GDS | CENTER FOR GLOBAL DEVELOPMENT + SUSTAINABILITY
THE HELLER SCHOOL AT BRANDEIS UNIVERSITY

FOOD

DRAFT

Ricardo Godoy

GDS WORKING PAPER SERIES / GLOBALIZATION AND INDIGENOUS COMMUNITIES / NO. 2020-03 / DECEMBER 21, 2020

Brandeis

CENTER FOR GLOBAL DEVELOPMENT + SUSTAINABILITY

GLOBALIZATION AND INDIGENOUS COMMUNITIES
WORKING PAPER 2020-03

This paper is a product of the Center for Global Development and Sustainability's work on globalization and indigenous communities.

DRAFT: 12/21/2020

Chapter 10

Food

Summary: *Aims*: Assess *1]* levels and trends in the amount and inequality of daily *per capita* foods and macronutrients eaten, *2]* reassess *per capita* income via the value of foods consumed, *3]* compare Ginis between staples, monetary value of food, and macronutrients. *Methods*: Household yearly data on foods eaten the past week was divided by household size to get *per capita* household estimates. To assess cash values, *per capita* amounts were multiplied by median village food prices. Intake of macronutrient (kcal, protein, fat, carbs) were obtained using international conversions. Ginis were computed to assess inequality in macronutrients and the amount and value of food. *Data*: Household were asked about 10 foods from towns, 11 from villages. Most data came from panel (2002-10). Village and town surveys were used to get food prices. Median yearly prices were imputed to missing prices. Inflation-adjusted prices were used in the analysis. *Findings*: *1]* *Amounts*. In a day, a person ate a total of 1.7 kg of rice, plantain, and manioc and 0.15 kg of wild animals. Among market foods, white sugar was prominent (0.04 kg). Tsimane' seldom ate their livestock. The median daily value of all foods eaten was ~11 *bolivianos* (Bs); ~80% came from own production (wildlife 65%, 4 main crops [manioc, maize, rice, plantain] 15%) and ~20% from the market. Since daily *per capita* cash income was 5.2 Bs and ~2 Bs was spent on food, daily *per capita* income from earnings + consumption (*sans* double counting) ≈ 14 Bs ($2); Tsimane' are money poor, but less poor than if income were measured with only cash earnings or only food value. Median *per capita*/day intake was 2869 kcal and 87, 48, and 514 gm of protein, fat, and carbs; these meet recommended intakes. *2]* *Inequality*. Ginis of the amounts of staples eaten ranged from 0.35-0.53 for plantains, rice, and sugar to >0.90 for their own livestock, wild birds, and cow heads. Ginis of the cash value of some food bundles and all foods were lower: refined foods and wildlife ~0.57, 4 crops or all foods = 0.46. Ginis for macronutrients were among the lowest, ranging from 0.31 (kcal, carbs) to 0.38 and 0.46 for proteins and fat. *3]* *Trends*. Quantities eaten/year did not change, except for manioc and game which fell (-3.2%, -2.4%) and pasta and cooking oil which rose (+1.2%, +0.8%). Intake of kcal, protein, and carbs fell yearly by -1.2% to -1.7%, while Ginis for macronutrients fell yearly (-1% to -1.8%), suggesting Tsimane' are becoming more egalitarian in eating poorer quality meals. The similarity between Ginis for macronutrients (0.31-0.46) and the Gini for the monetary value of all foods consumed/day (0.46) suggests macronutrient inequality might be a promising way to assess income (consumption) inequality in highly autarkic economies.

Ricardo Godoy

Heller School for Social Policy and Management

Brandeis University

Waltham, MA

USA

Email: rgodoy@brandeis.edu; telephone: 1-781-736-2784

I scrutinize food because, like economic inequality, it serves as a keyhole into wider matters. Food tells us about the proteins, starches, carbohydrates, energy, and fats eaten, and, thus, to a diet's harmony and a people's status. In earlier chapters we said Tsimane' had few assets and little cash, which does not mean they had measly income or consumption, or that they were asset poor. Gauging adults' cash inflows does not tell us about the goods landing in a household straight from fields and forests begirding the home, or from barter. Tallying the number of goods owned by adults in a society where people borrow assets from other households yields a flawed measure of what wealth does for those who have it, or for the poor who groke for it. Food differs because everyone eats food, because food is exclusionary ─ what I eat you cannot ─ and because, among the poor, much effort and many resources go into procuring food rather than fandangles to cocker whims. Tell me the share of time, cash, and goods people spend getting food and I'll tell you how well off they are. Also, the share of food from stores and from one's land shows how far the market has disemboweled and mangled a hidebound economy.

