mean	max	min	mean	max	min	mean	max	min	mean	max	min	mean	max
Benin	92	33	83	91	5	19	22	6	14	18	3	7	9	4	19	22	2	8	10	2	6	7
Burkina Faso	92	55	78	86	9	16	22	10	14	17	3	7	9	7	17	20	3	8	10	4	6	7
Côte d'Ivoire	91	53	84	89	11	20	24	6	17	18	3	7	9	12	21	22	2	8	9	3	5	6
Ethiopia	52	23	45	50	5	13	16	6	6	6	2	4	5	1	5	7	5	10	12	1	2	2
Guinea-Bissau	95	42	80	93	4	14	21	6	14	18	5	9	13	8	18	22	2	8	11	4	4	5
Malawi	95	52	85	95	8	21	28	8	11	12	4	7	9	7	22	27	3	10	14	2	3	3
Mali	94	66	86	90	15	20	23	15	17	18	5	8	9	16	19	22	6	8	10	4	6	7
Niger	89	55	77	81	12	17	19	9	16	18	4	6	7	6	17	20	4	7	9	2	4	6
Nigeria	72	50	67	71	11	18	19	7	7	7	4	7	8	9	15	18	5	11	12	2	4	5
Senegal	94	46	82	90	10	18	22	6	16	18	2	7	9	6	18	22	3	8	10	2	7	9
Togo	89	42	73	88	6	14	22	7	12	17	2	6	8	5	15	21	2	6	9	2	5	7

Notes: Only items suitable for a healthy diet are included. Items whose matching with food composition tables was considered poor are not included. The "National" column reports the total number of food items at country level. Columns under the heading "URCA" report the minimum, average and maximum number of food items available in an URCA for all items and by food group.

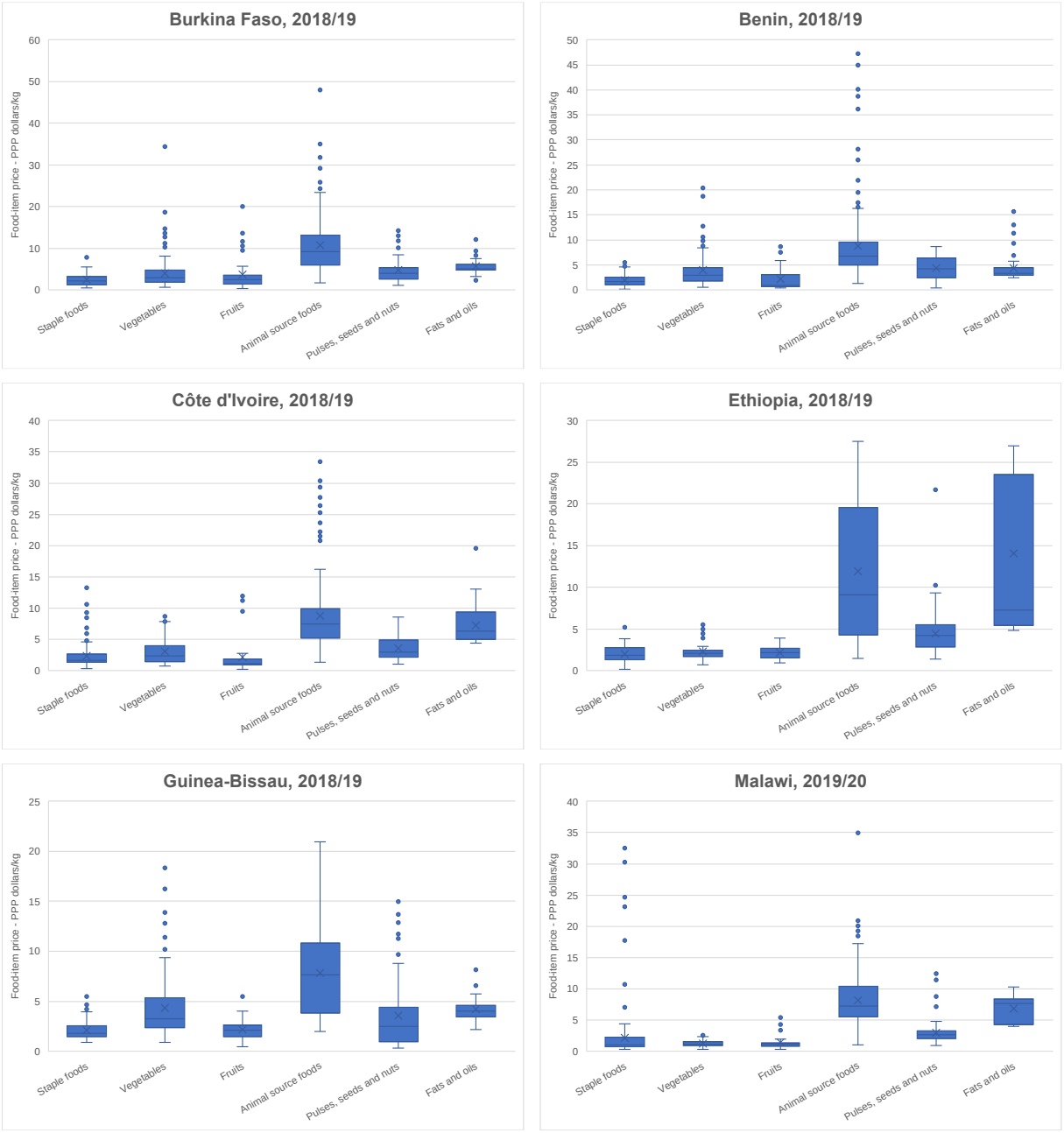
Source: Author's own elaboration.

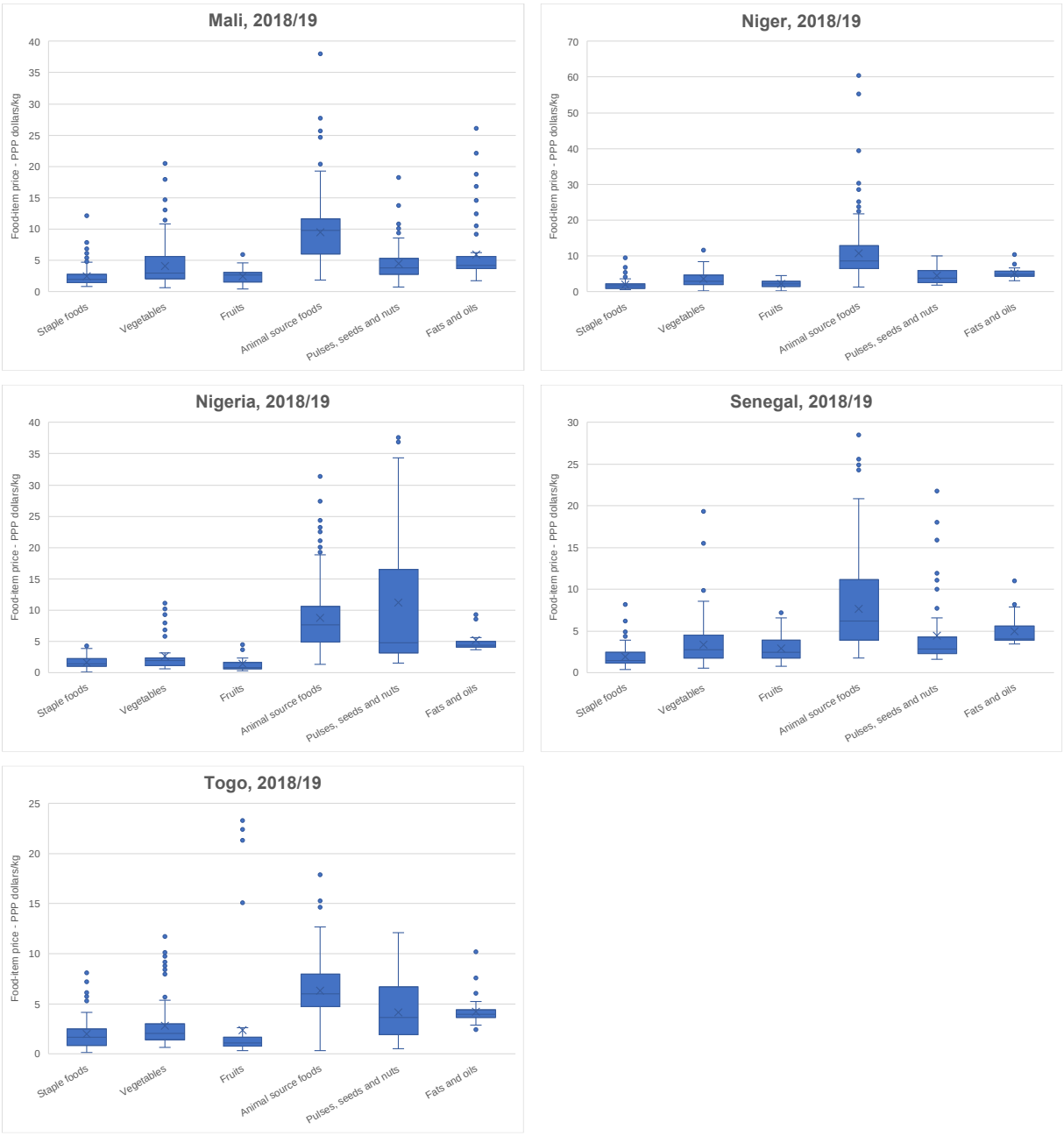
The revealed prices computed should be interpreted as crowdsourced prices. These may deviate from those collected in market surveys and from official CPI prices. In the analysis, revealed prices of the same item showed high fluctuation. This does not necessary reflect market volatility. Meaning, it does not reflect market price, but rather variations in quantity (as market prices vary according to the quantity purchased – for instance, bulk purchases versus single packages) and quality (as surveys ask for generic items rather than specific brands or specific varieties). In other words, in household surveys, items are not standardized as in the price data collection run by governments. Thus, the quality and variety of a food item purchased is likely to be different across households, reflecting access, availability and preferences.

If the purpose of the analysis is to capture the lowest cost of food items that are actually being consumed (therefore ensuring they are accessible, available and preferred), then using revealed household survey food prices may be preferred. There are some shortcomings in using household survey revealed prices. For example, they are not market prices but, rather, self-reported prices based on food expenditure recall, which is more susceptible to greater margins of error. Furthermore, household surveys are only available every three or more years; therefore, they are not regular enough for systematic monitoring or for capturing the current situation. Despite these shortcomings, however, using unit prices derived from food expenditure modules in household surveys has been found useful in recent studies that have

a policy focus (Adewopo *et al.*, 2021), and they have been used in several other studies to compute the cost of a healthy diet (Mahrt *et al.*, 2019; Mekonnen *et al.*, 2021).

Figure 1. Rural–urban continuum URCA-level food price by food group and country





Notes: Each bar displays the median, 25th and 75th percentile range, and whiskers of 1.5 times that range of the URCA prices of all food items available for the six food groups. Only items suitable for a healthy diet are included. Items whose matching with food composition tables was considered poor are not included.

Source: Author's own elaboration.

3.3 Income: variable construction and descriptive statistics

This paper uses household expenditure (from the same 11 household surveys) as proxy for income in order to define the income a household can credibly reserve for food (that is, after they have satisfied their other essential needs, such as health, clothing and housing, to ensure

a minimum living standard). Per capita income[17] is obtained from the consumption aggregate variables provided in the LSMS datasets.[18] The variables are spatially deflated and include value for gift, in-kind payments, and own production.

To obtain the income households can credibly reserve for food, four different variants of shares of total income are identified, using a data-driven approach. In other words, no normative value is imposed; rather, it is derived from the data on expenditure collected in the household surveys. The thresholds (described in Section 2.2) are reported in Table 5.

Two elements clearly emerge from Table 5. First, the rationale of (1) and (2) is similar: note how much the poorest households spend on food and thus, as better-off households (or countries in the case of [1]) spend a higher share of income for non-food expenditures, the rationale adopts a conservative assumption. Nevertheless, the use of the fixed thresholds of 52 percent (that is, the threshold adopted for the global monitoring estimations) would be too restrictive for almost all the countries analysed. The result of using the threshold of the FAO HDB methodology versus the food expenditure share of households from the bottom national income quintile would be a higher estimation of the percentage of people who cannot afford a healthy diet.

Second, the adoption of a national threshold in a subnational analysis inevitably would hide within-country variation in terms of economic vulnerability. In fact, the food expenditure share of households belonging to the bottom quintile varies significantly across the rural–urban continuum (URCA) within a country (column 3). In the 11 countries analysed, the average difference between the URCA with the highest food expenditure share and the URCA with the lowest food expenditure share is 14 percentage points, with a peak of a 29 percentage point difference in Guinea-Bissau.

Finally, the last threshold proposed (columns 4) captures the different levels of economic vulnerability within a country, and each household's ability to afford a healthy diet is measured against a more realistic level of income. In fact, when the income that a better-off household can credibly reserve for food is obtained using the food expenditure share of families from the bottom income quintile, the better-off household is most likely able to afford the cost of a healthy diet; however, in this way, we are imposing on the better-off household a lower budget to satisfy its non-food essential needs. In the 11 countries analysed, the average difference between the food expenditure share of households belonging to the first and fifth quintile of the income distribution is 6 percentage points. This means that, within countries, the geographic location of households, rather than their economic status, plays the biggest role.

Section 4.2 compares affordability indicators obtained using the thresholds described here.

[17] Per capita income is adopted because the cost of the food basket refers to a basket of 2 330 kcal, which is the energy required for a reference active woman, but this reference group/dietary energy requirement is a good proxy of the unweighted mean energy requirement for all sex-age-year groups age three years and older. (Herforth *et al.*, 2022).

[18] For Ethiopia only, household food and non-food expenditure were also calculated by the authors from the food expenditure module because food expenditure shares obtained using the consumption aggregates in the LSMS dataset were considered too high. Results using authors' consumption aggregates are reported in Annex 5.

Table 5. Comparison of different thresholds defining income that can be credibly reserved for food across the rural–urban continuum (URCA) by country

Country	Rural–urban continuum (URCA)	Fixed share of 52%	National bottom quintile	URCA bottom quintile	National first quintile	National second quintile	National third quintile	National fourth quintile	National fifth quintile
		(1)	(2)	(3)	(4)				
		(%)							
Benin	Large city (>1 million people)	52	57	49	57	57	56	55	51
	Intermediate city (0.25–1 million people)	52	57	51	57	57	56	55	51
	Small city (50–250 thousand people)	52	57	56	57	57	56	55	51
	Town (20–50 thousand people)	52	57	54	57	57	56	55	51
	<1 hour to a large city	52	57	54	57	57	56	55	51
	<1 hour to an intermediate city	52	57	55	57	57	56	55	51
	<1 hour to a small city	52	57	59	57	57	56	55	51
	<1 hour to a town	52	57	55	57	57	56	55	51
	1–2 hours to a city or town	52	57	57	57	57	56	55	51
	>2 hours to a city or town	52	57	49	57	57	56	55	51
	National	**52**	**57**	**57**	**57**	**57**	**56**	**55**	**51**
Burkina Faso	Large city (>1 million people)	52	49	42	49	48	49	49	45
	Intermediate city (0.25–1 million people)	52	49	43	49	48	49	49	45
	Small city (50–250 thousand people)	52	49	51	49	48	49	49	45
	Town (20–50 thousand people)	52	49	50	49	48	49	49	45
	<1 hour to a large city	52	49	48	49	48	49	49	45
	<1 hour to an intermediate city	52	49	48	49	48	49	49	45
	<1 hour to a small city	52	49	48	49	48	49	49	45
	<1 hour to a town	52	49	53	49	48	49	49	45
	1–2 hours to a city or town	52	49	50	49	48	49	49	45
	>2 hours to a city or town	52	49	48	49	48	49	49	45
	National	**52**	**49**	**49**	**49**	**48**	**49**	**49**	**45**
Côte d'Ivoire	Large city (>1 million people)	52	56	50	56	55	54	53	49
	Intermediate city (0.25–1 million people)	52	56	49	56	55	54	53	49
	Small city (50–250 thousand people)	52	56	54	56	55	54	53	49
	Town (20–50 thousand people)	52	56	53	56	55	54	53	49
	<1 hour to a large city	52	56	59	56	55	54	53	49
	<1 hour to an intermediate city	52	56	54	56	55	54	53	49
	<1 hour to a small city	52	56	56	56	55	54	53	49
	<1 hour to a town	52	56	53	56	55	54	53	49
	1–2 hours to a city or town	52	56	56	56	55	54	53	49
	>2 hours to a city or town	52	56	67	56	55	54	53	49
	National	**52**	**56**	**56**	**56**	**55**	**54**	**53**	**49**

Country	Rural–urban continuum (URCA)	Fixed share of 52%	National bottom quintile	URCA bottom quintile	National first quintile	National second quintile	National third quintile	National fourth quintile	National fifth quintile
		(1)	(2)	(3)	(4)				
		(%)							
Ethiopia	Large city (>1 million people)	52	83	75	83	83	84	81	78
	Intermediate city (0.25–1 million people)	52	83	71	83	83	84	81	78
	Small city (50–250 thousand people)	52	83	75	83	83	84	81	78
	Town (20–50 thousand people)	52	83	74	83	83	84	81	78
	<1 hour to a large city	52	83	78	83	83	84	81	78
	<1 hour to an intermediate city	52	83	80	83	83	84	81	78
	<1 hour to a small city	52	83	81	83	83	84	81	78
	<1 hour to a town	52	83	86	83	83	84	81	78
	1–2 hours to a city or town	52	83	87	83	83	84	81	78
	>2 hours to a city or town	52	83	82	83	83	84	81	78
	National	**52**	**83**	**83**	**83**	**83**	**84**	**81**	**78**
Guinea-Bissau	Large city (>1 million people)	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
	Intermediate city (0.25–1 million people)	52	58	50	58	57	57	56	53
	Small city (50–250 thousand people)	52	58	54	58	57	57	56	53
	Town (20–50 thousand people)	52	58	71	58	57	57	56	53
	<1 hour to a large city	52	58	51	58	57	57	56	53
	<1 hour to an intermediate city	52	58	58	58	57	57	56	53
	<1 hour to a small city	52	58	57	58	57	57	56	53
	<1 hour to a town	52	58	78	58	57	57	56	53
	1–2 hours to a city or town	52	58	60	58	57	57	56	53
	>2 hours to a city or town	52	58	63	58	57	57	56	53
	National	**52**	**58**	**58**	**58**	**57**	**57**	**56**	**53**
Malawi	Large city (>1 million people)	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
	Intermediate city (0.25–1 million people)	52	60	52	60	61	59	59	53
	Small city (50–250 thousand people)	52	60	54	60	61	59	59	53
	Town (20–50 thousand people)	52	60	56	60	61	59	59	53
	<1 hour to a large city	52	60	58	60	61	59	59	53
	<1 hour to an intermediate city	52	60	60	60	61	59	59	53
	<1 hour to a small city	52	60	61	60	61	59	59	53
	<1 hour to a town	52	60	62	60	61	59	59	53
	1–2 hours to a city or town	52	60	60	60	61	59	59	53
	>2 hours to a city or town	52	60	54	60	61	59	59	53
	National	**52**	**60**	**60**	**60**	**61**	**59**	**59**	**53**

Country	Rural–urban continuum (URCA)	Fixed share of 52%	National bottom quintile	URCA bottom quintile	National first quintile	National second quintile	National third quintile	National fourth quintile	National fifth quintile
		(1)	(2)	(3)	(4)				
		(%)							
Mali	Large city (>1 million people)	52	60	51	60	59	58	56	50
	Intermediate city (0.25–1 million people)	52	60	57	60	59	58	56	50
	Small city (50–250 thousand people)	52	60	59	60	59	58	56	50
	Town (20–50 thousand people)	52	60	57	60	59	58	56	50
	<1 hour to a large city	52	60	57	60	59	58	56	50
	<1 hour to an intermediate city	52	60	58	60	59	58	56	50
	<1 hour to a small city	52	60	60	60	59	58	56	50
	<1 hour to a town	52	60	64	60	59	58	56	50
	1–2 hours to a city or town	52	60	60	60	59	58	56	50
	>2 hours to a city or town	52	60	56	60	59	58	56	50
	National	**52**	**60**	**60**	**60**	**59**	**58**	**56**	**50**
Niger	Large city (>1 million people)	52	59	52	59	61	62	63	58
	Intermediate city (0.25–1 million people)	52	59	61	59	61	62	63	58
	Small city (50–250 thousand people)	52	59	61	59	61	62	63	58
	Town (20–50 thousand people)	52	59	62	59	61	62	63	58
	<1 hour to a large city	52	59	64	59	61	62	63	58
	<1 hour to an intermediate city	52	59	58	59	61	62	63	58
	<1 hour to a small city	52	59	59	59	61	62	63	58
	<1 hour to a town	52	59	58	59	61	62	63	58
	1–2 hours to a city or town	52	59	57	59	61	62	63	58
	>2 hours to a city or town	52	59	59	59	61	62	63	58
	National	**52**	**59**	**59**	**59**	**61**	**62**	**63**	**58**
Nigeria	Large city (>1 million people)	52	70	59	70	69	68	65	61
	Intermediate city (0.25–1 million people)	52	70	60	70	69	68	65	61
	Small city (50–250 thousand people)	52	70	63	70	69	68	65	61
	Town (20–50 thousand people)	52	70	66	70	69	68	65	61
	<1 hour to a large city	52	70	70	70	69	68	65	61
	<1 hour to an intermediate city	52	70	70	70	69	68	65	61
	<1 hour to a small city	52	70	71	70	69	68	65	61
	<1 hour to a town	52	70	71	70	69	68	65	61
	1–2 hours to a city or town	52	70	70	70	69	68	65	61
	>2 hours to a city or town	52	70	67	70	69	68	65	61
	National	**52**	**70**	**70**	**70**	**69**	**68**	**65**	**61**

Country	Rural–urban continuum (URCA)	Fixed share of 52%	National bottom quintile	URCA bottom quintile	National first quintile	National second quintile	National third quintile	National fourth quintile	National fifth quintile
		(1)	(2)	(3)	(4)				
		(%)							
Senegal	Large city (>1 million people)	52	53	52	53	54	52	50	43
	Intermediate city (0.25–1 million people)	52	53	53	53	54	52	50	43
	Small city (50–250 thousand people)	52	53	53	53	54	52	50	43
	Town (20–50 thousand people)	52	53	57	53	54	52	50	43
	<1 hour to a large city	52	53	52	53	54	52	50	43
	<1 hour to an intermediate city	52	53	50	53	54	52	50	43
	<1 hour to a small city	52	53	51	53	54	52	50	43
	<1 hour to a town	52	53	55	53	54	52	50	43
	1–2 hours to a city or town	52	53	53	53	54	52	50	43
	>2 hours to a city or town	52	53	56	53	54	52	50	43
	National	**52**	**53**	**53**	**53**	**54**	**52**	**50**	**43**
Togo	Large city (>1 million people)	52	53	48	53	53	51	50	45
	Intermediate city (0.25–1 million people)	52	53	50	53	53	51	50	45
	Small city (50–250 thousand people)	52	53	49	53	53	51	50	45
	Town (20–50 thousand people)	52	53	53	53	53	51	50	45
	<1 hour to a large city	52	53	53	53	53	51	50	45
	<1 hour to an intermediate city	52	53	52	53	53	51	50	45
	<1 hour to a small city	52	53	54	53	53	51	50	45
	<1 hour to a town	52	53	54	53	53	51	50	45
	1–2 hours to a city or town	52	53	53	53	53	51	50	45
	>2 hours to a city or town	52	53	62	53	53	51	50	45
	National	**52**	**53**	**53**	**53**	**53**	**51**	**50**	**45**

Notes: n.a. = not applicable. Guinea-Bissau and Malawi do not have cities that meet the population criteria for a large city. All food expenditure shares are obtained from the consumption aggregates available in the LSMS datasets. See Table A5.1 in Annex 5 for Ethiopian food expenditure shares based on authors' calculation of consumption aggregates.