Because others with better data, finer methods, and keener insights have analyzed nutrition among Tsimane' (Bethancourt et al., 2019; Kraft et al., 2018), I touch on it gingerly, focusing instead on two neglected topics among Tsimane'.

First, I want to reckon income through the value of food consumption. When, in earlier chapters, we measured cash income, cash expenditures, or the monetary value of goods garnered in truck, we looked only at adults. What happened to goods brought from one's fields and the forests environing a village, and what happened to children? Clearly, we can add cash income, cash expenditures, or the value of goods from barter for all adults in a household and divide each of these totals by household size to arrive at the average income or consumption of a person in the household, but children do not consume many things adults consume while many things people harvest never make it to cash accounting. One is left with the unpleasant feeling that averages of monetary income or monetary expenditures of dwellers in a household miss a large piece of the puzzle when judging well-being in extant cultures of apanthropy. Dividing the value of all foods consumed in a household by a metric of household size yields a more trustworthy, albeit not impregnable, measure of well-being because everyone eats food. As we shall see, desultory mistakes do not vanish. But one thing food consumption has, at least the way we measured it among Tsimane': the amount and value of the chief foods eaten, procured by households on their own from their farms and from the village forests, or bought. We asked about the quantity and price of the same staples year after year. And that step makes a difference. Divide the value of household food consumption by household size and you arrive close to true *per capita* consumption and ─ if you equate consumption with income ─ you land as near as you will ever get to a proper estimate of *per capita* income in autarky.

The second neglected conversation I touch on is economic inequality. Akrasia makes me revisit economic inequality through food consumption. The measures and conclusions about asset inequality of Chapter 9 are wanting for reasons noted there. If we believe the value of food consumption reflects unseen *per capita* or household income when societies choose to latibulate in far-away places, we can reassess income inequality through the value of food consumption. Foods differ in macronutrients and households in food portions, so foods can be used to compute measures of inequality for macronutrients, like fat, carbohydrates, and kilocalories, and trends in macronutrient disparities. Income inequality appraised with the monetary value of food consumption could mirror inequality in macronutrient intake. Possibly, exposure to the market does not change inequality in the value of food consumption, but alters the consumption of macronutrients. If apposite, this approach could point to another path linking income inequality with health, for it might not be inequality in income (measured through the value of food consumption) that harms, but inequalities in the ingredients of foods. Furthermore, if macronutrient inequality overlaps well with income (consumption) inequality, macronutrient inequality could serve to approximate income disparities in cashless economies.

Yearly food consumption: Quantities

We know little about Tsimane' food consumption in the past. Pauly and Nordenskiöld, two early modern observers of Tsimane', stressed that Tsimane' enjoyed a well-balanced diet of wildlife and home-grown crops. Pauly said their meals had fish, game animals, and crops like "manioc, maize, rice, valusa, [and] papaya" (Pauly, 1928, pp. 117-118)[i]. With his customary hyperbole for the ataraxia of unspoiled cultures, Nordenskiöld, the bailiwick of early researchers of Tsimane', went further, noting in an oneiric passage that among Tsimane' his staff had eaten:

> *... really well. Tsimane' had eggs, fish, game animal, and many crops from their fields. Rarely is fish or are game animals missing from a meal. For a Tsimane'....hunting is a source of food, not a pastime, as it is among some of the other tribes. When one arrives at their huts, one almost always sees them roasting a game animal. Frequently, they are cooking a wild boar, or a giant anteater, a monkey, a tapir, a capybara, a scrumptious coati, or some other delicacy. On the other hand, one rarely sees a bird in their diet; perhaps it is hard to hunt birds with bows and arrows, the only weapon available to Tsimane'* (Nordenskiöld, 2001 [orig 1924], pp. 158-160)[ii].