Source: Authors' own elaboration.

4 Results

4.1 How does the composition of Healthy Diet Basket vary across the rural–urban continuum (URCA)?

The composition of a HDB, which is fixed in terms of food groups and relative caloric contribution (see Table 1), is allowed to change within each country across the URCA. In fact, for each URCA, the least-cost item(s) of each food group is (or are) chosen. In addition, a national food basket is built based on the average national cost of food items available.

The main objective of this exercise is to show that, even when using the FAO HDB methodology rather than national FBDGs, the subnational definition of the basket composition, using crowdsourced prices, allows for the selection of different items based on different consumer habits or availability. Furthermore, it shows that the use of a national healthy diet basket in a subnational analysis may "impose"[19] items in some geographical areas which are not available or are not the least-cost solution.

As an example, Table 6, Table 7 and Table 8 report the detailed composition of the HDBs for Ethiopia, Mali and Nigeria for each URCA, as well as the national baskets (see Annex 2 for the other countries).

With the number of food items available in each Ethiopian URCA (on average 45) being significantly lower than in Mali (on average 87) and Nigeria (on average 67) (see Table 4), the basket composition shows lower within-country variability in Ethiopia. This is particularly true for vegetables, as the three least-cost items in Ethiopia are the same across all URCA. Nevertheless, despite the limited number of items, even the subnational baskets in Ethiopia do show some variability for the other food groups, except "fats and oils".[20]

Some items are common across all URCA in other countries as well, such as corn kernel as the first staple food in Mali and okra as a vegetable in Nigeria. However, the food basket composition is slightly different along the rural–urban continuum. For example, in the animal source food group, powdered milk is common across all URCA in Mali, but the second item is different: pork meat, selected for the national basket, is only included in the basket in three URCA. Similarly, in Nigeria, fresh milk is part of the basket in almost all URCAs, but pork meat is only selected in intermediate and small cities, and in remote rural areas. In almost all other Nigerian URCA, cheese (wara) is selected.

Within-country variability highlights how the use of a nationally defined basket in a subnational analysis would inevitably force some food items in some areas where they are unavailable or more expensive. For example, cheese (wara) is one of the animal source food items in the Nigerian national basket; however, it is not selected in five URCA. Indeed, this cheese is not reported at all (that is, not consumed) in two rural areas and it is more expensive than the second least-cost item of the food group in the three cities (+20 percent in intermediate and small cities; +131 percent in large cities). Similarly, in Mali, pork meat is one of the two items

[19] The items are selected only with the purpose of estimating the least-cost HDB in a specific place/time. There is no assumption that households should purchase those items.

[20] Latino, Holleman and Cafiero (forthcoming) compared the items selected for regional HDBs in Ethiopia using the FAO HDB methodology with the items selected by Alemayehu *et al.* (2023) using the Ethiopian FBDG, and highlighted the similarity of cross-region variability in the two studies as well as significant overlaps in the items selected.

selected for the animal source food group in the national basket. However, consumption of pork meat is not reported in seven out of ten regions. Another example is taro, a starchy root in the Ethiopian national basket, but whose consumption is reported in only two of the ten URCA. The second staple food, maize, would also be “imposed” in more remote rural areas (>2h) even though the item cost is 1.5 times higher than millet, the second least-cost staple food in those areas.

Table 6. Healthy Diet Basket composition across the rural–urban continuum (URCA) in Ethiopia

Rural–urban continuum (URCA)	Staple foods		Vegetables			Fruits		Animal source foods		Legumes, nuts and seeds	Oils and fats
Large city (>1 million people)	Purchased bread/ biscuit	Maize	Beetroot	Kale, cabbage, pumpkin leaf, lettuce, spinach	Onion	Avocado	Banana	Milk	Cheese	Horse beans	Oils (processed)
Intermediate city (0.25–1 million people)	Maize	Sorghum	Beetroot	Kale, cabbage, pumpkin leaf, lettuce, spinach	Onion	Avocado	Banana	Milk	Cheese	Haricot beans	Oils (processed)
Small city (50–250 thousand people)	Maize	Millet	Kale, cabbage, pumpkin leaf, lettuce, spinach	Beetroot	Onion	Avocado	Banana	Cheese	Milk	Haricot beans	Oils (processed)
Town (20–50 thousand people)	Taro	Maize	Kale, cabbage, pumpkin leaf, lettuce, spinach	Beetroot	Onion	Avocado	Mango	Milk	Eggs	Haricot beans	Oils (processed)
<1 hour to a large city	Maize	Millet	Beetroot	Kale, cabbage, pumpkin leaf, lettuce, spinach	Onion	Avocado	Banana	Cheese	Milk	Haricot beans	Oils (processed)
<1 hour to an intermediate city	Bula (white powder made from enset)	Maize	Beetroot	Kale, cabbage, pumpkin leaf, lettuce, spinach	Onion	Avocado	Mango	Cheese	Milk	Vetch	Oils (processed)
<1 hour to a small city	Taro	Maize	Kale, cabbage, pumpkin leaf, lettuce, spinach	Beetroot	Onion	Avocado	Mango	Cheese	Milk	Haricot beans	Oils (processed)
<1 hour to a town	Maize	Sorghum	Beetroot	Kale, cabbage, pumpkin leaf, lettuce, spinach	Onion	Mango	Banana	Goat meat and mutton	n.a.	Vetch	Oils (processed)
1–2 hours to a city or town	Maize	Sorghum	Beetroot	Kale, cabbage, pumpkin leaf, lettuce, spinach	Onion	Avocado	Mango	Cheese	Milk	Sunflower seeds	Oils (processed)
>2 hours to a city or town	Kocho (flatbread made from enset)	Millet	Kale, cabbage, pumpkin leaf, lettuce, spinach	Beetroot	Onion	Avocado	Mango	Milk	Eggs	Haricot beans	Oils (processed)
National	Taro	Maize	Beetroot	Kale, cabbage, pumpkin leaf, lettuce, spinach	Onion	Avocado	Banana	Cheese	Milk	Haricot beans	Oils (processed)

Notes: The order of food items in each food group is given by the rank cost, with the first item being the least-cost item in the group. "National" refers to the national basket identified using the national prices of all food items available in the country. The second item in the "Animal source foods" group is missing because not enough observations are available for other food items in the group (n.a. = not available). Cost and affordability will not be computed for this URCA.

Source: Authors’ own elaboration.

Table 7. Healthy Diet Basket composition across the rural–urban continuum (URCA) in Mali

Rural–urban continuum (URCA)	Staple foods		Vegetables			Fruits		Animal source foods		Legumes, nuts and seeds	Oils and fats
Large city (>1 million people)	Corn kernels	Millet flour	Dry okra	Potato leaves	Nalta jute (Fakoye)	Avocado	Dates	Powdered milk	Pork Meat	Coconut	Cottonseed oil
Intermediate city (0.25–1 million people)	Corn kernels	Millet	Dry okra	Bean leaves	Cucumber	Avocado	Dates	Powdered milk	Dried Fish	Dried peanuts in shell	Peanut oil
Small city (50–250 thousand people)	Corn kernels	Millet	Dry okra	Dried tomato	Potato leaves	Avocado	Dates	Powdered milk	Curd, yogurt	Shelled peanuts	Other oils n.e.s. (corn, soya, etc.)
Town (20–50 thousand people)	Corn kernels	Sorghum	Dry okra	Dried tomato	Potato leaves	Dates	Avocado	Powdered milk	Cheese	Shelled peanuts	Cottonseed oil
<1 hour to a large city	Corn kernels	Sorghum	Dry okra	Dried tomato	Spinach leaves	Avocado	Dates	Powdered milk	Curd, yogurt	Shelled peanuts	Other oils n.e.s. (corn, soya, etc.)
<1 hour to an intermediate city	Corn kernels	Millet	Dry okra	Nalta jute (Fakoye)	Potato leaves	Avocado	Mango	Powdered milk	Curd, yogurt	Roasted peanut	Cottonseed oil
<1 hour to a small city	Corn kernels	Millet	Dry okra	Spinach leaves	Dried tomato	Avocado	Dates	Pork Meat	Powdered milk	Dried peas	Other oils n.e.s. (corn, soya, etc.)
<1 hour to a town	Corn kernels	Sorghum	Dry okra	Dried tomato	Bean leaves	Dates	Mango	Powdered milk	Curd, yogurt	Coconut	Other oils n.e.s. (corn, soya, etc.)
1–2 hours to a city or town	Corn kernels	Sorghum	Dry okra	Dried tomato	Spinach leaves	Ananas	Dates	Powdered milk	Pork Meat	Coconut	Other oils n.e.s. (corn, soya, etc.)
>2 hours to a city or town	Corn kernels	Sorghum	Spinach leaves	Dry okra	Dried tomato	Dates	Sweet Banana	Powdered milk	Dried Fish	Shelled peanuts	Refined palm oil
National	Corn kernels	Sorghum	Dry okra	Dried tomato	Nalta jute (Fakoye)	Avocado	Dates	Pork Meat	Powdered milk	Shea nuts	Other oils n.e.s. (corn, soya, etc.)

Notes: n.e.s. = not else specified. The order of food items in each food group is given by the rank cost, with the first item being the least-cost item in the group. “National” refers to the national basket identified using the national prices of all food items available in the country.

Source: Authors’ own elaboration.

Table 8. Healthy Diet Basket composition across the rural–urban continuum (URCA) in Nigeria

Rural–urban continuum (URCA)	Staple foods		Vegetables			Fruits		Animal source foods		Legumes, nuts and seeds	Oils and fats
Large city (>1 million people)	Gari – yellow (cassava meal)	Maize (shelled/off the cob)	Eggplant	Leaves (cocoyam, spinach, etc.)	Okra – dried	Mango	Avocado	Fresh milk	Fish – smoked	Groundnuts (shelled)	Palm oil
Intermediate city (0.25–1 million people)	Cassava – roots	Guinea corn/sorghum	Eggplant	Okra – dried	Leaves (Cocoyam, Spinach, etc.)	Mango	Orange/ tangerine	Fresh milk	Pork	Soybeans	Palm oil
Small city (50–250 thousand people)	Cassava – roots	Guinea corn/sorghum	Okra – dried	Leaves (cocoyam, spinach, etc.)	Eggplant	Avocado	Pawpaw	Fresh milk	Pork	Groundnuts (shelled)	Palm oil
Town (20–50 thousand people)	Cassava – roots	Guinea corn/sorghum	Okra – dried	Leaves (cocoyam, spinach, etc.)	Eggplant	Orange/ tangerine	Pawpaw	Fresh milk	Cheese (wara)	Soybeans	Palm oil
<1 hour to a large city	Cassava – roots	Maize (shelled/off the cob)	Leaves (cocoyam, spinach, etc.)	Okra – dried	Eggplant	Pawpaw	Orange/ tangerine	Cheese (wara)	Fresh milk	Groundnuts (shelled)	Palm oil
<1 hour to an intermediate city	Cassava – roots	Guinea corn/sorghum	Leaves (cocoyam, spinach, etc.)	Okra – dried	Eggplant	Pawpaw	Orange/ tangerine	Cheese (wara)	Fresh milk	Soybeans	Other oil and fat
<1 hour to a small city	Cassava – roots	Millet	Eggplant	Leaves (cocoyam, spinach, etc.)	Okra – dried	Mango	Pineapple	Cheese (wara)	Fresh milk	Soybeans	Palm oil
<1 hour to a town	Gari – yellow (cassava meal)	Guinea corn/sorghum	Okra – dried	Leaves (cocoyam, spinach, etc.)	Onions	Mango	Avocado	Fresh milk	Local eggs	Soybeans	Palm oil
1–2 hours to a city or town	Cassava – roots	Millet	Leaves (cocoyam, spinach, etc.)	Eggplant	Okra – dried	Mango	Orange /tangerine	Cheese (wara)	Fresh milk	Soybeans	Other oil and fat
>2 hours to a city or town	Gari – white (cassava meal)	Maize (unshelled/on the cob)	Leaves (cocoyam, spinach, etc.)	Eggplant	Okra – dried	Orange/ tangerine	Banana	Fish – smoked	Pork	Groundnuts (shelled)	Palm oil
National	Cassava – roots	Guinea corn/sorghum	Okra – dried	Leaves (cocoyam, spinach, etc.)	Eggplant	Mango	Pawpaw	Cheese (wara)	Fresh milk	Groundnuts (shelled)	Palm oil

Notes: The order of food items in each food group is given by the rank cost, with the first item being the least-cost item in the group. "National" refers to the national basket identified using the national prices of all food items available in the country.

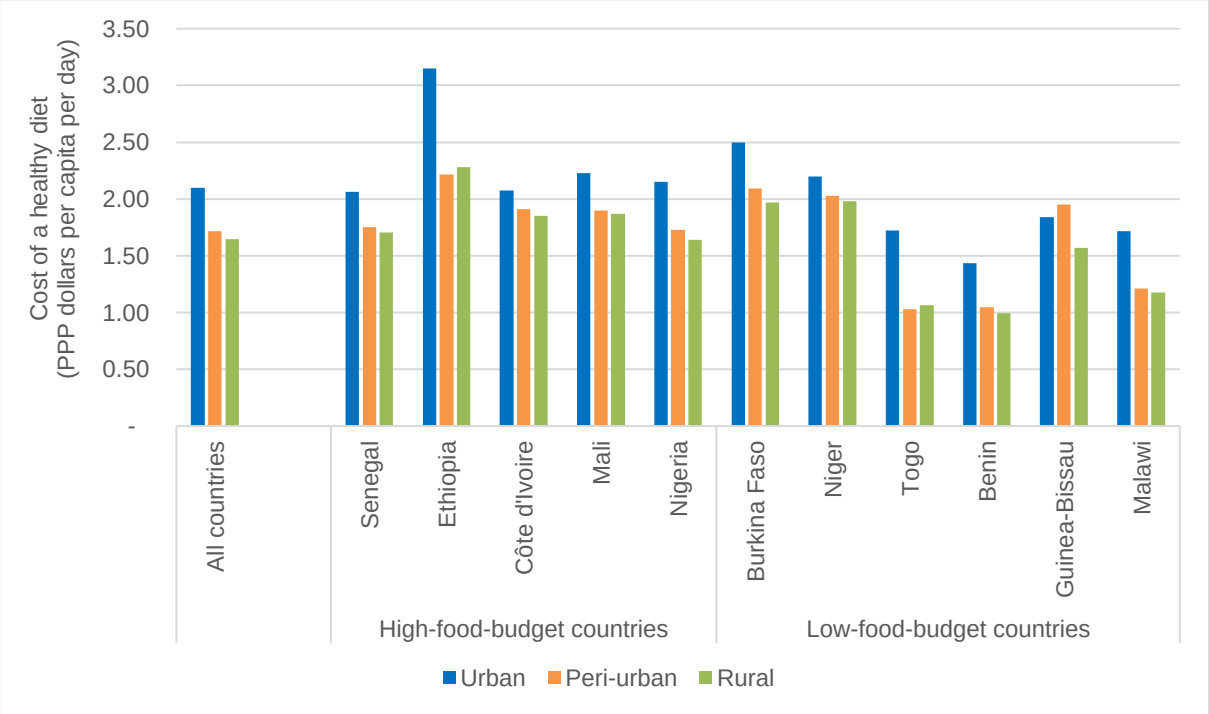
Source: Authors' own elaboration.

The different composition of the HDBs together with the availability of subnational prices makes it possible to analyse the within-country variability of the cost of healthy diet.

Across the 11 African countries analysed, the cost of a healthy diet in urban centres is on average 1.2 times higher than in peri-urban areas and it then decreases the smaller the city size and moving closer to rural areas. The higher cost in urban centres may be associated with the widespread diffusion of supermarkets in cities, which increase access to a more diverse

diet, but at the same time increase the cost of a healthy diet up, making it less affordable for poorer households (FAO *et al.*, 2023).

Figure 2. Cost of a healthy diet in urban, peri-urban and rural areas (URCA) by high- and low-food budget countries



Notes: URCA with fewer than 30 observations are excluded. Areas 1 hour travel or less to a town in Ethiopia are not included for price unavailability. Countries are ordered based on the market value of the household food consumption.

Source: Authors' own elaboration.

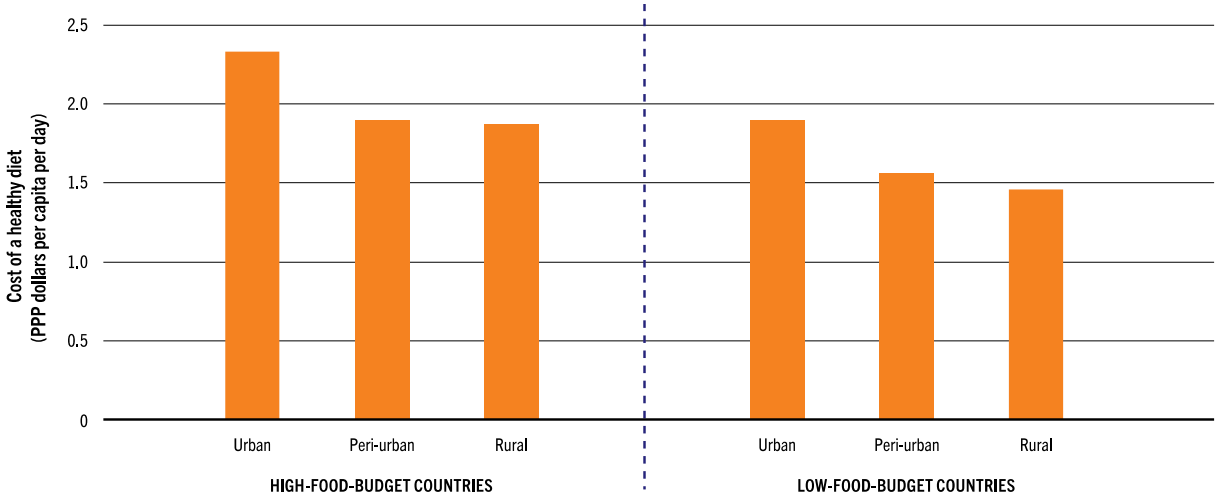
However, there are exceptions to this cost pattern: Côte d'Ivoire and Guinea-Bissau, where the cost in peri-urban areas is higher than in urban areas; and Ethiopia and Togo, where the cost is higher in rural areas than in peri-urban areas (Figure 2). In all cases, poor transport infrastructure is a major factor which limits the availability of nutritious foods (often highly perishable) and increases their cost (Ministry of Health Guinea-Bissau, 2021; Moszoro and Soto, 2022).

Another important issue is the cost differences between high- and low-food-budget countries, as shown in Figure 3. The cost of a healthy diet in high-food-budget countries is 23 percent, 22 percent, and 28 percent higher, respectively, than in low-food-budget countries. The higher cost in high-food-budget countries is mainly due to the higher cost of vegetables and animal source foods (29 percent and 32 percent higher than in low-food-budget countries, respectively). For countries in both food-budget groups, the largest decrease in the cost occurs moving from urban to peri-urban areas, while in rural areas the cost is similar to (in high-food-budget countries) or only slightly lower than (in low-food-budget countries) the cost in peri-urban areas.

A more disaggregated view of the rural–urban continuum (that is, considering the ten URCA categories) reveals a much closer convergence in the cost of a healthy diet in high-food-budget

countries, particularly in urban areas (Figure 4). On the other hand, the range in the cost is wider for low-food-budget countries. The greater convergence in the cost of a healthy diet in high-food-budget countries points to their better connectivity in food supply chains across the rural–urban continuum compared to low-food-budget countries.