He went on to note that fish eclipsed game animals in their diet and that, among foods from domesticated animals, only poultry stood out. Plantains they used to feed themselves and their hunting dogs. They had a profusion of food but did not give it away to opscheploopers. Instead, Tsimane' regaled Nordenskiöld's cabal with fermented drinks from maize, manioc, and plantains. In summarizing his impression of Tsimane' diet, he wrote that the land of Tsimane' (and Mosetén) was "*without doubt a good place to live. I don't think these people are ever hungry. During the rainy season fishing and hunting sometimes fail, forcing them to become vegetarians" (Nordenskiöld, 2001 [orig 1924], p. 161)*[iii].

<u>The foods measured: Quantities</u>. The datasets used I summarize in Table 10.1 and Appendix A. We surveyed all households in all the villages of the two studies (Chapter 5): the nine-year longitudinal study (2002-2010, TAPS) and the baseline of the randomized-controlled trial (2008).

Insert Table 10.1

Surveyors were instructed to ask the two household heads jointly about the amount of 21 foods consumed the seven days before the interview (Table 10.2). Answers typically came from women, but men stepped in when women were too shy to answer, and sometimes one spouse complemented or amended what the other had said. When one household head was absent, surveyors interviewed the one present; surveyors did not wait for both spouses to be there before doing the interview.

The choice of foods to ask about in the survey came from a five-quarter panel study (1999-2000) which took place before the yearly longitudinal study (2002-2010). In the first study we collected data on food consumption by asking households each quarter to recall all foods eaten during the previous 24 hours (Byron, 2003, pp. 54-55). The method allowed us to identify the range of foods eaten regularly throughout the year in two villages, one remote (Yaranda) and one near (San Antonio) the town of San Borja.

I split foods into those most likely households got from their fields and village commons, and those they most likely bought in towns. The distinction helps to assess autarky but ignores the betweenity of the two food groups. For example, I place beef and jerky with market foods because these meats Tsimane' ordinarily buy in towns, but sometimes they slaughter their cattle to eat. I follow Bethancourt et al. (2019) in splitting the two food groups into smaller packages. Among foods from their land, I put four crops (manioc, rice, maize, and plantains), three types of wildlife (birds, fish, game animals), meats most likely obtained from their livestock (chickens, ducks, and pigs), and eggs from their chickens and ducks. Even though wild birds and fish are game animals, I reserve the term *game animals* for mammals and reptiles. In market foods I put meats (beef, cow heads, jerky)[iv] and canned sardines, cooking oil, lard, and four types of refined foods: sugar, flour, noodles, and bread. Market foods Tsimane' obtain in towns, but sometimes travelling merchants bring them to villages.

Insert Table 10.2

Household heads were asked to report the amount of a food eaten, which they did with amounts expressed in the units of measure they would normally use. Spouses reported most crops, some meats, and many refined foods in kilograms. The amount of maize they reported in *mancornas*, the unit of measure Tsimane' use to talk about maize quantity (1 *mancorna* = 1.91 kilograms). Commercial foods bought in the market they reported in cans (sardines), bottles (cooking oil), or number of units (bread, cow heads). Eggs, whether from the market or from their poultry, they reported in units.

Questions about animal wildlife were the most complex. In most years, household heads were first asked to list the three main birds, six main fish, and four main game animals the household had eaten during the past week (Appendix B). To arrive at the net amount consumed by the household from these initial answers, surveyors followed three steps. First, they asked for the number of animals caught. Second, if people had foraged with another household, they were asked about the number of animals they had kept for their household. Last, surveyors asked for the number of animals from the catch villagers had bestowed on others back in the village.