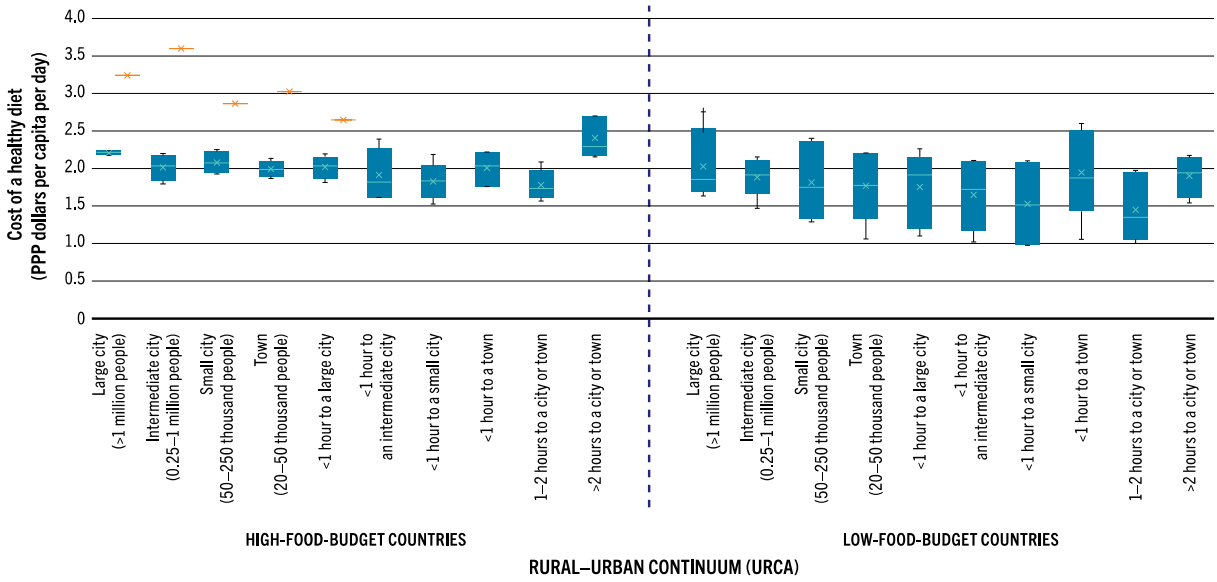
Figure 3. Cost of a healthy diet in urban, peri-urban and rural areas (URCA) in high- and low-food budget countries



Notes: URCA with fewer than 30 observations are excluded. Areas 1 hour travel or less to a town in Ethiopia are not included for price unavailability.

Source: Authors' own elaboration.

Figure 4. Cost of a healthy diet across the rural–urban continuum (URCA) in high- and low-food budget countries



Notes: Each bar visualizes the median, 25th and 75th percentile range, and whiskers of 1.5 times that range of the cost of a healthy diet for the 11 countries analysed across the rural–urban continuum (URCA) by high- and low-food-budget countries, in PPP dollars per capita per day (PPP = purchasing power parity). Crosses above the bars in the high-food-budget section are the cost of a heathy diet in urban centres in Ethiopia, classified as outliers compared to the values of other countries in the same URCA.

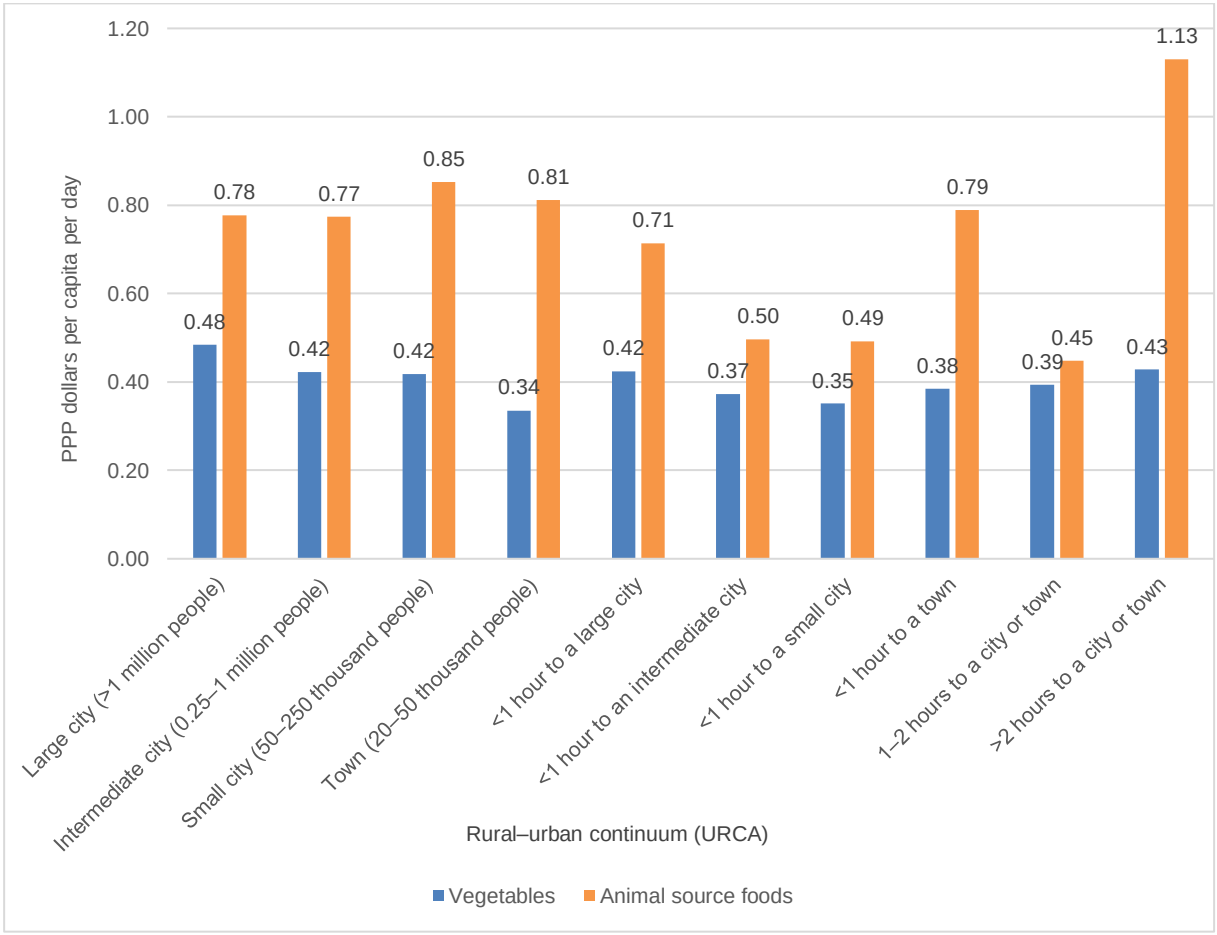
Source: Authors' own elaboration.

Looking at the cost pattern across the rural–urban continuum for individual countries (Annex 3) provides further insights, though these are not discussed here. For policy and programming, however, this information is crucial as it makes it possible to identify and prioritize areas of intervention. Furthermore, the cost of the food basket can easily be decomposed to look at the cost composition and understand the major drivers of the cost of a healthy diet.

In this analysis, when the 11 countries are pooled together, the cost structure by food group does not present any striking differences along the rural–urban continuum (Figure A2.1 and Figure A2.2 in Annex 2), with the animal source foods group being the largest cost contributor, even when compared to vegetables and fruits combined.

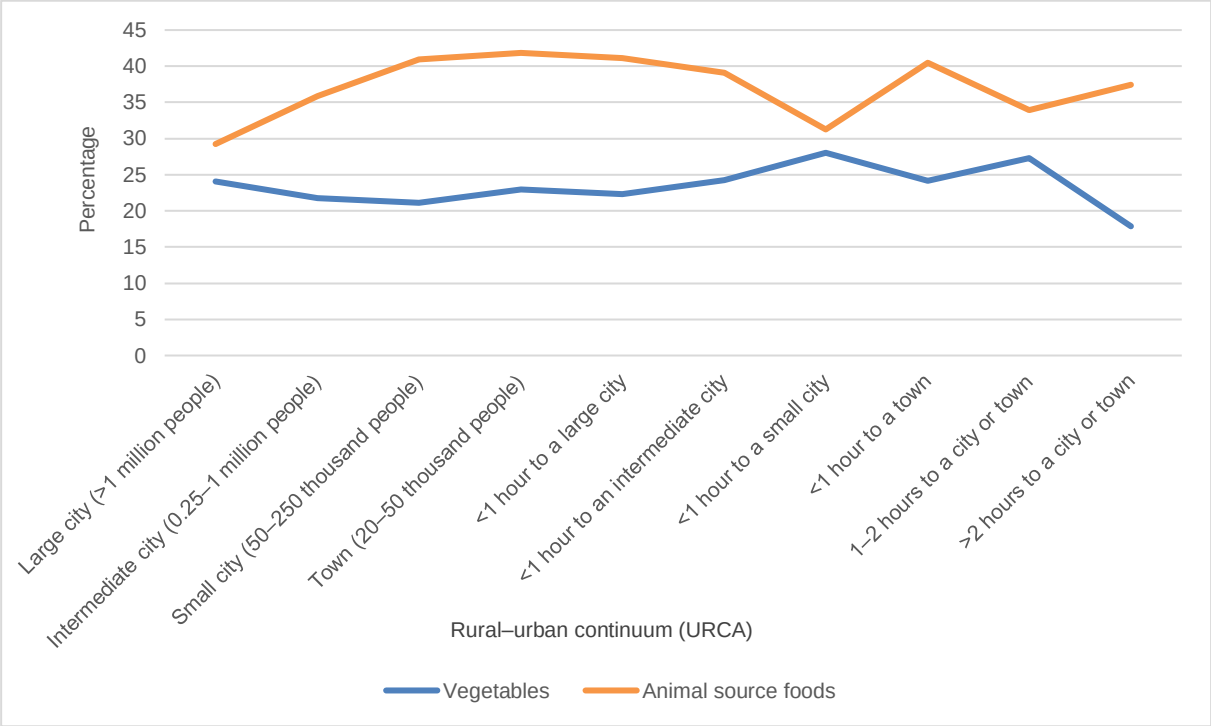
However, the analysis of each country shows some interesting results. For example, in Nigeria the per capita daily cost of vegetables and animal source foods is always higher in cities (of any size) than in peri-urban areas, the only exception being the daily cost of vegetables in towns (Figure 5). The lower cost of these two food groups in the outskirts of cities can be explained by their proximity to the production sites of these perishable products. Another example is Mali, where the contributions of the vegetable and animal source foods groups along the rural–urban continuum behave exactly as a reverse mirror, with the cost share of vegetables decreasing just when the cost share of animal source foods increases (Figure 6).

Figure 5. Cost of vegetables and animal source foods across the rural–urban continuum (URCA) in Nigeria



Source: Authors' own elaboration.

Figure 6. Cost share of vegetables and animal source foods in a healthy diet across the rural–urban continuum (URCA) in Mali



Source: Authors' own elaboration.

4.2 Affordability of a healthy diet across the rural–urban continuum (URCA) using different definitions of income

Affordability refers to the ability of a person to access a healthy diet. It is a measure of economic access and thus assesses whether a person's economic resources are enough to acquire a healthy diet. As explained in Section 2.2, the affordability indicators are obtained by comparing the cost of a healthy diet with the income a household can credibly reserve for food. The latter is defined according to four different thresholds. Table A4.2 in Annex 4 compares the different levels of affordability obtained by URCA for all 11 countries when the four different thresholds are used.[21]

The first finding is that the use of the fixed threshold of 52 percent in all countries and subnational units of analysis generally results in a higher estimation of the share of people unable to afford a healthy diet, compared to the other methods (see for example Figure 7 and Figure 8), with the main exception of Burkina Faso.

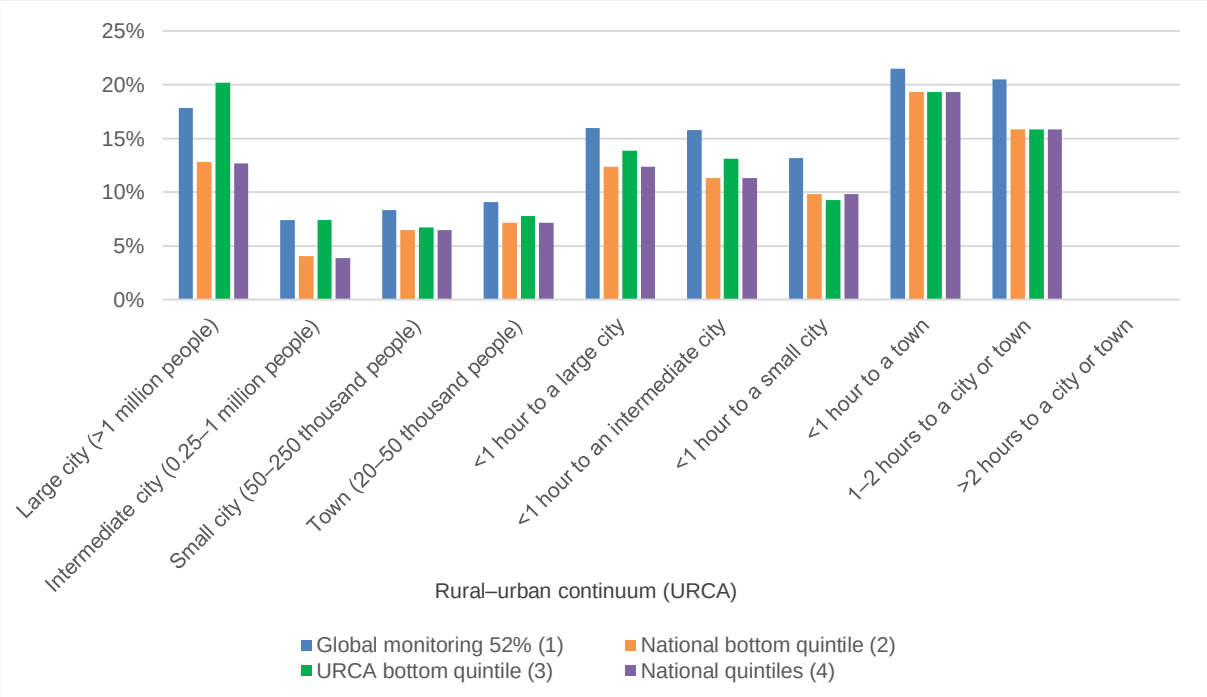
The second finding is that in rural areas, affordability shares are similar or slightly higher when estimated by adopting the food expenditure share of the bottom national income quintile versus that of each URCA bottom quintile. However, the estimates are always lower in large cities and, sometimes, in other urban centres and peri-urban areas as well (see for example Figure 7). This happens because a higher share of better-off households lives in cities and, in

[21] See Table A5.2 in Annex 5 for different levels of affordability in Ethiopia based on thresholds (that is, food expenditure shares) obtained from authors' calculation of household consumption aggregates.

these URCA, food expenditure shares of the households belonging to the URCA bottom income quintile are lower. Accordingly, using the national bottom quintile allows for a higher share of total income for food expenditure, and a household living in a large city will have enough money to access a healthy diet. However, the household may not be able to satisfy other non-food basic needs, which are likely more costly in cities.

The issue of assigning a higher share of total income for food expenditure to better-off households could be solved by the fourth method proposed (that is, using the average food expenditure shares of the national income quintile the household belongs to). Following the same logic described in the previous paragraph, one would expect that the share of people unable to afford a healthy diet will be higher when using thresholds based on the income quintile a household belongs to rather than the food expenditure share of the bottom quintile. The data, however, do not always corroborate this hypothesis (see for example Figure 8). Reasons are twofold and interconnected. First, in some countries (such as Niger) data violate Engel's Law. As the food expenditure share is higher in higher quintiles, a larger share of total income for food expenditure is allowed, resulting in a lower estimate of the number of people who are unable to afford a healthy diet. The second reason is that, in each URCA, the household distribution across income quintiles is different (for instance, often most of the better-off households live in urban areas). As the cost of a healthy diet is URCA-specific, if the cost is lower in URCA with a high percentage of better-off households, despite the use of quintile-specific thresholds, a greater share of households will still be able to afford a healthy diet.

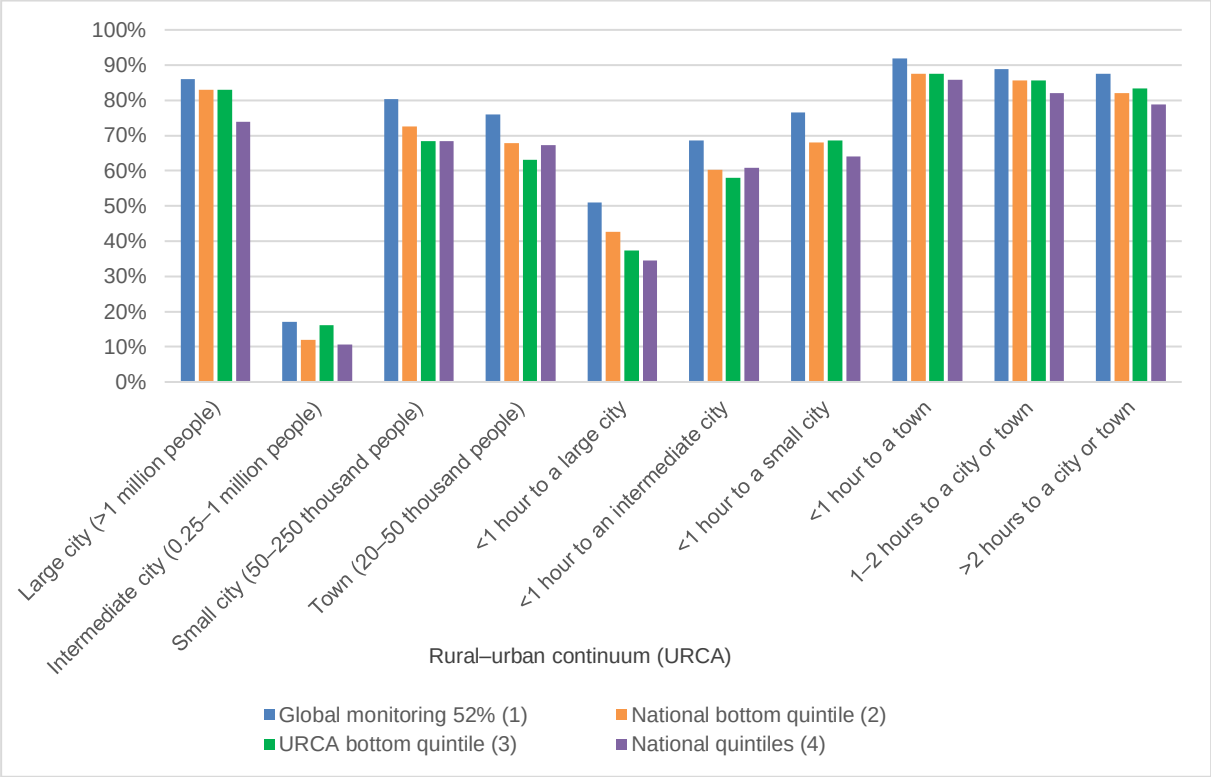
Figure 7. Affordability of a healthy diet across the rural–urban continuum (URCA) in Benin, based on different definitions of income that can be credibly reserved for food



Note: Values for URCA with fewer than 30 observations are not shown.

Source: Authors' own elaboration.

Figure 8. Affordability of a healthy diet across the rural–urban continuum (URCA) in the Niger, based on different definitions of income that can be credibly reserved for food



Source: Authors' own elaboration.

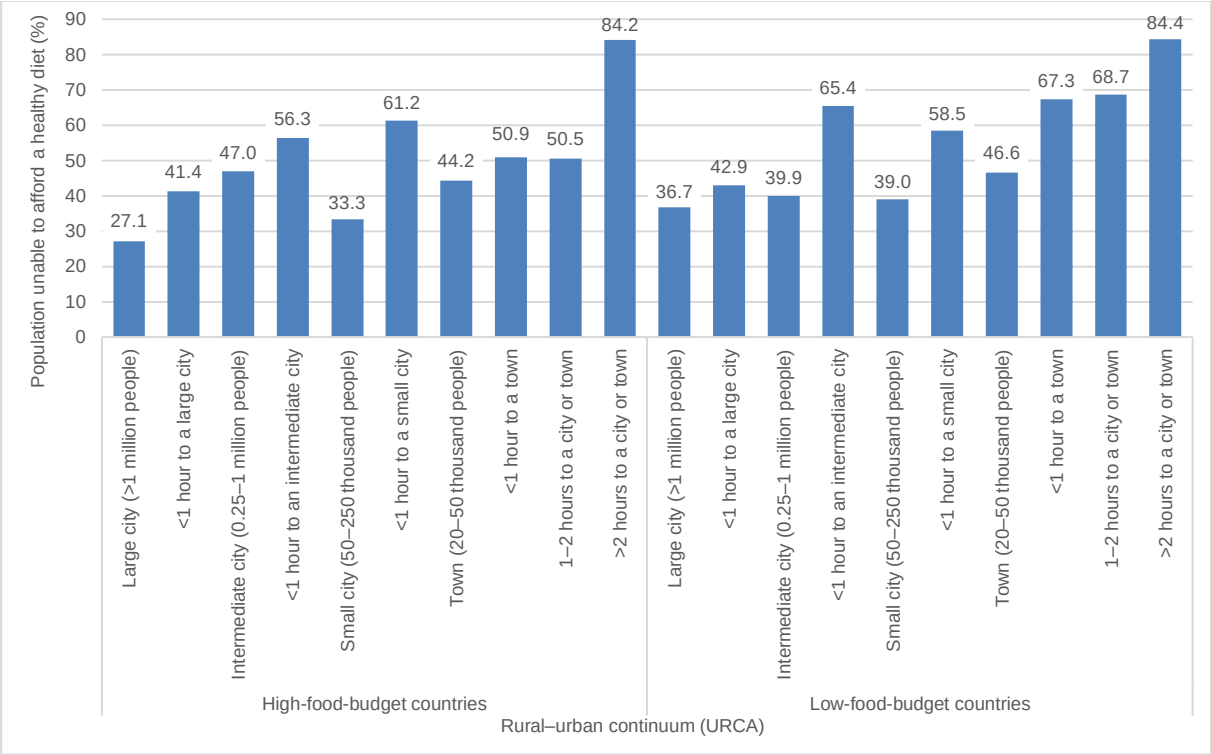
The use of a national metric (food expenditure share by national income quintile) in a subnational analysis is nevertheless imprecise. The cost of non-food essential needs may vary significantly within a country and their weight in a household budget can differ significantly based on the location of the household. For this reason, the food expenditure share of the households in the bottom income quintile of each spatial unit of analysis (that is, each URCA) was adopted to continue the analysis and explore how the cost and affordability of a healthy diet varies across the rural–urban continuum. Although thresholds by income quintile and URCA could have been more precise, the restricted number of observations limited the analysis. Furthermore, the use of the food expenditure share of households in the bottom quintile better aligns with the FAO HDB methodology,[22] while the differentiation of the threshold across URCA recognizes spatial specificities and reflects findings of a recent cross-country analysis conducted by Headey, Hirvonen and Alderman (2023), where the authors warn about the risk of assuming that non-food costs are a fixed portion of the income. Thus, the decision to let the share of income credibly reserved to food differ for each URCA allows for considering possible different levels of economic development and different needs within a country.

[22] In Herforth *et al.* (2020) the methodological paper behind *The State of Food Security and Nutrition in the World 2020*, the average food expenditure share of the bottom quintile in low-income countries is assumed to be the portion of income that can be credibly reserved for food.

Figure 9 shows how access to a healthy diet varies across the rural–urban continuum, following different paths based on the different levels of development and urbanization of the 11 countries analysed. The first important finding is that a high cost of healthy diet in an area does not necessarily translate into less affordability. Indeed, household income level plays a crucial role in ensuring that the household can access a healthy diet.

In the countries analysed, the cost of a healthy diet in peri-urban areas is lower than in urban areas (Figure 2 and Figure 3), but the percentage of the population unable to afford a healthy diet is always higher in the areas surrounding each urban centre, regardless of the country food-budget group (Figure 9). Other similarities between the two country food-budget groups are 1) the large gap between small cities and their surrounding areas; 2) the similar conditions between areas less than 1 hour from a town and areas between 1 and 2 hours from any urban centre (though the levels of unaffordability are much higher in low-food-budget countries); and 3) the significant high share of the population unable to secure a healthy diet in more remote rural areas.

Figure 9. Percentage of population unable to afford a healthy diet across the rural–urban continuum (URCA), in high- and low-food budget countries



Notes: Income that can be credibly reserved for food is obtained using food expenditure shares of households in the bottom quintile of total (food and non-food) expenditure distribution in each URCA.

Source: Authors' own elaboration.

On the other hand, the two country groups differ in that the share of people unable to afford a healthy diet is higher in low-food-budget countries along the rural–urban continuum than in high-food-budget countries. Furthermore, the gap between large cities and their suburbs is wider in high-food-budget countries. This is likely due to the greater presence of slums on the outskirts of large cities in high-food-budget countries.

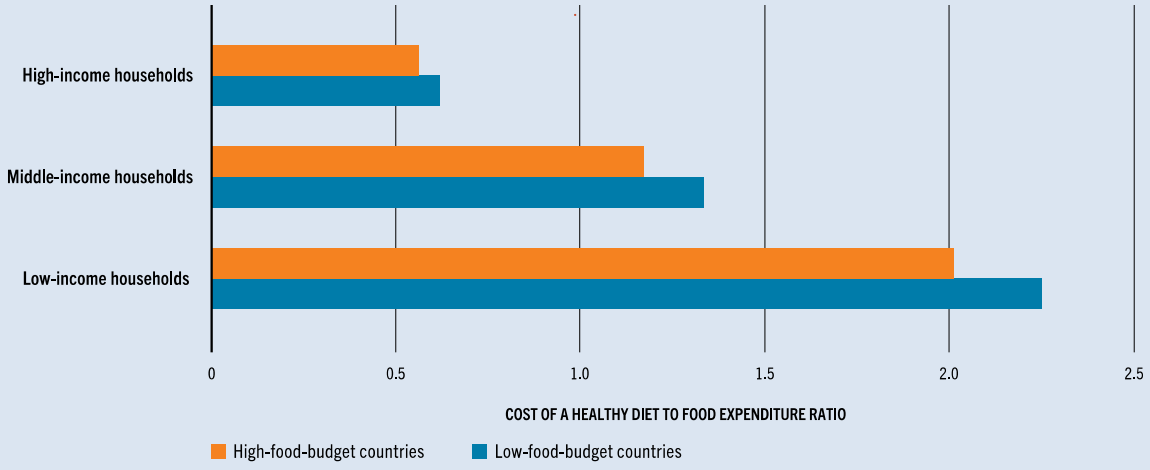
The country group classification, though useful to highlight main trends, inevitably hides country peculiarity. Indeed, investigating the cost pattern across the rural–urban continuum for individual countries (Figure A4.2 in Annex 4) can provide important insights, and it is key to identifying and prioritizing areas of intervention for policy and programming. For example, in the Niger, a low-food-budget country with the highest percentage of the population (among the 11 countries analysed) living in areas more than 1 hour from any urban centre, the percentage of the population unable to afford a healthy diet grows as cities get smaller and as one moves into rural areas. On the other hand, Burkina Faso and Guinea-Bissau, though also low-food-budget countries, follow a different pattern, with affordability levels remaining more or less constant across urban centres.

Box 1. Is actual household food expenditure enough to cover the cost of a healthy diet basket?

Household surveys collect data on actual expenditure on food consumption for each household. Comparing the cost of a healthy diet and what households are actually spending on food (including market value of own food production, food received as a gift or as in-kind payments) is a useful comparison as it tells us whether households would have to spend more or less of their income in order to access a healthy diet.

With the only exception of Burkina Faso and the Niger, in all countries analysed, the cost of a healthy diet is lower than the amount households spend on food. However, when the analysis is broken down by household income tercile, in all countries, for low- and middle-income households, the cost of a healthy diet exceeds average food expenditure[1] (Table A4.1 in Annex 4). For low-income households, the cost of a healthy diet basket is about twice the amount that households spend on food; specifically, 2.3 times higher in low-food-budget countries and 2 times higher in high-food-budget countries (Figure 10). This finding is true across the rural–urban continuum, but it becomes particularly acute in peri-urban and rural areas (Figure A4.1 in Annex 4).

Figure 10. Ratio of the cost of a healthy diet to average food expenditure by household income level in high- and low-food-budget countries



Note: The household grouping is based on terciles of total (food and non-food) expenditure.

Source: Authors' own elaboration.

4.3 National cost and affordability of a healthy diet: comparing different aggregation methods

Table 9 reports the results of two different ways of computing the national cost of a healthy diet and the related affordability indicators.

The first method (columns a) computes the cost of a healthy diet basket by defining the composition of a national basket based on the least-cost item(s) in each food group at the country level. The share of people unable to afford a healthy diet (column c) is calculated by comparing the national distribution of household income that can be credibly reserved for food with the estimated national cost; and the number of people who cannot afford a healthy diet (column e) is calculated by multiplying the share of people who cannot afford a healthy diet with the survey-estimated national population.

With the second method, a national basket is not identified. Instead, the cost of a national healthy diet basket (column b) is computed as a population-weighted average of the URCA healthy diet basket costs. Similarly, the share of people unable to afford a healthy diet (column d) is computed as a population-weighted average of the subnational shares, while the number of people (column f) is simply the sum of all people unable to afford a healthy diet in each URCA.

Table 9. Comparison of national cost and affordability of a healthy diet using different aggregation methods by country

Country	Cost of a healthy diet		People unable to afford a healthy diet			
	National computation	Subnational aggregation	National computation	Subnational aggregation	National computation	Subnational aggregation
	(a)	(b)	(c)	(d)	(e)	(f)
	(PPP dollars per capita per day)		(%)		(number of people)	
Benin	1.201	1.158	14	12	1 642 041	1 412 932
Burkina Faso	2.042	2.151	67	72	13 599 137	13 717 770
Côte d'Ivoire	1.921	1.945	30	33	7 758 212	7 256 575
Ethiopia	2.511	2.364	71	70	65 802 492	62 651 533
Guinea-Bissau	1.583	1.754	32	40	540 444	655 371
Malawi	1.232	1.252	66	67	11 913 277	11 989 034
Mali	1.844	1.975	28	32	5 485 288	6 123 395
Niger	2.176	2.031	79	76	17 185 486	16 245 085
Nigeria	1.804	1.827	44	46	65 952 900	67 989 218
Senegal	1.907	1.890	33	31	5 197 780	4 801 078
Togo	1.189	1.308	26	29	1 992 523	2 212 227

Notes: The share and number of people who cannot afford a healthy diet exclude: 1) areas less than 1 hour from a town in Senegal and Togo; 2) areas more than 2 hours from a city or town in Benin and Togo; and 3) towns in Guinea-Bissau. See Table A5.3 in Annex 5 for affordability indicators in Ethiopia based on thresholds (that is, food expenditure shares) obtained from authors' calculation of household consumption aggregates.

Source: Authors' own elaboration.

In most of the countries the cost of a healthy diet basket is lower with the first method. The reason is quite intuitive. For each food group the least-cost item in the entire country is picked, thus the basket is made of the cheapest options available. The consequence is that the first method generally estimates a lower share and number of people unable to afford a healthy diet. The main exceptions are Ethiopia and the Niger (and, to a less extent, Benin and Senegal), where the cost and, consequently, the share of people unable to afford a healthy diet are higher when a national basket is identified (column a and c). The reason is that, in both countries, the cost of a healthy diet in the three most populated URCAs, is lower than the cost of the national computed healthy diet.

Going beyond the debate of which is the right method, the authors wish to highlight that a minimum requirement for the validity of the methodology is the aggregability of subnational estimations, meaning that the number of people estimated at subnational levels should add up to the number of people obtained when affordability is assessed at the national level. In other words, columns *c* and *d* should be the same. This is not the case in any of the country case studies.

This should not be surprising, as the composition of the national food basket is different than the composition of the subnational food baskets. What column *c and e* are actual counting is the number of people unable to afford the cheapest combination of items in the country. This is a purely hypothetical situation, as people in a given area will likely not have access to that specific combination of food items. Therefore, column *c and e* could be interpreted as a lower boundary of the affordability indicators.

5 Discussion

5.1 Does the Healthy Diet Basket (HDB) methodology allow for enough food item variation in the healthy diet basket to reflect local consumption patterns?

Food-Based Dietary Guidelines (FBDGs) are developed by national governments to advise consumers on what to eat to pursue a healthy diet. They reflect a country's food production and consumption patterns, sociocultural influences, food composition data, and accessibility, among other factors. As they are context-specific, they are usually the starting point in identifying the exact composition of a healthy food basket in a cost and affordability analysis.

The FAO HDB methodology recognizes that a healthy diet can comprise a combination of different foods which can vary by local context. Nevertheless, quantified FBDGs are available for only a few countries. For this reason, the HDB methodology applies the recommendation of ten quantified FBDGs and defines food group amounts as the median amounts of each food group recommended in the ten quantified FBDGs. The decision to use the ten FBDGs was driven by the recency of their publication and by the guidelines being fully quantifiable and being from diverse world regions. The resulting food group proportions approximates a larger range of FBDGs than the original ten and captures commonalities across national guidelines (FAO, 2023). Nevertheless, when it comes to national and subnational studies, the use of the FAO HDB methodology has been questioned as it is said not to reflect local consumption patterns.

Although the use of national FDBGs should be always preferred, as described in Section 4.1, the use of the FAO HDB methodology combined with the use of crowdsourced prices allows for the selection of different items based, in part, on different consumer habits and food availability, even where food prices are available for a limited number of food items, such as Ethiopia.

5.2 How to define income to measure affordability?

This paper presented four different ways to identify the income a household can credibly reserve for food. The principle applied is the same as that used in the FAO HDB methodology; that is, looking at the food expenditure share of the poor households. The idea is that poor households are just able to meet their essential needs, thus their expenditure patterns should unveil the minimum cost of covering essential food and non-food needs.

But, how to identify the poor segment of the population? At the national or subnational level? Comparison of food expenditure shares (Section 3.3) and the corresponding affordability measures (Section 4.2) showed that the adoption of a national threshold (that is, the food expenditure share of households in the national bottom quintile) in a subnational analysis hides within-country variation in terms of economic vulnerability, as the food expenditure share of households belonging to the bottom quintile varies significantly across the rural–urban continuum (URCA) within a country.

In large cities and in some other urban centres and peri-urban areas, affordability shares estimated were generally lower when adopting the food expenditure share of the national bottom quintile versus that of each URCA bottom quintile. Indeed, as a higher share of better-off households lives in urban centres and, in these URCA, food expenditure shares of

households in the bottom income quintile are generally lower, using the national bottom quintile allows for a higher share of total income for food expenditure, and a household living in a large city would have enough money to access a healthy diet. However, the household may not be able to satisfy other non-food basic needs, which are likely more expensive in cities.

Going beyond the direction of the bias that would be encountered, the analysis suggests that in a subnational analysis, when possible, food expenditure shares of households in the bottom income quintile of the subnational unit of analysis should be preferred. If the number of observations available are not sufficient, income tercile can also be considered. Furthermore, the specific context should be analysed and the appropriate level of data necessary should be evaluated. It is indeed possible that the food expenditure shares of some of the poorest households, who are not even able to satisfy non-food essential needs, present abnormal, extreme food expenditure shares, therefore inflating the share of income that will be calculated for the affordability analysis.

The other definition of household income that can be credibly reserved for food proposed in the comparative analysis was based on the fixed threshold of 52 percent, adopted in the global monitoring estimation. Although the rationale for this is similar (that is, looking at how much the poorest households spend on food and, thus, adopting a conservative assumption), the use of this threshold was shown to be too restrictive for almost all the countries analysed. The consequence of using the global monitoring threshold versus the threshold given by the food expenditure share of households belonging to the national bottom quintile would be a higher estimation of people unable to afford a healthy diet.

Finally, the possibility of defining income by using the average food expenditure shares of the income quintile that each household belongs to was explored. The hypothesis is that this would better capture the different level of economic vulnerability in a country. However, in the 11 countries analysed, the average difference between the food expenditure share of households belonging to the first and fifth quintiles of the income distribution is relatively low. Furthermore, the use of a national metric (food expenditure share by national income quintile) in a subnational analysis could be imprecise. The cost of non-food essential needs may vary significantly within a country and their weight in a household budget can be significantly different, depending on the location of the household. In other words, geographic location, rather than economic status of households, may play a bigger role. This is another reason to prefer the use of the food expenditure share of households belonging to the bottom quintile of the subnational unit of analysis.

5.3 How should subnational estimates be aggregated to be consistent with national-level estimates?

Section 4.3 discussed the discrepancies between national estimations of cost and affordability of a healthy diet when pursued with different methods; that is, identifying a national healthy food basket and relative national cost and affordability indicators versus averaging the cost and affordability indicators of each subnational unit of analysis. One would expect that in the same analysis the number of people who cannot afford a healthy diet in subnational units would add up to the number of people obtained when assessing this at the national level. However, the comparative analysis shows that, in most of the countries, both the cost and the share of people unable to afford a healthy diet are lower when a national food basket is defined. As explained in Section 4.3, the reason is simply a technical one, as by construction a national

basket is made up of the cheapest options available nationally. Accordingly, in a national assessment, one is estimating the number of people unable to afford the cheapest combination of items in the country. However, a national basket is a hypothetical basket, which people in a given area will likely not have access to. Therefore, 1) a national estimation based on a national healthy diet basket should be interpreted as the lower boundary of the affordability indicators; and 2) when a subnational analysis is conducted, a national estimation should be obtained as population-weighted averages of subnational estimations.

5.4 Should national and global monitoring estimation be the same?

Since 2020, FAO has been publishing global, regional and country-level estimations of the CoAHD. Discrepancies between estimates from national studies and global monitoring have already emerged, questioning the validity of the estimations themselves. Furthermore, the national estimations conducted in this study (see Table 9) differ from the ones reported in *The State of Food Security and Nutrition in the World 2023* (FAO *et al.*, 2023). Although the numbers are not directly comparable for some countries (as some subnational units were excluded in this analysis), it emerges clearly that cost and affordability indicators are significantly higher in the global monitoring estimations. The discrepancies may first come as a surprise, given that both estimations follow the same methodology. However, the discrepancies are not inconsistencies, and estimations should not be compared, because different data sources for income distribution and prices were used in the calculations.

In the global monitoring estimations reported in the annual *The State of Food Security and Nutrition in the World 2023* report, income distributions used for the estimation of affordability indicators are from the World Bank's Poverty and Inequality Platform; whereas this paper uses total household expenditure from household survey data as a proxy for income distribution.

Furthermore, in the global monitoring estimations of the cost of a healthy diet, food-item prices are from the World Bank's International Comparison Program (ICP), whereas prices used in this paper are derived from household surveys. The International Comparison Program (ICP) was established as a system for performing cross-country comparisons. For this reason, prices are collected for comparable products, that are mostly likely more expensive than the equivalent domestic item normally purchased by the households.

Already, Headey, Hirvonen and Alderman (2023) have pointed out that diet costs based on ICP prices seem to be higher than diet costs estimated from other national price sources, such as prices collected by national governments to compute the Consumer Price Index (CPI) for inflation monitoring purposes. In turn, prices from the CPI and those derived from household surveys differ. However, no unidirectional pattern has been found (Schneider, 2022). Headey, Hirvonen and Alderman (2023) also show that some ICP countries have shorter food lists than others and this "product coverage bias" likely biases upwards the costs of several food groups.

Furthermore, most ICP products may only be found in large urban stores and are unavailable in rural areas, thus neglecting the significant price variation within countries. On the other hand, prices derived from expenditure modules of household surveys reflect more closely what is normally purchased by households and capture the differences in terms of price levels and item availability along the rural–urban continuum. As mentioned in Section 3.2, although there are some shortcomings linked to the use of unit prices derived from food expenditure modules of household surveys, unit prices have been found useful in recent studies (Adewopo *et al.*,

2021) and used in several other studies to compute the cost of a healthy diet (Mahrt *et al.*, 2019; Mekonnen *et al.*, 2021).

From the difference in the source of food price derives another important divergence between the global monitoring estimation and the national estimation conducted in this paper: the basket composition. The choice of the item comprising the basket is in fact driven by the cost of the items. The composition of the national baskets is therefore different in the two estimations.

Finally, other than the data source, a further divergence between the global monitoring estimations and the national estimations conducted in this paper is in the calculation of the income a household can credibly reserve for food. Although, the two estimations are based on the same assumption, in this paper the share of income that can be credibly reserved for food varies by URCA and is set equal to the average food expenditure share of households belonging to the lowest income quintile in each URCA. In the global monitoring estimation, the share of income that can be credibly reserved for food is set equal to 52 percent for all countries. This percentage equals the average share of income spent on food in low-income countries, based on the national account expenditure data from the World Bank ICP.

Given the differences explained above, the discrepancies between the global monitoring estimations and national estimations should not come as a surprise. On the other hand, their similarity should be interpreted as a coincidence where divergences have just played a compensating role.

6 Limitations of the study

The use of the URCA dataset allows for a novel analysis in exploring how the cost and affordability of a healthy diet varies along the rural–urban continuum, where locations are characterized in terms of access to services provided by their urban centre of reference. The URCA analysis allowed to identify the extent to which access to a healthy diet in rural areas is influenced by proximity to large cities or towns. However, the advantage of using the URCA dataset in this analysis, comes with two limitations. First, the sampling of the household survey used was not conducted to be representative at URCA level. Although some checks were performed to understand the extent to which the analysis could be sound at URCA level (Annex 1), the results are not statistically representative at URCA level.

The second limitation derives from the fact that data for the household surveys were collected between 2018 and 2019 (except Malawi, where they were collected between 2019 and 2020), while the URCA dataset was developed based on 1) the GHS Settlement Model (GHS-SMOD) grid to identify cities and towns; 2) the GHS-POP grid for 2015 to calculate the urban population in each city; and 3) travel time classifications based on Nelson *et al.* (2019) with updated cost surface from Weiss *et al.* (2020). Accordingly, the matching between the URCA dataset and the household surveys presents some time inconsistencies. Nevertheless, as the information on road and infrastructure used in the URCA dataset was the most updated at the time the dataset was developed, which is around the same time the surveys were conducted, it is expected that the travel time in the URCA dataset does not diverge significantly from the travel time faced by the households in the surveys.

On the other side, as population in urban centres in the URCA dataset is based on the 2015 GHS-POP, it is possible that some households assigned to peri-urban areas are actually misclassified (that is, if a city has expanded, some areas that in 2015 were classified as “less than 1 hour from the city” could have become part of the city in 2018/19). This is however only the case if the city had expanded geographically and not just in population size. In addition, it is possible that an urban centre may have grown in population size between 2015 and 2018/19 and made the jump from small to intermediate city, or from intermediate to large city.

7 Conclusions

This paper has explored different methodological issues related to the national and subnational estimation of the cost and affordability of a healthy and offered some evidence on the validity of the FAO HDB methodology for the subnational estimation.

The analysis of cost and affordability of healthy diet requires a non-trivial amount of information which becomes even more burdensome when a subnational analysis is undertaken. An ad hoc data collection would be ideal, but often it is necessary to rely on existing data. The challenges that derive from this are significant.

The first resource to turn to is a national FDBG if it is quantified. Although a recent a quantifiable national FBDG should always be preferred, often this is not available. In this case, the FAO HDB methodology can be safely adopted. The fear that it may not allow for enough item variation is in fact discredited in this paper, which shows that the FAO HDB methodology combined with crowdsourced food prices allows for enough variation in item selection to partially reflect local consumption patterns.[23]

The second element that was investigated was related to the measure of affordability and the definition of income. The comparison of different approaches for the computation of the income a household can credibly reserve for food suggested that in a subnational analysis, when possible, food expenditure shares of households in the bottom quintile of the subnational unit of analysis should be preferred. In fact, the adoption of a national threshold in a subnational analysis would hide within-country variation in terms of economic vulnerability. Food expenditure shares of poor households can vary significantly across the rural–urban continuum (URCA) within a country given that the cost of non-food essential needs may vary within a country and their weight in a household budget can be significantly different depending on the location of the household. In other words, geographic location, and not just household economic status, plays a big role. Furthermore, policy interventions aiming to remove bottlenecks in the agrifood system to improve the affordability of a healthy diet will most likely need a spatial lens.

The policy perspective brings us to the last consideration. The paper highlighted and explained the reason for the apparent inconsistency between national estimations and global monitoring estimations in *The State of Food Security and Nutrition in the World 2023* report. Discrepancies between those estimates have raised doubts regarding the validity of the method itself. However, as explained in the previous sections, national and global monitoring estimations are likely to be different because of the different data sources used. This inevitably raises the question of which of those estimates is correct. This depends on the purpose of the analysis. National and global estimations have different objectives. Global monitoring is meant to provide global evidence on people's capacity to afford a healthy diet and to increase countries' accountability towards the goal of making healthy diets affordable.

[23] The method does not account for household preferences in a systematic way, as is done, for example, by Mahrt *et al.* (2019). However, by allowing different items to be selected in each subnational unit of analysis and by using a list of items actually consumed in each subnational unit of analysis, within-country variation in food consumption habits can be captured.

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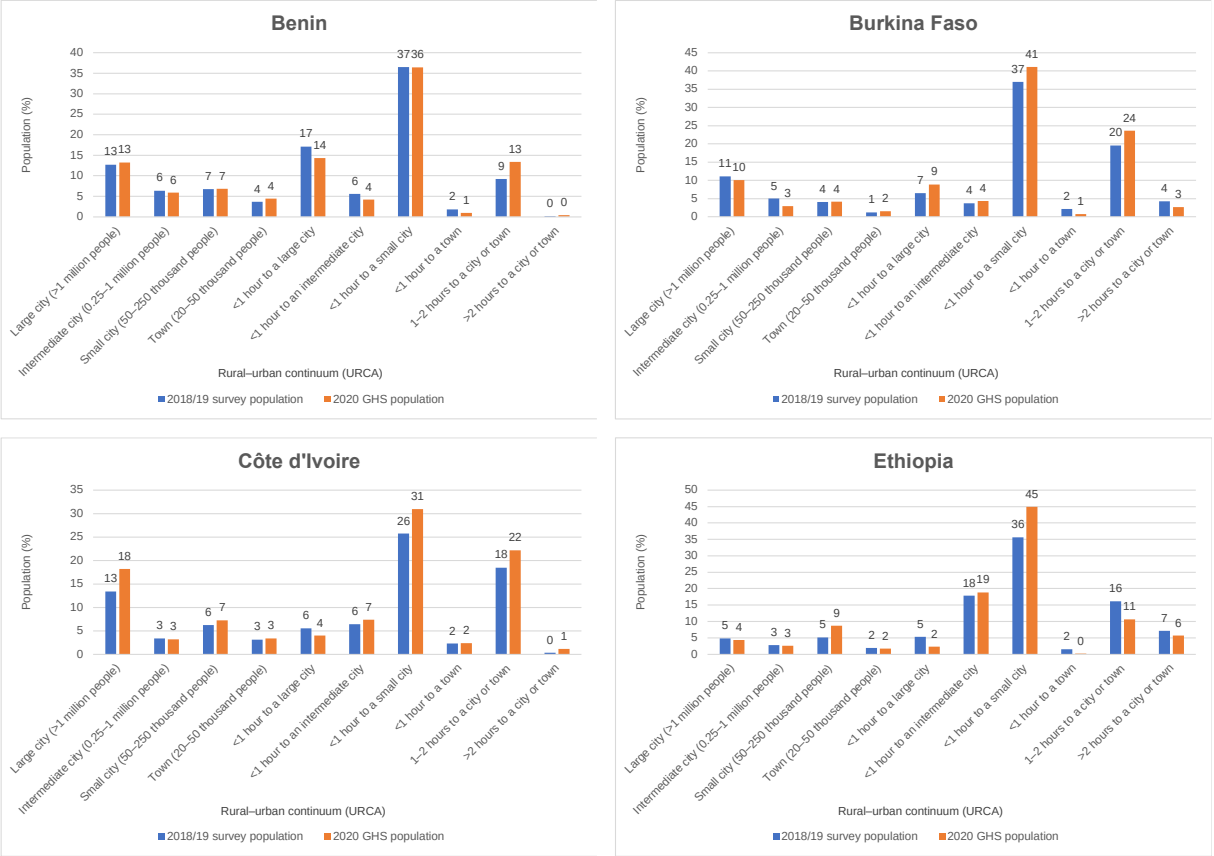
Annexes

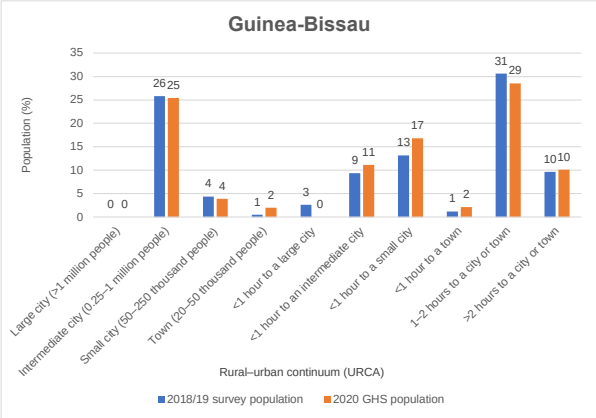
Annex 1. Survey and actual population distribution across the rural–urban continuum (URCA)

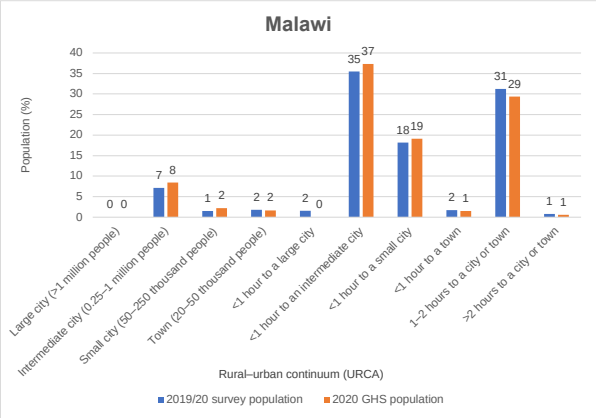
The 11 household surveys used in the analysis of this paper are all representative at the national level and their first geopolitical subnational unit, but sampling was not done to make the data representative at the URCA level. For this reason, the distribution of population surveyed across the rural–urban continuum (URCA) was compared with the actual population distribution (estimated based on the 2020 Global Human Settlement Population [GHS-POP] dataset and the URCA dataset), and it was found to be sufficiently similar so as to exclude that any catchment area was under- or overrepresented in each survey.

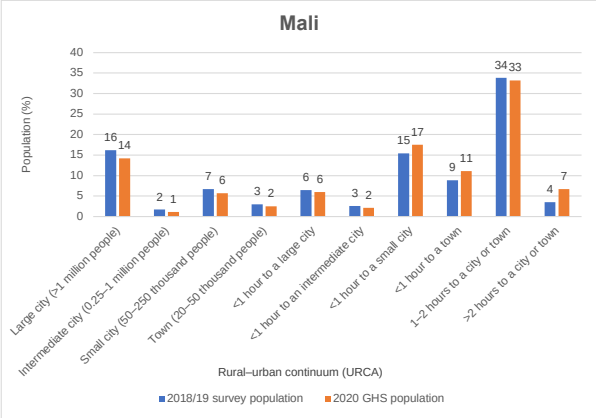
Figure A1.1 shows and compare the population distribution across the rural–urban continuum (URCA) based on the survey estimates and the GHS estimates.

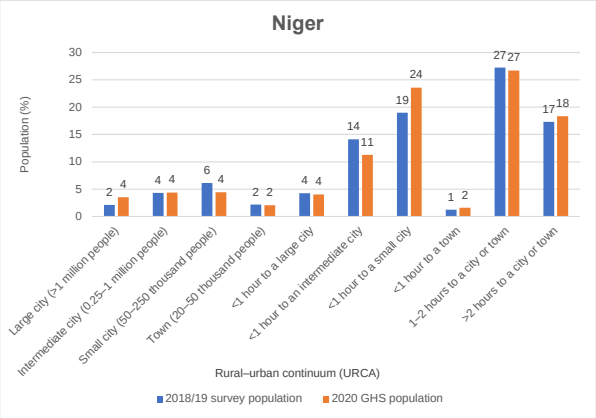
Figure A1.1 Population distribution across the rural–urban continuum (URCA) for each country

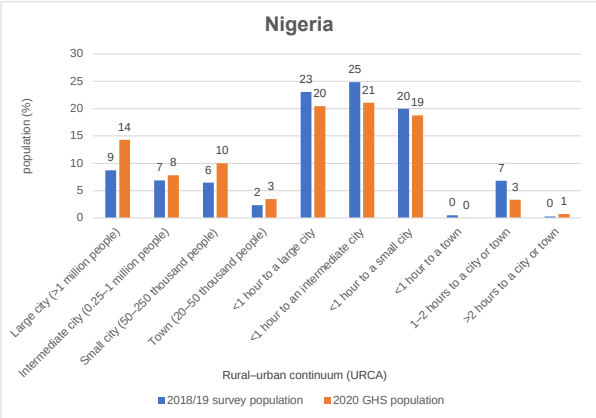


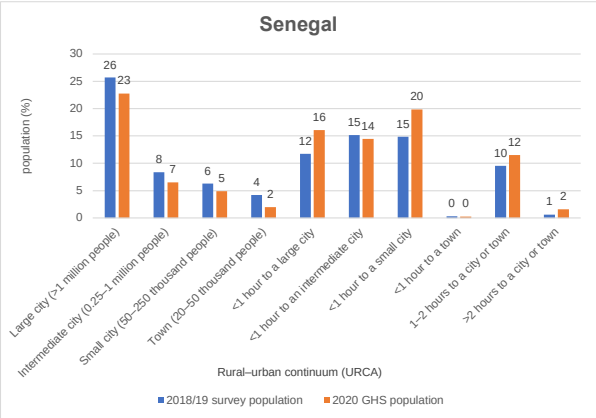


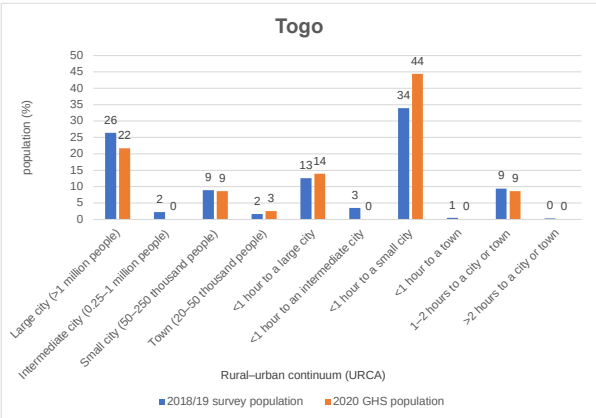












Source: Authors' own elaboration.

Annex 2. Healthy Diet Basked (HDB) composition and cost

Table A2.1 Healthy Diet Basket (HDB) composition across the rural–urban continuum (URCA) in Benin

Rural–urban continuum (URCA)	Staple foods		Vegetables			Fruits		Animal source foods		Legumes, nuts and seeds	Oils and fats
Large city (>1 million people)	Corn kernels	Gari, tapioca	Moringa, cassava leaves, taro leaves and other leaves	Eggplant leaves (gboma)	Juta leaves (adémè)	Sweet banana	Pineapple	Cheese (amon)	Pork	Dried peas	Peanut oil
Intermediate city (0.25–1 million people)	Corn kernels	Cassava flour	Dried tomato	Dried okra	Eggplant leaves (gboma)	Sweet banana	Mango	Cheese (amon)	Pork	Coconut	Peanut oil
Small city (50–250 thousand people)	Plantain	Corn kernels	Dried tomato	Moringa, cassava leaves, taro leaves and other leaves	Eggplant leaves (gboma)	Mango	Sweet banana	Cheese (amon)	Goat meat	Coconut	Red palm oil
Town (20–50 thousand people)	Plantain	Corn kernels	Dried tomato	Moringa, cassava leaves, taro leaves and other leaves	Eggplant leaves (gboma)	Mango	Sweet banana	Cheese (amon)	Pork	Coconut	Red palm oil
<1 hour to a large city	Plantain	Corn kernels	Dried tomato	Eggplant, squash/zucchini	Moringa, cassava leaves, taro leaves and other leaves	Sweet banana	Mango	Cheese (amon)	Pork	Coconut	Red palm oil
<1 hour to an intermediate city	Plantain	Corn kernels	Dried tomato	Moringa, cassava leaves, taro leaves and other leaves	Eggplant, squash/ zucchini	Sweet banana	Mango	Cheese (amon)	Goat meat	Dried peas	Red palm oil
<1 hour to a small city	Plantain	Corn kernels	Dried tomato	Moringa, cassava leaves, taro leaves and other leaves	Eggplant leaves (gboma)	Sweet banana	Mango	Cheese (amon)	Pork	Shea nuts	Red palm oil
<1 hour to a town	Plantain	Corn kernels	Dried tomato	Eggplant leaves (gboma)	Eggplant, squash/ zucchini	Sweet banana	Mango	Pork meat	Cheese (amon)	Coconut	Red palm oil
1–2 hours to a city or town	Plantain	Millet	Dried tomato	Moringa, cassava leaves, taro leaves and other leaves	Eggplant, squash/ zucchini	Sweet banana	Mango	Cheese (amon)	Pork	Dried peanuts in shell	Butter
>2 hours to a city or town	Corn kernels	Sorghum	Dried okra	Fresh onion	Baobab leaves	Sweet banana	Orange	Fresh fish (carp)	Beef	Cowpeas/dried beans	Peanut oil
National	Corn kernels	Sorghum	Dried tomato	Moringa, cassava leaves, taro leaves and other leaves	Eggplant leaves (gboma)	Sweet banana	Mango	Cheese (amon)	Pork	Dried peas	Red palm oil

Notes: The order of food items in each food group is given by the rank cost, with the first item being the least-cost item in the group. "National" refers to the national basket identified using the national prices of all food items available in the country.

Source: Authors' own elaboration

Table A2.2 Healthy Diet Basket (HDB) composition across the rural–urban continuum (URCA) in Burkina Faso

Rural–urban continuum (URCA)	Staple foods		Vegetables			Fruits		Animal source foods		Legumes, nuts and seeds	Oils and fats
Large city (>1 million people)	Corn kernels	Millet	Eggplant, squash/ zucchini	Dried okra	Green bean	Avocado	Mango	Powdered milk	Dried fish	Shelled peanuts	Refined palm oil
Intermediate city (0.25–1 million people)	Corn kernels	Millet	Dried tomato	Eggplant, squash/ zucchini	Dried okra	Avocado	Watermelon, melon	Powdered milk	Dried fish	Fresh peanuts in shell	Peanut oil
Small city (50–250 thousand people)	Corn kernels	Sorghum	Dried tomato	Eggplant, squash/ zucchini	Bean leaves	Avocado	Watermelon, melon	Powdered milk	Dried fish	Fresh peanuts in shell	Other oils n.e.s. (corn, palm kernel, soybean)
Town (20–50 thousand people)	Corn kernels	Millet	Dried tomato	Eggplant, squash/ zucchini	Dried okra	Watermelon, melon	Mango	Powdered milk	Dried fish	Coconut	Other oils n.e.s. (corn, palm kernel, soybean)
<1 hour to a large city	Corn kernels	Sorghum	Dried tomato	Eggplant, squash/ zucchini	Bean leaves	Watermelon, melon	Avocado	Powdered milk	Dried fish	Cowpeas/dried beans	Other oils n.e.s. (corn, palm kernel, soybean)
<1 hour to an intermediate city	Corn kernels	Sorghum	Dried tomato	Eggplant, squash/ zucchini	Dried okra	Watermelon, melon	Avocado	Powdered milk	Beef	Fresh peanuts in shell	Other oils n.e.s. (corn, palm kernel, soybean)
<1 hour to a small city	Corn kernels	Sorghum	Dried tomato	Eggplant, squash/ zucchini	Moringa, cassava leaves, taro leaves and other leaves	Watermelon, melon	Mango	Powdered milk	Dried fish	Fresh peanuts in shell	Other oils n.e.s. (corn, palm kernel, soybean)
<1 hour to a town	Sorghum	Millet	Dried tomato	Eggplant, squash/ zucchini	Baobab Leaves (fresh or dried)	Watermelon, Melon	Mango	Fresh milk	Curd, yogurt	Cowpeas/Dried beans	Red palm oil
1–2 hours to a city or town	Corn kernels	Sorghum	Dried tomato	Eggplant, squash/ zucchini	Dried okra	Watermelon, melon	Sweet banana	Powdered milk	Dried fish	Fresh peanuts in shell	Other oils n.e.s. (corn, palm kernel, soybean)
>2 hours to a city or town	Corn kernels	Millet	Dried tomato	Eggplant, squash/ zucchini	Cabbage	Watermelon, melon	Sweet banana	Powdered milk	Dried fish	Fresh peanuts in shell	Other oils n.e.s. (corn, palm kernel, soybean)
National	Corn kernels	Sorghum	Dried tomato	Eggplant, squash/ zucchini	Dried okra	Watermelon, melon	Avocado	Powdered milk	Dried fish	Shea nuts	Other oils n.e.s. (corn, palm kernel, soybean)

Notes: n.e.s. = not else specified. The order of food items in each food group is given by the rank cost, with the first item being the least-cost item in the group. "National" refers to the national basket identified using the national prices of all food items available in the country.

Source: Authors' own elaboration.

Table A2.3 Healthy Diet Basket (HDB) composition across the rural–urban continuum (URCA) in Côte d'Ivoire

Rural–urban continuum (URCA)	Staple foods		Vegetables			Fruits		Animal source foods		Legumes, nuts and seeds	Oils and fats
Large city (>1 million people)	Corn kernels	Imported rice (denicachia)	Dried tomato	Other leaves (cassava, taro, baobab, beans)	Potato leaves	Avocado	Sweet banana	Fresh milk	Pork	Shelled peanuts	Refined palm oil
Intermediate city (0.25–1 million people)	Corn kernels	Attieke (cassava dish)	Dried tomato	Other leaves (cassava, taro, baobab, beans)	Potato leaves	Avocado	Sweet banana	Powdered milk	Pork	Shelled peanuts	Refined palm oil
Small city (50–250 thousand people)	Corn kernels	Attieke (cassava dish)	Other leaves (cassava, taro, baobab, beans)	Potato leaves	Dried okra	Avocado	Sweet banana	Powdered milk	Pork	Shelled peanuts	Refined palm oil
Town (20–50 thousand people)	Corn kernels	Attieke (cassava dish)	Dried tomato	Other leaves (cassava, taro, baobab, beans)	Potato leaves	Avocado	Sweet banana	Pork	Powdered milk	Coconut	Refined palm oil
<1 hour to a large city	Millet	Attieke (cassava dish)	Dried tomato	Potato leaves	Other leaves (cassava, taro, baobab, beans)	Avocado	Sweet banana	Powdered milk	Pork	Shelled peanuts	Refined palm oil
<1 hour to an intermediate city	Corn kernels	Attieke (cassava dish)	Dried tomato	Other leaves (cassava, taro, baobab, beans)	Dried okra	Avocado	Sweet banana	Pork	Fresh milk	Shelled peanuts	Refined palm oil
<1 hour to a small city	Attieke (cassava dish)	Corn kernels	Dried tomato	Dried okra	Potato leaves	Avocado	Sweet banana	Fresh milk	Pork	Coconut	Refined palm oil
<1 hour to a town	Attieke (cassava dish)	Corn flour	Other leaves (cassava, taro, baobab, beans)	Dried tomato	Dried okra	Avocado	Sweet banana	Fresh milk	Pork	Shelled peanuts	Refined palm oil
1–2 hours to a city or town	Attieke (cassava dish)	Corn kernels	Dried tomato	Other leaves (cassava, taro, baobab, beans)	Dried okra	Avocado	Sweet banana	Fresh milk	Pork	Coconut	Refined palm oil
>2 hours to a city or town	Cassava	Imported rice (denicachia)	Dried okra	Sorrel leaves (dah)	Eggplant, squash/ zucchini	Avocado	Sweet banana	Fresh milk	Dried fish	Cowpeas/ dried beans	Refined palm oil
National	Corn kernels	Attieke (cassava dish)	Dried tomato	Other leaves (cassava, taro, baobab, beans)	Dried okra	Avocado	Sweet banana	Fresh milk	Pork	Shelled peanuts	Cottonseed oil

Notes: The order of food items in each food group is given by the rank cost, with the first item being the least-cost item in the group. "National" refers to the national basket identified using the national prices of all food items available in the country.

Source: Authors' own elaboration.

Table A2.4 Healthy Diet Basket (HDB) composition across the rural–urban continuum (URCA) in Guinea-Bissau

Rural–urban continuum (URCA)	Staple foods		Vegetables			Fruits		Animal source foods		Legumes, nuts and seeds	Oils and fats
Large city (>1 million people)	Simple imported rice	Wheat flour, local or imported	Dried okra	Moringa leaves (nenebadadje)	Eggplant, squash/ zucchini	Baobab fruit	Tamarind	Fresh fish (djafal)	Dried fish	Fresh peanuts in shell	Soybean oil
Intermediate city (0.25–1 million people)	Fragrant imported rice	Millet	Dried okra	Moringa leaves (nenebadadje)	Eggplant, squash/ zucchini	Baobab fruit	Tamarind	Fresh fish (djafal)	Pork meat	Fresh peanuts in shell	Soybean oil
Small city (50–250 thousand people)	Simple imported rice	Millet flour	Eggplant, squash/ zucchini	Fresh onion	Djagatu (bright-red eggplant)	Baobab fruit	Tamarind	Fresh fish (djafal)	Fresh fish (mackerel)	Peanut paste	Peanut oil
Town (20–50 thousand people)	Simple imported rice	Corn flour	Dried okra	Eggplant, squash/ zucchini	Fresh onion	Tamarind	Baobab fruit	Fresh fish (djafal)	Dried fish	Fresh peanuts in shell	Soybean oil
<1 hour to a large city	Local rice (npampam)	Millet	Eggplant, squash/ zucchini	Peas	Fresh onion	Baobab fruit	Tamarind	Fresh fish (djafal)	Pork	Fresh peanuts in shell	Soybean oil
<1 hour to an intermediate city	Local rice (npampam)	Sorghum	Dried okra	Moringa leaves (nenebadadje)	Eggplant, squash/ zucchini	Baobab fruit	Tamarind	Fresh fish (djafal)	Dried fish	Fresh peanuts in shell	Soybean oil
<1 hour to a small city	Simple imported rice	Traditional bread	Fresh onion	Djagatu (bright-red eggplant)	Sorrel leaves	Baobab fruit	Tamarind	Fresh fish (djafal)	Powdered milk	Fresh peanuts in shell	Other oils n.e.s. (corn, mixed, etc.)
<1 hour to a town	Corn flour	Simple imported rice	Dried tomato	Dried okra	Eggplant, squash/ zucchini	Baobab fruit	Tamarind	Fresh fish (djafal)	Pork	Fresh peanuts in shell	Other oils n.e.s.. (corn, mixed, etc.)
1–2 hours to a city or town	Fragrant imported rice	Cassava flours	Dried tomato	Dried okra	Moringa leaves (nenebadadje)	Baobab fruit	Tamarind	Fresh fish (djafal)	Pork	Chabeu (fruit of the wild oil palm)	Other oils n.e.s (corn, mixed, etc.)
>2 hours to a city or town	Sorghum	Simple imported rice	Dried tomato	Dried okra	Moringa leaves (nenebadadje)	Baobab fruit	Tamarind	Fresh fish (djafal)	Pork	Fresh peanuts in shell	Soybean oil
National	Simple imported rice	Wheat flour, local or imported	Dried okra	Moringa leaves (nenebadadje)	Eggplant, squash/ zucchini	Baobab fruit	Tamarind	Fresh fish (djafal)	Dried fish	Fresh peanuts in shell	Soybean oil

Notes: n.e.s. = not else specified. The order of food items in each food group is given by the rank cost, with the first item being the least-cost item in the group. "National" refers to the national basket identified using the national prices of all food items available in the country.

Source: Authors' own elaboration.

Table A2.5 Healthy Diet Basket (HDB) composition across the rural–urban continuum (URCA) in Malawi

Rural–urban continuum (URCA)	Staple foods		Vegetables			Fruits		Animal source foods		Legumes, nuts and seeds	Oils and fats
Large city (>1 million people)	Maize ufa mgaiwa (normal flour)	Orange sweet potato	Pumpkin	Cabbage	Rape (tanaposi)	Avocado	Wild fruits (masau, malambe, etc.)	Sun-dried fish (large variety)	Small animals – rabbits, mice, etc.	Soybean flour	Cooking oil
Intermediate city (0.25–1 million people)	Maize ufa refined (fine flour)	Plantain	Pumpkin	Cabbage	Other cultivated green leafy vegetables	Avocado	Wild fruit (masau, malambe, etc.)	Sun-dried fish (large variety)	Pork	Soybean flour	Cooking oil
Small city (50–250 thousand people)	Maize ufa mgaiwa (normal flour)	Cassava – boiled (vendor)	Cabbage	Pumpkin	Rape (tanaposi)	Avocado	Mango	Sun-dried fish (large variety)	Pork	Soybean flour	Cooking oil
Town (20–50 thousand people)	Maize ufa mgaiwa (normal flour)	Cassava flour	Pumpkin	Cabbage	Other cultivated green leafy vegetables	Avocado	Wild fruit (masau, malambe, etc.)	Sun-dried fish (large variety)	Pork	Groundnut fresh (unshelled)	Cooking oil
<1 hour to a large city	Sorghum (mapira)	Maize ufa madeya (bran flour)	Pumpkin	Cabbage	Rape (tanaposi)	Avocado	Mango	Other poultry – guinea fowl, doves, etc.	Sun dried fish (large variety)	Pigeon pea (nandolo)	Cooking oil
<1 hour to an intermediate city	Pearl millet (mchewere)	Maize ufa madeya (bran flour)	Pumpkin	Cabbage	Other cultivated green leafy vegetables	Avocado	Mango	Other poultry – guinea fowl, doves, etc.	Small animal – rabbit, mice, etc.	Pigeon pea (nandolo)	Cooking oil
<1 hour to a small city	Maize ufa refined (fine flour)	Orange sweet potato	Cabbage	Rape (tanaposi)	Other cultivated green leafy vegetables	Avocado	Mango	Pork	Fresh milk	Soybean flour	Cooking oil
<1 hour to a town	Pearl millet (mchewere)	Sorghum (mapira)	Pumpkin	Cabbage	Rape (tanaposi)	Avocado	Mango	Other poultry – guinea fowl, doves, etc.	Sun-dried fish (large variety)	Groundnut (shelled)	Cooking oil
1–2 hours to a city or town	Maize ufa mgaiwa (normal flour)	Cassava flour	Rape (tanaposi)	Other cultivated green leafy vegetables	Cabbage	Avocado	Guava	Sun dried fish (small variety)	Sun-dried fish (medium variety)	Groundnut (shelled)	Cooking oil
>2 hours to a city or town	Sorghum (mapira)	Pearl millet (mchewere)	Pumpkin	Cabbage	Rape (tanaposi)	Avocado	Mango	Other poultry – guinea fowl, doves, etc.	Sun-dried fish (large variety)	Pigeon pea (nandolo)	Cooking oil
National	Maize ufa mgaiwa (normal flour)	Orange sweet potato	Pumpkin	Cabbage	Rape (tanaposi)	Avocado	Wild fruits (masau, malambe, etc.)	Sun-dried fish (large variety)	Small animals – rabbits, mice, etc.	Soybean flour	Cooking oil

Notes: The order of food items in each food group is given by the rank cost, with the first item being the least-cost item in the group. "National" refers to the national basket identified using the national prices of all food items available in the country.

Source: Authors' own elaboration.

Table A2.6 Healthy Diet Basket (HDB) composition across the rural–urban continuum (URCA) in the Niger

Rural–urban continuum (URCA)	Staple foods		Vegetables			Fruits		Animal source foods		Legumes, nuts and seeds	Oils and fats
Large city (>1 million people)	Corn kernels	Millet	Eggplant, squash/ zucchini	Dried tomato	Moringa	Dates	Sweet banana	Curd, yogurt	Dried fish	Shelled peanuts	Refined palm oil
Intermediate city (0.25–1 million people)	Sorghum	Corn kernels	Dried tomato	Dried okra	Moringa	Dates	Sweet banana	Curd, yogurt	Fresh milk	Dried peanuts in shell	Refined palm oil
Small city (50–250 thousand people)	Sorghum	Millet	Dried tomato	Moringa	Eggplant, squash/ zucchini	Dates	Mango	Curd, yogurt	Offal and tripe (liver, kidney, etc.)	Dried peanuts in shell	Refined palm oil
Town (20–50 thousand people)	Millet	Corn kernels	Dried tomato	Dried okra	Moringa	Dates	Mango	Curd, yogurt	Fresh milk	Dried peanuts in shell	Refined palm oil
<1 hour to a large city	Sorghum	Millet	Dried tomato	Moringa	Dried okra	Dates	Mango	Curd, yogurt	Dried fish	Dried peanuts in shell	Refined palm oil
<1 hour to an intermediate city	Millet	Sorghum	Dried tomato	Moringa	Dried okra	Dates	Watermelon, melon	Fresh milk	Curd, yogurt	Roasted peanut	Other oils n.e.s. (corn, palm kernel, soy)
<1 hour to a small city	Millet	Corn kernels	Dried tomato	Moringa	Dried okra	Dates	Mango	Curd, yogurt	Fresh milk	Roasted peanut	Red palm oil
<1 hour to a town	Sorghum	Millet	Moringa	Dried tomato	Dried okra	Watermelon, melon	Dates	Curd, yogurt	Beef meat	Roasted peanut	Refined palm oil
1–2 hours to a city or town	Sorghum	Corn kernels	Dried tomato	Moringa	Dried okra	Dates	Mango	Curd, yogurt	Fresh milk	Dried peanuts in shell	Other oils n.e.s. (corn, palm kernel, soy)
>2 hours to a city or town	Sorghum	Millet	Moringa	Dried tomato	Dried okra	Dates	Mango	Curd, yogurt	Offal and tripe (liver, kidney, etc.)	Shelled peanuts	Red palm oil
National	Millet	Sorghum	Dried tomato	Moringa	Eggplant, squash/ zucchini	Dates	Mango	Curd, yogurt	Fresh milk	Dried peanuts in shell	Refined palm oil

Notes: n.e.s.= not else specified. The order of food items in each food group is given by the rank cost, with the first item being the least-cost item in the group. "National" refers to the national basket identified using the national prices of all food items available in the country.

Source: Authors' own elaboration.

Table A2.7 Healthy Diet Basket (HDB) composition across the rural–urban continuum (URCA) in Senegal

Rural–urban continuum (URCA)	Staple foods		Vegetables			Fruits		Animal source foods		Legumes, nuts and seeds	Oils and fats
Large city (>1 million people)	Corn flour	Millet	Dried tomato	Dried okra	Eggplant, squash/ zucchini	Dates	Mango	Dried fish (tambadiang, kong)	Powdered milk	Shelled peanuts	Peanut oil (ségal)
Intermediate city (0.25–1 million people)	Corn kernels	Millet	Dried tomato	Dried okra	Bean leaves	Dates	Mango	Dried fish (tambadiang, kong)	Other smoked fish (kong fumé, yaboy ou obo fumé)	Shelled peanuts	Peanut oil (ségal)
Small city (50–250 thousand people)	Corn kernels	Millet	Dried tomato	Dried okra	Eggplant, squash/ zucchini	Dates	Mango	Dried fish (tambadiang, kong)	Other smoked fish (kong fumé, yaboy ou obo fumé)	Shelled peanuts	Peanut oil (ségal)
Town (20–50 thousand people)	Sorghum	Corn kernels	Dried okra	Eggplant, squash/ zucchini	Carrot	Dates	Mango	Dried fish (tambadiang, kong)	Other smoked fish (kong fumé, yaboy ou obo fumé)	Shelled peanuts	Refined peanut oil
<1 hour to a large city	Corn flour	Millet	Dried tomato	Dried okra	Eggplant, squash/ zucchini	Dates	Mango	Dried fish (tambadiang, kong)	Other smoked fish (kong fumé, yaboy ou obo fumé)	Shelled peanuts	Peanut oil (ségal)
<1 hour to an intermediate city	Corn flour	Millet	Dried tomato	Dried okra	Eggplant, squash/ zucchini	Mango	Dates	Dried fish (tambadiang, kong)	Other smoked fish (kong fumé, yaboy ou obo fumé)	Shelled peanuts	Peanut oil (ségal)
<1 hour to a small city	Corn kernels	Sorghum	Dried tomato	Dried okra	Eggplant, squash/ zucchini	Dates	Mango	Dried fish (tambadiang, kong)	Other smoked fish (kong fumé, yaboy ou obo fumé)	Shelled peanuts	Peanut oil (ségal)
<1 hour to a town	Corn kernels	Millet	Bean leaves	Eggplant, squash/ zucchini	Fresh onion	Mango	Lemons	Dried fish (tambadiang, kong)	Powdered milk	Shelled peanuts	Soybean oil, vegetable oils (e.g., ninaal, jaara, etc.)
1–2 hours to a city or town	Corn on the cob	Millet	Dried tomato	Dried okra	Bean leaves	Dates	Mango	Dried fish (tambadiang, kong)	Other smoked fish (kong fumé, yaboy ou obo fumé)	Shelled peanuts	Peanut oil (ségal)
>2 hours to a city or town	Millet	Local rice (broken)	Carrot	Eggplant, squash/ zucchini	Cabbage	Dates	Sweet banana	Other smoked fish (kong fumé, yaboy ou obo fumé)	Fresh milk	Shelled peanuts	Soy oil, vegetable oil (e.g., ninaal, jaara, etc.)
National	Corn kernels	Millet	Dried tomato	Dried okra	Eggplant, squash/ zucchini	Dates	Mango	Dried fish (tambadiang, kong)	Other smoked fish (kong fumé, yaboy ou obo fumé)	Shelled peanuts	Peanut oil (ségal)

Notes: The order of food items in each food group is given by the rank cost, with the first item being the least-cost item in the group. "National" refers to the national basket identified using the national prices of all food items available in the country.

Source: Authors' own elaboration.

Table A2.8 Healthy Diet Basket (HDB) composition across the rural–urban continuum (URCA) in Togo

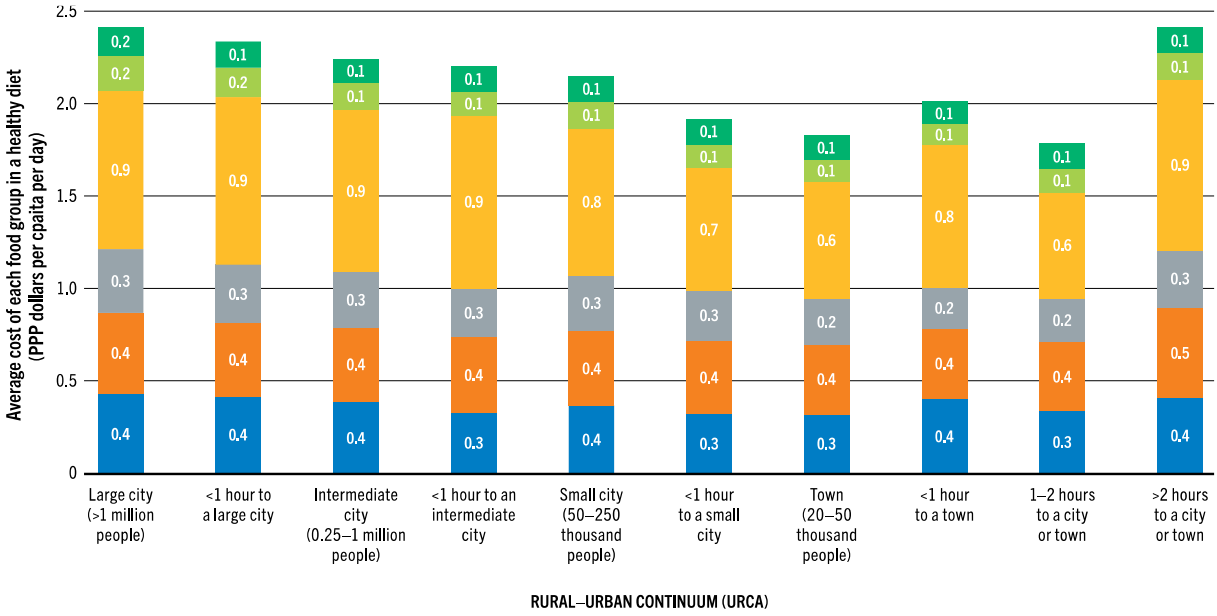
Rural–urban continuum (URCA)	Staple foods		Vegetables			Fruits		Animal source foods		Legumes, nuts and seeds	Oils and fats
Large city (>1 million people)	Corn kernels	Taro (macabo)	Baobab leaves	Moringa, cassava leaves, taro leaves and other leaves	Dried okra	Mango	Avocado	Cheese	Powdered milk	Coconut	Cottonseed oil
Intermediate city (0.25–1 million people)	Corn kernels	Tapioca (gari)	Dried okra	Baobab leaves	Eggplant leaves (gboma)	Pineapple	Sweet banana	Powdered milk	Smoked fish (horse mackerel)	Coconut	Cottonseed oil
Small city (50–250 thousand people)	Corn kernels	Tapioca (gari)	Baobab leaves	Moringa, cassava leaves, taro leaves and other leaves	Dried okra	Mango	Avocado	Cheese	Pork	Fresh peanuts in shell	Other oils n.e.s.
Town (20–50 thousand people)	Corn kernels	Tapioca (gari)	Moringa, cassava leaves, taro leaves and other leaves	Baobab leaves	Dried okra	Mango	Avocado	Cheese	Smoked fish (horse mackerel)	Coconut	Cottonseed oil
<1 hour to a large city	Taro (macabo)	Corn kernels	Moringa, cassava leaves, taro leaves and other leaves	Baobab leaves	Dried okra	Avocado	Mango	Cheese	Fresh milk	Coconut	Cottonseed oil
<1 hour to an intermediate city	Corn kernels	Tapioca (gari)	Baobab leaves	Dried okra	Eggplant leaves (gboma)	Mango	Sweet banana	Cheese	Smoked fish (horse mackerel)	Fresh peanuts in shell	Cottonseed oil
<1 hour to a small city	Corn kernels	Tapioca (gari)	Baobab leaves	Dried tomato	Moringa, cassava leaves, taro leaves and other leaves	Mango	Avocado	Fresh fish (sea bass)	Cheese	Fresh peanuts in shell	Other oils n.e.s.
<1 hour to a town	Corn kernels	Tapioca (gari)	Baobab leaves	Eggplant leaves (gboma)	Dried okra	Sweet banana	Ananas	Cheese	Pork	Cowpeas/ dried beans	Soybean oil
1–2 hours to a city or town	Corn kernels	Tapioca (gari)	Moringa, cassava leaves, taro leaves and other leaves	Baobab leaves	Dried okra	Mango	Avocado	Cheese	Fresh milk	Fresh peanuts in shell	Shea butter
>2 hours to a city or town	Corn kernels	Tapioca (gari)	Baobab leaves	Eggplant, squash/ zucchini	Fresh tomato	Mango	Orange	Eggs	Beef	Shelled peanuts	Red palm oil
National	Corn kernels	Tapioca (gari)	Dried tomato	Baobab leaves	Moringa, cassava leaves, taro leaves and other leaves	Mango	Avocado	Cheese	Pork	Fresh peanuts in shell	Other oils n.e.s.

Notes: n.e.s. = not else specified. The order of food items in each food group is given by the rank cost, with the first item being the least-cost item in the group. "National" refers to the national basket identified using the national prices of all food items available in the country.

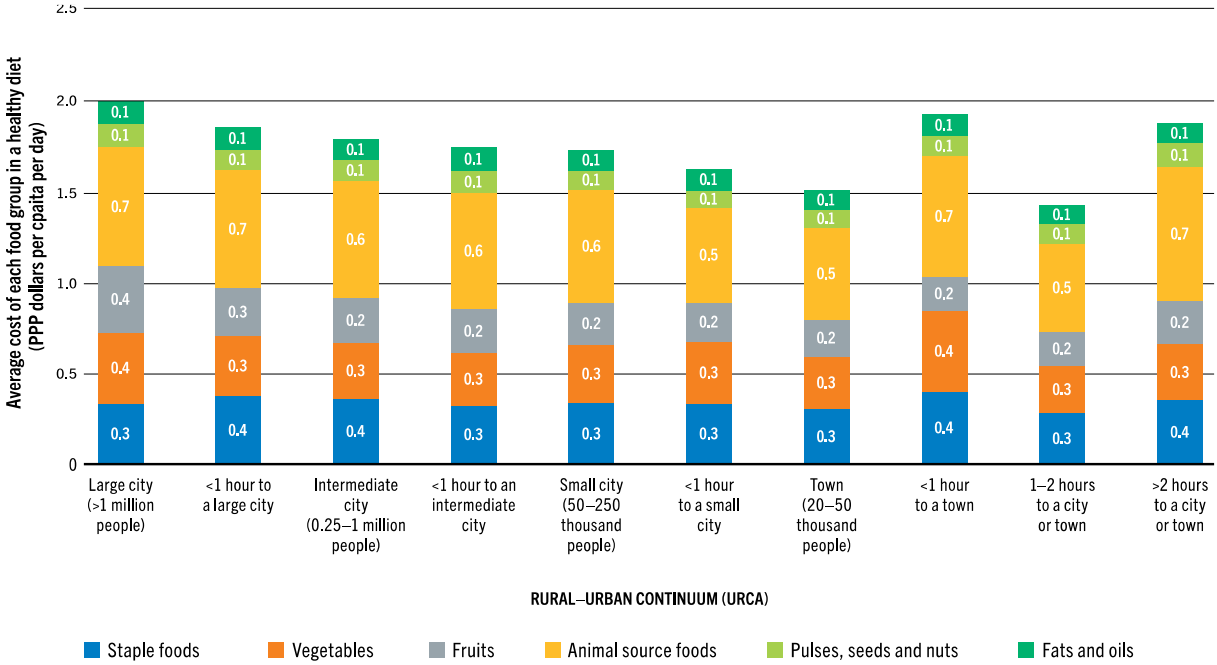
Source: Authors' own elaboration.

Figure A2.1 Average cost of each food group in a healthy diet across the rural–urban continuum (URCA) in high- and low-food-budget countries

a. High-food-budget countries



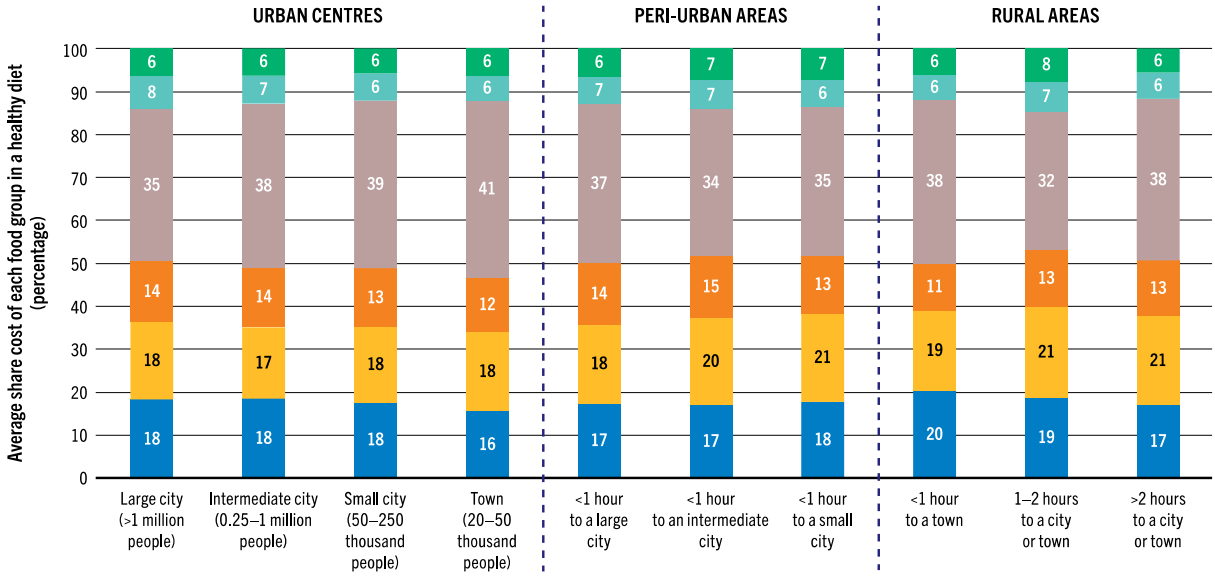
b. Low-food-budget countries



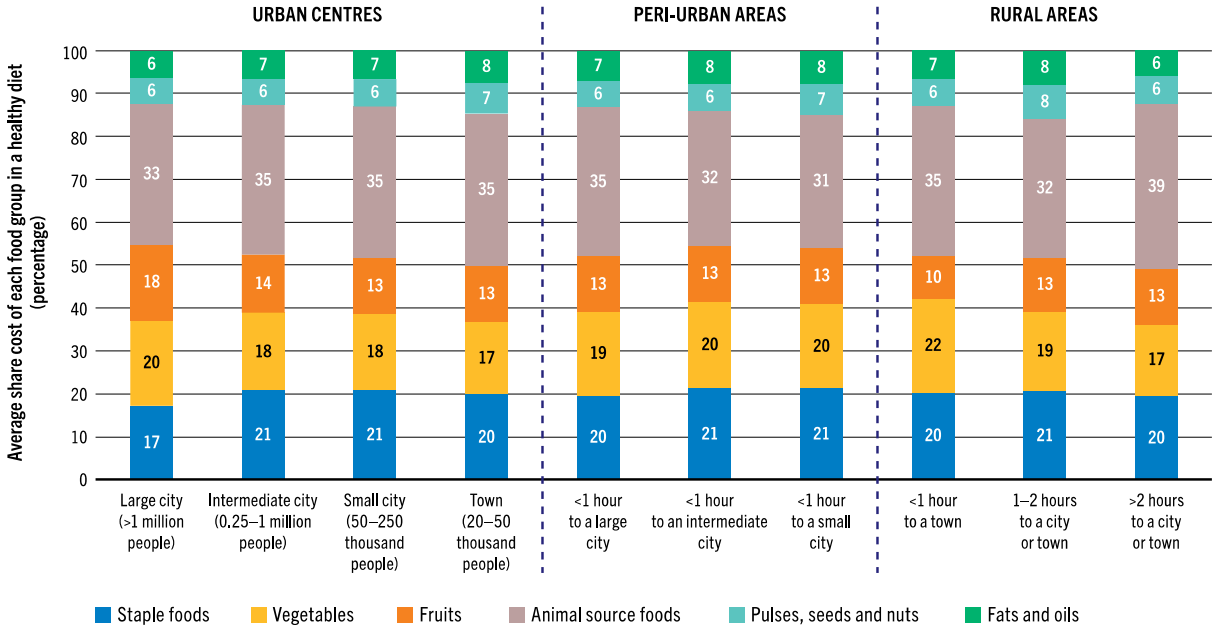
Source: Authors' own elaboration.

Figure A2.2 Average share cost of each food group in a healthy diet across the rural–urban continuum (URCA) in high- and low-food-budget countries

a. High-food-budget countries



b. Low-food-budget countries



Source: Authors' own elaboration.

Annex 3. Cost of a healthy diet across the rural–urban continuum (URCA) by country

Table A3.1 Cost of a healthy diet basket across the rural–urban continuum (URCA) by country

Rural–urban continuum (URCA)	High-food-budget countries					Low-food-budget countries					
	Senegal	Ethiopia	Côte d'Ivoire	Mali	Nigeria	Guinea-Bissau	Benin	Togo	Burkina Faso	Malawi	Niger
	(PPP dollars per capita per day)					(PPP dollars per capita per day)					
Urban	2.06	3.15	2.07	2.23	2.15	1.84	1.44	1.72	2.50	1.72	2.20
Large city (>1 million people)	2.19	3.24	2.18	2.23	2.23	n.a.	1.62	1.84	2.74	n.a.	1.84
Intermediate city (0.25–1 million people)	1.80	3.60	1.98	2.20	2.09	1.85	1.46	1.95	2.14	1.71	2.09
Small city (50–250 thousand people)	1.93	2.87	1.99	2.25	2.17	1.79	1.27	1.33	2.34	1.68	2.39
Town (20–50 thousand people)	1.98	3.03	1.87	2.13	2.00	n.r.	1.05	1.58	2.20	1.76	2.19
Peri-urban	1.75	2.21	1.91	1.90	1.73	1.95	1.05	1.03	2.09	1.21	2.03
<1 hour to a large city	1.81	2.65	2.05	2.20	2.03	2.06	1.22	1.09	2.11	1.75	2.25
<1 hour to an intermediate city	1.62	2.13	1.82	2.40	1.62	2.10	1.01	1.51	2.08	1.21	1.91
<1 hour to a small city	1.84	2.19	1.90	1.69	1.53	1.83	0.98	0.96	2.09	1.18	2.07
Rural	1.71	2.28	1.85	1.87	1.64	1.57	1.00	1.07	1.97	1.18	1.98
<1 hour to a town	n.r.	–	1.76	2.22	2.04	2.59	1.05	0.00	2.40	1.79	1.86
1–2 hours to a city or town	1.67	2.09	1.85	1.74	1.57	1.54	0.99	1.07	1.96	1.12	1.93
>2 hours to a city or town	2.29	2.70	2.16	2.20	2.70	1.53	n.r.	n.r.	1.80	2.16	2.06

Notes: n.a. = not applicable. Cost in URCA with fewer than 30 observations are not shown (n.r. = not reported). In Ethiopia, cost of heathy diet basket in areas 1 hour travel or less to a town was not computed for price unavailability. Countries are ordered based on the market value of the household food consumption.

Source: Authors' own elaboration.

Annex 4. Affordability of healthy diet. Is actual household food expenditure enough to cover the cost of Healthy Diet Basket?

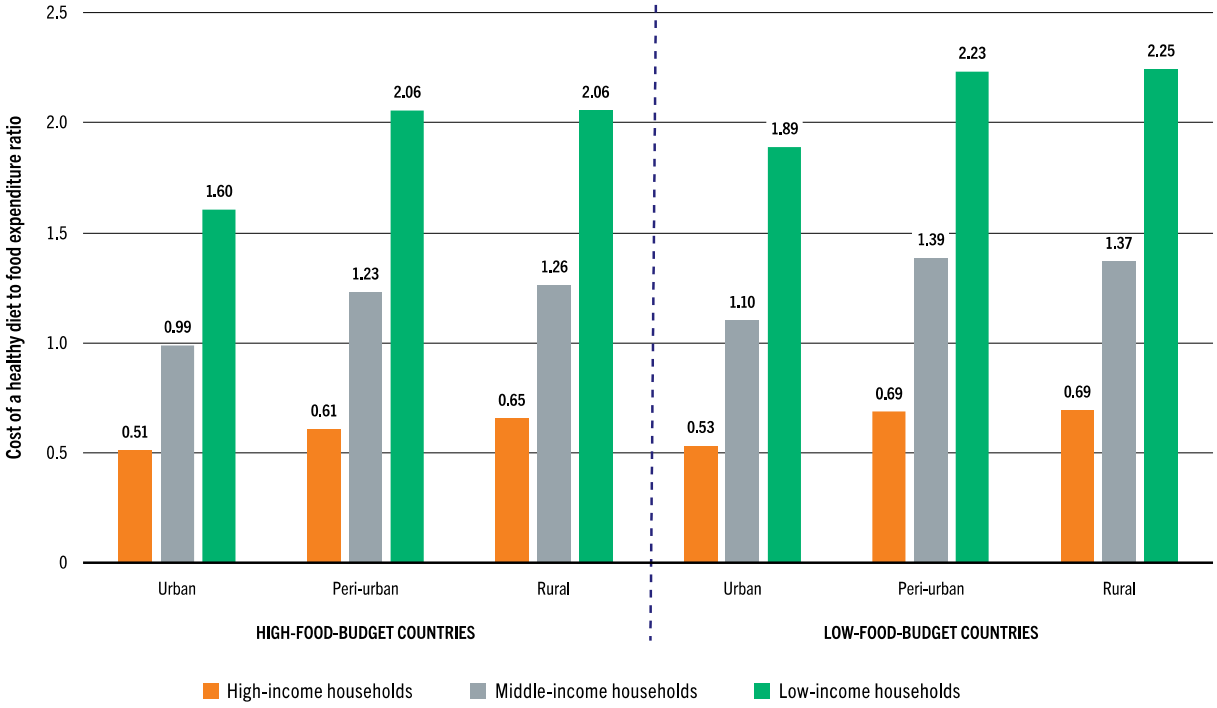
Table A4.1 Ratio of the cost of a healthy diet and average food expenditure across the rural–urban continuum by country

Rural–urban continuum (URCA)	Expenditure on food	Average cost of a healthy diet	Ratio of cost of a healthy diet to average food expenditures			
			National	Low-income households	Middle-income households	High-income households
	(PPP dollars per capita per day)		(ratio)			
High-food-budget countries	2.34	2.00	0.86	2.01	1.17	0.56
Senegal	2.57	1.89	0.74	1.65	1.01	0.49
Ethiopia	2.44	2.36	0.97	2.73	1.44	0.60
Côte d'Ivoire	2.29	1.94	0.85	1.81	1.14	0.59
Mali	2.29	1.98	0.86	1.80	1.09	0.57
Nigeria	2.26	1.83	0.81	2.07	1.16	0.55
Low-food-budget countries	1.62	1.61	1.00	2.25	1.34	0.62
Guinea-Bissau	2.06	1.75	0.85	1.74	1.11	0.59
Benin	2.00	1.16	0.58	1.33	0.80	0.37
Togo	1.69	1.31	0.77	1.89	1.10	0.50
Burkina Faso	1.57	2.15	1.37	3.33	1.96	0.88
Malawi	1.52	1.25	0.82	2.19	1.19	0.49
Niger	1.46	2.03	1.39	3.01	1.85	0.89

Notes: A ratio greater than 1 shows how many times a healthy diet is more expensive than the average food expenditures. Households are grouped by household total expenditure terciles. Countries are ordered based on the market value of the household food consumption.

Source: Authors' own elaboration.

Figure A4.1 Ratio of the cost of a healthy diet to average food expenditure, by household income level and by urban, peri-urban and rural (URCA) in high- and low-food-budget countries



Notes: A ratio greater than 1 shows how many times a healthy diet is more expensive than the average food expenditures. Households are grouped by household total expenditure terciles.

Source: Authors' own elaboration.

Table A4.2 Affordability of a healthy diet across the rural–urban continuum (URCA) based on different definitions of income that can be credibly reserved for food by country

Country	Rural–urban continuum (URCA)	Percentage of people unable to afford a healthy diet				Number of people unable to afford a healthy diet			
		Fixed share of 52%	National bottom quintile	URCA bottom quintile	National quintiles	Fixed share of 52%	National bottom quintile	URCA bottom quintile	National quintiles
		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Benin	Large city (>1 million people)	18	13	20	13	265 049	190 155	300 261	188 926
	Intermediate city (0.25–1 million people)	7	4	7	4	55 502	30 098	55 502	28 838
	Small city (50–250 thousand people)	8	6	7	6	66 171	51 113	53 306	51 113
	Town (20–50 thousand people)	9	7	8	7	38 362	30 414	32 948	30 414
	<1 hour to a large city	16	12	14	12	319 595	248 241	277 916	248 241
	<1 hour to an intermediate city	16	11	13	11	103 903	74 213	86 238	74 213
	<1 hour to a small city	13	10	9	10	561 954	419 850	395 114	419 850
	<1 hour to a town	21	19	19	19	45 884	41 304	41 304	41 304
	1–2 hours to a city or town	20	16	16	16	220 700	170 342	170 342	170 342
	>2 hours to a city or town	n.r.	n.r.	n.r.	n.r.	n.r.	n.r.	n.r.	n.r.
	National	**18**	**14**	**14**	**14**	**2 158 041**	**1 642 041**	**1 642 041**	**1 642 041**
Burkina Faso	Large city (>1 million people)	41	45	53	48	917 282	1 014 319	1 180 168	1 080 529
	Intermediate city (0.25–1 million people)	41	46	55	45	408 717	460 592	553 343	457 509
	Small city (50–250 thousand people)	47	51	49	51	381 688	414 394	391 346	412 328
	Town (20–50 thousand people)	53	57	56	57	123 870	133 385	132 019	133 156
	<1 hour to a large city	74	78	79	77	970 927	1 017 491	1 042 888	1 016 809
	<1 hour to an intermediate city	65	68	69	68	485 082	508 709	513 852	505 471
	<1 hour to a small city	77	80	80	80	5 739 013	5 967 203	5 983 134	5 955 052
	<1 hour to a town	69	71	68	74	297 222	302 855	291 683	318 045
	1–2 hours to a city or town	72	75	75	75	2 847 139	2 974 782	2 945 547	2 961 133
	>2 hours to a city or town	74	78	79	78	639 651	673 421	683 792	668 058
	National	**64**	**67**	**67**	**67**	**12 839 326**	**13 599 137**	**13 599 137**	**13 494 680**
Côte d'Ivoire	Large city (>1 million people)	12	9	14	9	404 544	292 643	474 016	309 120
	Intermediate city (0.25–1 million people)	19	15	24	16	160 424	128 720	202 134	133 298

Country	Rural–urban continuum (URCA)	Percentage of people unable to afford a healthy diet				Number of people unable to afford a healthy diet			
		Fixed share of 52%	National bottom quintile	URCA bottom quintile	National quintiles	Fixed share of 52%	National bottom quintile	URCA bottom quintile	National quintiles
		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Small city (50–250 thousand people)	23	20	22	21	361 125	319 616	346 304	325 330
	Town (20–50 thousand people)	27	21	25	22	216 322	164 923	203 133	174 357
	<1 hour to a large city	36	33	28	33	505 173	462 597	394 739	469 343
	<1 hour to an intermediate city	43	36	40	38	697 644	596 966	651 392	619 044
	<1 hour to a small city	49	43	42	44	3 234 079	2 825 427	2 782 334	2 886 030
	<1 hour to a town	49	43	47	43	288 088	251 885	278 949	254 624
	1–2 hours to a city or town	46	40	40	41	2 182 556	1 885 814	1 882 423	1 949 266
	>2 hours to a city or town	61	57	47	57	53 096	49 385	41 151	49 385
	National	**35**	**30**	**30**	**31**	**8 966 400**	**7 758 212**	**7 758 212**	**7 942 844**
Ethiopia	Large city (>1 million people)	71	46	51	49	2 988 969	1 925 965	2 154 268	2 067 625
	Intermediate city (0.25–1 million people)	87	66	73	67	2 128 486	1 608 082	1 800 621	1 655 851
	Small city (50–250 thousand people)	67	38	46	38	3 022 220	1 700 921	2 068 818	1 731 881
	Town (20–50 thousand people)	91	68	77	74	1 603 492	1 195 803	1 355 665	1 292 411
	<1 hour to a large city	79	55	61	56	3 830 900	2 655 782	2 977 675	2 741 019
	<1 hour to an intermediate city	87	68	70	70	14 715 046	11 428 808	11 838 027	11 760 957
	<1 hour to a small city	91	73	75	75	30 645 440	24 684 078	25 107 304	25 315 840
	<1 hour to a town	-	-	-	-	-	-	-	-
	1–2 hours to a city or town	87	65	61	67	13 120 473	9 846 613	9 191 240	10 184 694
	>2 hours to a city or town	97	91	91	91	6 597 110	6 156 031	6 157 915	6 160 241
	National	**88**	**71**	**71**	**72**	**82 037 096**	**65 802 492**	**65 802 492**	**66 843 316**
Guinea-Bissau	Large city (>1 million people)	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
	Intermediate city (0.25–1 million people)	27	19	30	20	117 380	80 258	131 438	84 625
	Small city (50–250 thousand people)	29	22	26	24	21 359	15 970	19 110	17 455
	Town (20–50 thousand people)	n.r.	n.r.	n.r.	n.r.	n.r.	n.r.	n.r.	n.r.
	<1 hour to a large city	47	41	47	44	20 845	18 199	20 845	19 247

Country	Rural–urban continuum (URCA)	Percentage of people unable to afford a healthy diet				Number of people unable to afford a healthy diet			
		Fixed share of 52%	National bottom quintile	URCA bottom quintile	National quintiles	Fixed share of 52%	National bottom quintile	URCA bottom quintile	National quintiles
		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	<1 hour to an intermediate city	68	56	56	58	106 375	88 445	88 331	90 281
	<1 hour to a small city	60	51	53	53	131 912	113 099	116 452	116 452
	<1 hour to a town	88	88	75	88	17 378	17 300	14 803	17 300
	1–2 hours to a city or town	57	46	43	47	291 083	236 461	218 366	241 965
	>2 hours to a city or town	44	34	29	34	70 006	55 281	46 027	55 448
	National	**41**	**32**	**32**	**33**	**690 815**	**540 444**	**540 444**	**559 447**
Malawi	Large city (>1 million people)	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
	Intermediate city (0.25–1 million people)	51	42	51	50	651 656	531 177	651 656	631 677
	Small city (50–250 thousand people)	55	46	53	54	148 207	123 887	141 902	144 872
	Town (20–50 thousand people)	71	61	67	70	224 701	192 125	213 947	222 995
	<1 hour to a large city	76	65	67	75	214 327	184 510	189 254	211 941
	<1 hour to an intermediate city	78	70	71	72	5 012 733	4 487 925	4 514 154	4 593 996
	<1 hour to a small city	73	66	66	68	2 389 355	2 162 553	2 148 626	2 211 621
	<1 hour to a town	92	86	85	92	284 118	264 420	262 509	282 369
	1–2 hours to a city or town	76	66	66	68	4 314 882	3 732 640	3 736 369	3 859 713
	>2 hours to a city or town	96	94	95	96	131 013	128 587	130 618	131 013
	National	**74**	**66**	**66**	**67**	**13 328 605**	**11 913 277**	**11 913 277**	**12 144 949**
Mali	Large city (>1 million people)	19	13	19	15	598 664	414 599	612 852	471 591
	Intermediate city (0.25–1 million people)	22	11	15	15	73 179	37 845	49 763	48 638
	Small city (50–250 thousand people)	28	18	19	20	360 809	231 868	244 261	257 684
	Town (20–50 thousand people)	24	11	14	13	140 886	67 851	83 954	74 837
	<1 hour to a large city	38	29	33	32	484 160	368 711	415 655	407 775
	<1 hour to an intermediate city	57	51	52	53	287 285	255 274	262 411	263 927
	<1 hour to a small city	42	31	31	32	1 284 280	943 905	948 447	969 786
	<1 hour to a town	65	49	45	54	1 132 314	849 625	792 641	945 681
	1–2 hours to a city or town	47	34	36	36	3 129 640	2 256 022	2 391 764	2 398 139

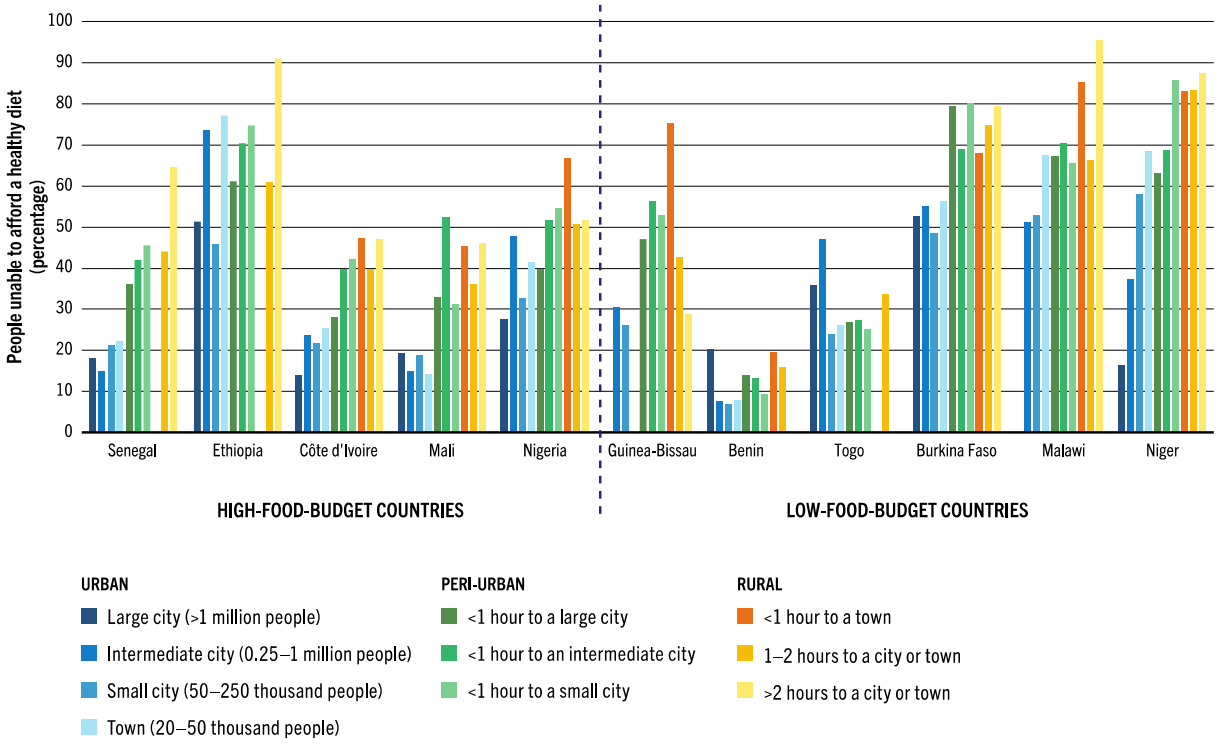
Country	Rural–urban continuum (URCA)	Percentage of people unable to afford a healthy diet				Number of people unable to afford a healthy diet			
		Fixed share of 52%	National bottom quintile	URCA bottom quintile	National quintiles	Fixed share of 52%	National bottom quintile	URCA bottom quintile	National quintiles
		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	>2 hours to a city or town	54	41	46	43	379 292	288 559	321 647	299 931
	National	**38**	**28**	**28**	**29**	**7 465 583**	**5 485 288**	**5 485 288**	**5 682 734**
Niger	Large city (>1 million people)	17	12	16	11	78 278	55 119	74 420	48 701
	Intermediate city (0.25–1 million people)	51	43	37	34	480 995	401 044	351 039	325 022
	Small city (50–250 thousand people)	69	60	58	61	920 002	808 309	776 507	813 619
	Town (20–50 thousand people)	80	73	68	68	378 992	342 767	322 596	322 596
	<1 hour to a large city	76	68	63	67	704 243	628 580	584 074	622 033
	<1 hour to an intermediate city	77	68	69	64	2 365 579	2 099 715	2 118 860	1 974 728
	<1 hour to a small city	89	86	86	82	3 676 256	3 543 913	3 543 913	3 389 545
	<1 hour to a town	86	83	83	74	228 264	220 270	220 493	196 491
	1–2 hours to a city or town	88	82	83	79	5 198 031	4 872 469	4 948 175	4 675 835
	>2 hours to a city or town	92	88	88	86	3 470 012	3 305 009	3 305 009	3 241 075
	National	**84**	**79**	**79**	**76**	**18 233 116**	**17 185 486**	**17 185 486**	**16 472 215**
Nigeria	Large city (>1 million people)	34	16	28	18	4 362 939	2 035 014	3 594 964	2 359 579
	Intermediate city (0.25–1 million people)	60	37	48	37	6 202 159	3 757 402	4 924 441	3 848 546
	Small city (50–250 thousand people)	49	27	33	28	4 788 214	2 631 744	3 144 491	2 705 322
	Town (20–50 thousand people)	59	40	41	41	2 048 632	1 409 324	1 446 867	1 441 389
	<1 hour to a large city	61	41	40	42	20 796 488	13 937 386	13 657 795	14 459 709
	<1 hour to an intermediate city	69	52	52	52	25 521 628	19 114 970	19 114 970	19 252 618
	<1 hour to a small city	76	55	55	55	22 635 218	16 424 780	16 239 477	16 512 611
	<1 hour to a town	79	67	67	71	580 617	491 600	491 600	522 094
	1–2 hours to a city or town	70	53	51	53	7 128 012	5 398 092	5 150 142	5 398 092
	>2 hours to a city or town	64	52	52	52	276 257	224 471	224 471	224 471
	National	**62**	**44**	**44**	**46**	**93 033 640**	**65 952 900**	**65 952 900**	**68 891 272**
Senegal	Large city (>1 million people)	17	17	18	17	717 485	687 632	736 300	717 485

Country	Rural–urban continuum (URCA)	Percentage of people unable to afford a healthy diet				Number of people unable to afford a healthy diet			
		Fixed share of 52%	National bottom quintile	URCA bottom quintile	National quintiles	Fixed share of 52%	National bottom quintile	URCA bottom quintile	National quintiles
		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Intermediate city (0.25–1 million people)	16	16	15	15	219 964	216 662	199 225	195 477
	Small city (50–250 thousand people)	22	21	21	19	221 169	213 428	213 237	194 147
	Town (20–50 thousand people)	28	27	22	26	184 157	181 535	148 321	176 415
	<1 hour to a large city	35	34	36	30	659 543	637 717	673 256	570 731
	<1 hour to an intermediate city	39	39	42	37	950 946	932 555	1 015 549	890 555
	<1 hour to a small city	45	44	46	42	1 057 491	1 037 477	1 082 772	999 507
	<1 hour to a town	n.r.	n.r.	n.r.	n.r.	n.r.	n.r.	n.r.	n.r.
	1–2 hours to a city or town	45	45	44	43	686 542	679 143	669 855	655 288
	>2 hours to a city or town	75	75	65	75	72 402	72 402	62 563	72 402
	National	**33**	**33**	**33**	**31**	**5 336 188**	**5 197 780**	**5 197 780**	**4 962 979**
Togo	Large city (>1 million people)	30	29	36	31	607 968	580 314	721 531	632 819
	Intermediate city (0.25–1 million people)	46	46	47	47	79 323	79 323	80 246	80 246
	Small city (50–250 thousand people)	19	19	24	19	128 491	125 465	161 168	125 465
	Town (20–50 thousand people)	27	26	26	27	34 102	33 130	33 130	34 102
	<1 hour to a large city	28	27	27	27	264 897	257 041	256 325	263 082
	<1 hour to an intermediate city	27	27	27	27	72 535	72 535	72 535	72 535
	<1 hour to a small city	27	25	25	25	700 069	659 164	646 608	659 164
	<1 hour to a town	n.r.	n.r.	n.r.	n.r.	n.r.	n.r.	n.r.	n.r.
	1–2 hours to a city or town	36	33	33	35	256 254	237 162	240 684	249 765
	>2 hours to a city or town	n.r.	n.r.	n.r.	n.r.	n.r.	n.r.	n.r.	n.r.
	National	**27**	**26**	**26**	**27**	**2 090 973**	**1 992 523**	**1 992 523**	**2 029 495**

Notes: n.a. = not applicable; n.r. = not reported. Guinea-Bissau and Malawi do not have cities that meet the population criteria for large city, so no estimates are provided. Affordability indicators in URCA with fewer than 30 observations are not shown. In Ethiopia, indicators are not computed in areas 1 hour travel or less to a town because the basket was incomplete, and it was not possible to compute the cost.

Source: Authors' own elaboration.

Figure A4.2 Unaffordability of a healthy diet across the rural–urban continuum (URCA) by high- and low-food-budget countries



Notes: Affordability indicators in URCA with fewer than 30 observations are not shown. In Ethiopia, indicators are not computed in areas 1 hour travel or less to a town because the basket was incomplete and it was not possible to compute the cost. Countries are ordered based on the market value of the household food consumption.

Source: Authors' own elaboration.

Table A4.3 Percentage of people unable to afford a healthy diet across the rural–urban continuum (URCA) by country

Rural–urban continuum (URCA)	High-food-budget countries					Low-food-budget countries					
	Senegal	Ethiopia	Côte d'Ivoire	Mali	Nigeria	Guinea-Bissau	Benin	Togo	Burkina Faso	Malawi	Niger
	(%)					(%)					
Urban	**18.2**	**57.1**	**18.4**	**18.3**	**35.9**	**29.9**	**12.8**	**33.3**	**52.6**	**54.2**	**47.4**
Large city (>1 million people)	18.0	51.3	13.9	19.2	27.6	n.a.	20.2	35.8	52.6	n.a.	16.2
Intermediate city (0.25–1 million people)	14.9	73.4	23.6	14.9	47.9	30.5	7.4	46.8	55.0	51.1	37.3
Small city (50–250 thousand people)	21.3	45.8	21.9	18.6	32.5	26.2	6.7	23.8	48.6	52.9	58.0
Town (20–50 thousand people)	22.2	77.1	25.4	14.2	41.3	n.r.	7.8	26.1	56.3	67.5	68.3
Peri-urban	**41.5**	**72.2**	**39.7**	**33.8**	**48.4**	**53.6**	**10.9**	**25.6**	**79.2**	**68.8**	**76.7**
<1 hour to a large city	35.9	61.2	27.9	32.7	39.7	47.1	13.9	26.7	79.4	67.1	63.1
<1 hour to an intermediate city	42.0	70.4	39.7	52.3	51.6	56.3	13.1	27.2	68.9	70.5	68.6
<1 hour to a small city	45.6	74.7	42.3	31.2	54.5	52.9	9.2	24.9	80.2	65.6	85.7
Rural	**45.3**	**70.1**	**40.8**	**38.5**	**51.7**	**40.3**	**16.4**	**33.5**	**74.9**	**67.8**	**84.9**
<1 hour to a town	n.r.	-	47.3	45.4	66.7	75.3	19.3	n.r.	68.1	85.4	83.0
1–2 hours to a city or town	44.0	60.7	39.9	35.9	50.6	42.6	15.8	33.5	74.7	66.2	83.3
>2 hours to a city or town	64.7	91.0	47.1	46.0	51.6	28.6	n.r.	n.r.	79.4	95.3	87.5

Notes: n.a. = not applicable. Guinea-Bissau and Malawi do not have cities that meet the population criteria for large city, so no estimates are provided. Percentages in URCA with fewer than 30 observations are not shown (n.r. = not reported). In Ethiopia, the percentage is not computed in areas 1 hour travel or less to a town because the basket was incomplete and it was not possible to compute the cost.

Source: Authors' own elaboration.

Annex 5. Income variable and affordability measure in Ethiopia

In this study, the indicator of affordability is obtained by comparing the income that households can credibly reserve for food to the cost of a healthy diet, as it is assumed that a minimum of household income must be reserved for non-food expenditures to satisfy other essential needs, such as clothing, housing, health and education.

Household expenditure is used as a proxy for income and the share of food expenditure of poor households is used to identify the portion of income that can be credibly reserved for food. Variables used for food and non-food expenditure are the consumption aggregates provided directly in the LSMS dataset. In the case of Ethiopia, however, the food expenditure shares obtained were considered too high. For this reason, the authors calculated the household food and non-food expenditure from the household expenditure module. This annex describes the results on affordability measure obtained by using these consumption aggregates.[24]

To obtain the total household food expenditure, the non-reported values (such as for gift and own produce) were estimated by multiplying the reported quantities consumed by the median of revealed prices from the smallest spatial unit that includes the household where there was a minimum of three observations of the same item unit combination. “Chewables” items were not considered to be food. To account for outliers and data reporting errors, all per-adult equivalent quantities and values were winsorized at the 98 percent level (cuts at 1 and 99) before and after the non-reported value data were estimated.

To obtain the non-food expenditure, also the six and twelve-month non-food expenditures, education expenses, health expenses and rent[25] were included. Both the non-food aggregates and at the total non-food expenditure were winsorized at the 98 percent level.

The next paragraphs describe how the results presented in Section 4.2 and Section 4.3 would be affected by the use of the authors’ consumption aggregates.

In Section 4.2 three different groups of households were identified to explore which expenditure patterns it would be best to use to reveal what share of income can be credibly reserved for food. See Table A5.1 for a comparison of the food expenditure shares obtained by using either LSMS or the authors’ calculation of consumption aggregates. See Table A5.2 for the different levels of affordability by URCA when the different thresholds obtained from the LSMS and the authors’ consumption aggregates are used.

The main findings reported in Section 1.8 about the comparison of affordability measures based on different definitions of income still hold true when income is defined based on the authors’ calculation of consumption aggregates. Indeed, Table A5.2 shows that: 1) the use of the fix thresholds of 52 percent in all subnational units of analysis brings to a higher estimation the share of people unable to afford a healthy diet compared to the other methods; 2) when adopting the food expenditure share of the bottom national income quintile versus that of each

[24] The number of Ethiopian households included in the analysis for Annex 5 is lower than that reported in Table 3, because some households were dropped when expenditure variables were winsorized. Specifically, the number of households included in this analysis are: 695 in large city, 500 in intermediate city, 822 in small city, 151 in towns, 358 in areas less than 1 hour to a large city, 940 in areas less than 1 hour to an intermediate city, 1,757 in areas less than 1 hour to a small city, 58 in areas less than 1 hour to a town, 743 in areas 1 to 2 hours to any urban center, and 411 in areas more than 2 hours to any urban center.

[25] Estimated rent was imputed to households who did not report rent. Housing variables were used in a hedonic estimation of the rent.

URCA bottom quintile, similar or slightly higher affordability shares are estimated in rural areas, but the estimates are lower in urban areas; 3) the share of people unable to afford a healthy diet is higher when using thresholds based on the income quintile a household belongs to rather than the food expenditure share of the national bottom quintile.

The final choice, discussed in Section 4.2, was to adopted the food expenditure share of the households in the bottom income quintile of each spatial unit of analysis (that is, in each URCA) to continue the analysis and explore how the cost and affordability of a healthy diet varies across the rural–urban continuum. The use of the authors' consumption aggregates versus the LSMS consumption aggregates has a marginal impact on the final variable of interest at the national level and, as expected, the use of lower food expenditure shares pushed up slightly the affordability measures (see Table A5.2 and Figure A5.1). Across the rural–urban continuum, the differences do not always move in the same directions, and they are higher in peri-urban areas of large cities, but the overall trend across the continuum is the same regardless of the source used for the consumption aggregates.

Table A5.1 Comparison of food expenditure shares across the rural–urban continuum (URCA) in Ethiopia, obtained from different consumption aggregates

Consumption aggregates	Rural–urban continuum (URCA)	National bottom quintile	URCA bottom quintile	National first quintile	National second quintile	National third quintile	National fourth quintile	National fifth quintile
		(2)	(3)	(4)				
		(%)						
LSMS consumption aggregates	Large city (>1 million people)	83	75	83	83	84	81	78
Authors' consumption aggregates	Large city (>1 million people)	69	60	69	70	68	66	61
LSMS consumption aggregates	Intermediate city (0.25–1 million people)	83	71	83	83	84	81	78
Authors' consumption aggregates	Intermediate city (0.25–1 million people)	69	58	69	70	68	66	61
LSMS consumption aggregates	Small city (50–250 thousand people)	83	75	83	83	84	81	78
Authors' consumption aggregates	Small city (50–250 thousand people)	69	63	69	70	68	66	61
LSMS consumption aggregates	Town (20–50 thousand people)	83	74	83	83	84	81	78
Authors' consumption aggregates	Town (20–50 thousand people)	69	63	69	70	68	66	61
LSMS consumption aggregates	<1 hour to a large city	83	78	83	83	84	81	78

Consumption aggregates	Rural–urban continuum (URCA)	National bottom quintile	URCA bottom quintile	National first quintile	National second quintile	National third quintile	National fourth quintile	National fifth quintile
		(2)	(3)	(4)				
		(%)						
Authors' consumption aggregates	<1 hour to a large city	69	73	69	70	68	66	61
LSMS consumption aggregates	<1 hour to an intermediate city	83	80	83	83	84	81	78
Authors' consumption aggregates	<1 hour to an intermediate city	69	70	69	70	68	66	61
LSMS consumption aggregates	<1 hour to a small city	83	81	83	83	84	81	78
Authors' consumption aggregates	<1 hour to a small city	69	69	69	70	68	66	61
LSMS consumption aggregates	<1 hour to a town	83	86	83	83	84	81	78
Authors' consumption aggregates	<1 hour to a town	69	55	69	70	68	66	61
LSMS consumption aggregates	1–2 hours to a city or town	83	87	83	83	84	81	78
Authors' consumption aggregates	1–2 hours to a city or town	69	74	69	70	68	66	61
LSMS consumption aggregates	>2 hours to a city or town	83	82	83	83	84	81	78
Authors' consumption aggregates	>2 hours to a city or town	69	67	69	70	68	66	61
LSMS consumption aggregates	National	83	83	83	83	84	81	78
Authors' consumption aggregates	National	69	69	69	70	68	66	61

Source: Authors' own elaboration.

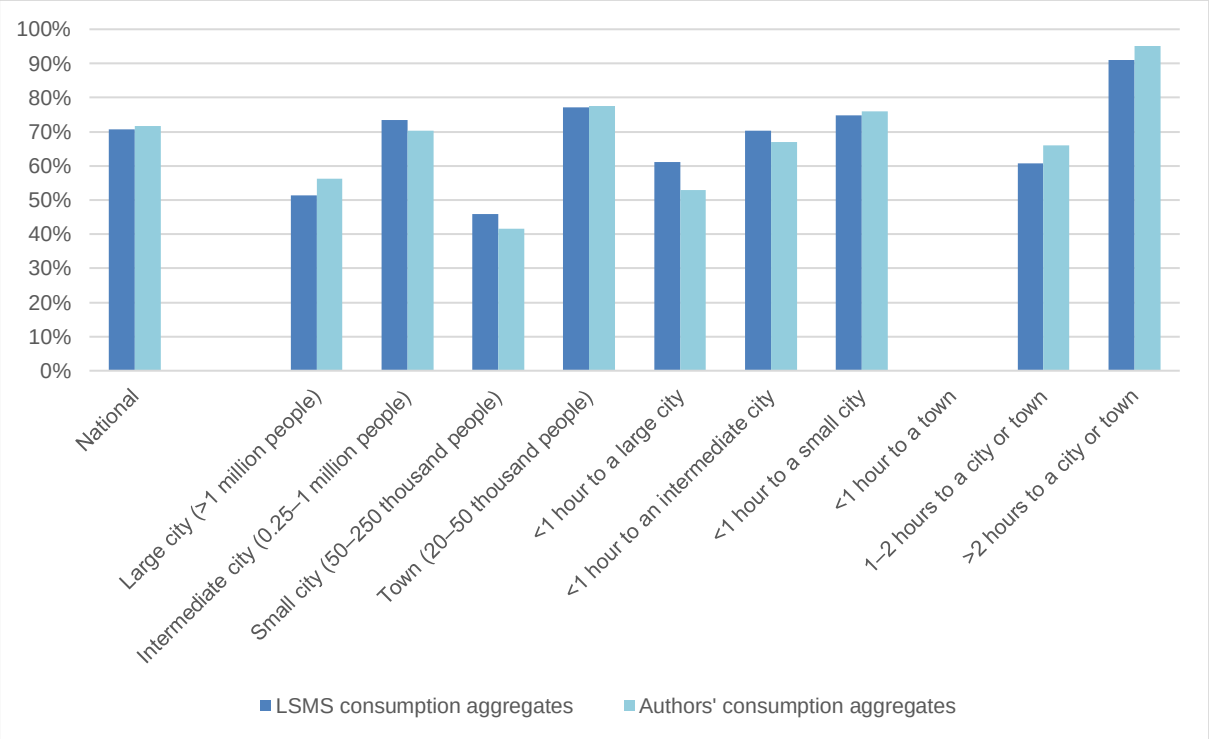
Table A5.2 Affordability of a healthy diet across the rural–urban continuum (URCA) in Ethiopia, based by different definitions of income that can credibly be reserved for food and obtained from different consumption aggregates

Consumption aggregates	Rural–urban continuum (URCA)	Percentage of people unable to afford a healthy diet				Number of people unable to afford a healthy diet			
		Fixed share of 52%	National bottom quintile	URCA bottom quintile	National quintiles	Fixed share of 52%	National bottom quintile	URCA bottom quintile	National quintiles
		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
LSMS consumption aggregates	Large city (>1 million people)	71	46	51	49	2 988 969	1 925 965	2 154 268	2 067 625
Authors' consumption aggregates		64	47	56	55	2 680 155	1 960 463	2 361 358	2 306 643
LSMS consumption aggregates	Intermediate city (0.25–1 million people)	87	66	73	67	2 128 486	1 608 082	1 800 621	1 655 851
Authors' consumption aggregates		79	59	70	69	1 936 793	1 446 228	1 727 483	1 681 735
LSMS consumption aggregates	Small city (50–250 thousand people)	67	38	46	38	3 022 220	1 700 921	2 068 818	1 731 881
Authors' consumption aggregates		57	36	42	48	2 589 001	1 621 181	1 875 591	2 148 054
LSMS consumption aggregates	Town (20–50 thousand people)	91	68	77	74	1 603 492	1 195 803	1 355 665	1 292 411
Authors' consumption aggregates		89	65	78	80	1 567 061	1 148 115	1 362 469	1 404 657
LSMS consumption aggregates	<1 hour to a large city	79	55	61	56	3 830 900	2 655 782	2 977 675	2 741 019
Authors' consumption aggregates		77	58	53	66	3 747 786	2 807 180	2 578 550	3 221 094
LSMS consumption aggregates	<1 hour to an intermediate city	87	68	70	70	14 715 046	11 428 808	11 838 027	11 760 957
Authors' consumption aggregates		83	68	67	70	13 882 776	11 443 779	11 256 296	11 839 572
LSMS consumption aggregates	<1 hour to a small city	91	73	75	75	30 645 440	24 684 078	25 107 304	25 315 840
Authors' consumption aggregates		88	76	76	79	29 644 366	25 556 608	25 556 608	26 489 600
LSMS consumption aggregates	<1 hour to a town								
Authors' consumption aggregates									

Consumption aggregates	Rural–urban continuum (URCA)	Percentage of people unable to afford a healthy diet				Number of people unable to afford a healthy diet			
		Fixed share of 52%	National bottom quintile	URCA bottom quintile	National quintiles	Fixed share of 52%	National bottom quintile	URCA bottom quintile	National quintiles
		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
LSMS consumption aggregates	1–2 hours to a city or town	87	65	61	67	13 120 473	9 846 613	9 191 240	10 184 694
Authors' consumption aggregates		86	73	66	76	12 953 738	11 004 640	9 977 900	11 531 414
LSMS consumption aggregates	>2 hours to a city or town	97	91	91	91	6 597 110	6 156 031	6 157 915	6 160 241
Authors' consumption aggregates		98	94	95	96	6 617 409	6 355 603	6 434 070	6 466 453
LSMS consumption aggregates	National	88	71	71	72	82 037 096	65 802 492	65 802 492	66 843 316
Authors' consumption aggregates		84	72	72	74	78 271 864	66 773 256	66 773 256	68 873 088

Source: Authors' own elaboration.

Figure A5.1 Comparison of the percentage of people unable to afford a healthy diet in Ethiopia, when different income sources are used



Note: The percentage is not computed in areas 1 hour travel or less to a town because the basket was incomplete and it was not possible to compute the cost.

Source: Authors' own elaboration.

Finally, Section 4.3 compared two different ways of computing the national cost of a healthy diet and the related affordability indicators. As Table A5.3 indicates, the main finding that Ethiopia is one of the exceptions among the 11 countries analysed still holds true when income is defined based on the authors' calculation of consumption aggregates.

In Ethiopia, the cost a healthy diet and, consequently, the share of the population unable to afford a healthy diet are higher when a national basket is identified.

Table A5.3 Comparison of national affordability of a healthy diet using different methods and different income sources

	People unable to afford a healthy diet			
	National Healthy Diet Basket	Subnational aggregation	National Healthy Diet Basket	Subnational aggregation
	(c)	(d)	(e)	(f)
	(%)		(number of people)	
LSMS consumptin aggregates	70.7	69.5	65 802 492	62 651 533
Authors' consumption aggregates	71.7	70.0	66 773 256	63 130 325

Source: Authors' own elaboration.

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