Once surveyors knew the net number of animals brought to the household, they converted the number of animals into kilograms. Conversions differed for birds, fish, and game animals, as it did for livestock, and drew on our understanding of the approximate weight of animals. For game birds, surveyors asked if the bird was large or small, and, for the conversion, they imputed one kilogram of weight to a small bird and two to a large one. For game animals living on land, like reptiles and mammals, two approaches were used. Surveyors asked subjects to estimate the weight of the animal, which Tsimane' expressed in *arrobas* (1 *arroba* = 11.5 kilograms) when speaking of large animals or in kilograms when speaking of smaller ones. In addition, we used conversions when subjects could not report the weight in kilograms. For instance, when asking about *paca*, surveyors would have asked if the *paca* had been large or small. We had decided that, in general, an adult *paca* weighed 8-10 kilograms and a medium to a small *paca* weighed 4-5 kilograms. For each *paca* reported, surveyors assigned a weight in kilograms based on these equivalences. Another example. We asked about the weight of deer in *arrobas* (not in kilograms) and assigned two *arrobas* to a large deer and one to a small or medium deer. Roughly the same happened when assessing the weight of the fish catch. A large fish was assumed to weigh one kilogram, and a medium fish half a kilogram. To convert the weight of very small fish into kilograms, we asked how much of their catch could have fitted into a standard, locally made cotton carrying bag Tsimane' weave, or into a gourd; our recipe said fish that filled a bag weighed one *arroba* (11.5 kilograms), a gourd one kilogram. To change the number of chickens or ducks eaten to kilograms, we said a chicken weighed one kilogram, a duck weighed three[v].

Most questions were about amounts eaten, with two exceptions: manioc and maize. Tsimane' generally do not eat manioc; they ferment it to make *chicha*, catlap or strong. The information on manioc consumption has another shortcoming. We asked about the amount brought to the household, not about the amount eaten. People could have sold, bartered, or given away the manioc they collected, fed it to swine, or consumed it after the survey. With maize we asked about how much they had used to ferment *chicha*, not about the amount eaten, which is not off the mark. Children and older adults sometimes eat roasted tender maize on the cob, but most maize is used to flavor *chicha* from manioc or plantain, though infrequently Tsimane' make *chicha* only from maize.

The foods measured: Macronutrients. I scaffold on the work of Flores et al. (1971) and Bethancourt et al. (2019) to convert amounts of foods into kilocalories and grams of proteins, fat, and carbohydrates. Appendix C has the conversions used, which are straightforward except for two cases. *[i]* When asking about chicken, duck, and pork meat we asked about the number of animals eaten (chickens, ducks). Surveyors turned the number into kilograms assuming common weights in the area for chickens and ducks: 1 chicken = 1 kilogram, 1 duck = 3 kilograms. With pork, we asked directly about the kilograms eaten. *[ii]* When asking about wildlife, surveyors converted the number of animals caught into kilograms using the algorithms described earlier; because these amounts referred to the gross weight of wild animals, hoofs, bones, beaks, scales, and all, I trimmed gross weights by the percent edible, shown in the fourth column of Appendix C.

Level of measurement.

Households. We asked about the amount of 21 foods consumed by the household in the past seven days. If two households ate together, surveyors assigned the same amount of food to each household. This rarely happened. In 2002, 1.6% of households ate with another household (four out of 261); in 2003, 3.7% did (nine out of 239 households).

Individuals: Household size. Because I want to measure income, I need to express the value of food consumption per person, the yardstick to portray income in international studies. To do so, I had to adjust household-level measures of quantities and values of food consumption by household size. Owing to measurement errors in reported age (Chapter 5), I avoided tallying food consumption by adult equivalents and use the humbler, more reliable, method of displaying food ciphers per person.

The file on the yearly demographic composition of households was not good enough to asses household size because it had permanent dweller who could have been away the week before the survey, the recall period for reporting food consumption. I want to match as closely as I can the amount of food reported for the past week to the number of people in the household at that time. To tally the head count, I chose to appraise household size using the file on anthropometry. Other than the ill and parturient mothers, we collected anthropometry from everyone. The anthropometry file has all the people who would have most certainly eaten the foods reported by the household.

Sometimes a household lacked anthropometry data. This happened if surveyors finished asking questions about food consumption and the family left before surveyors could measure anthropometry. When this happened, I use the head count from the yearly demographic survey. In the baseline of the randomized-controlled trial (2008) I found seven households without anthropometry data. For these households I reluctantly used the demography module at the start of the study to find household size. In the yearly longitudinal study, in 2002 and 2003, 15 and 22 households had data on food consumption but no anthropometry data. For 2002, I used data from the demography module. I did not use the demography file for 2003 as it only included changes to the 2002 survey from death, marriage, and emigration. To avoid mistakes from re-estimating the demographic composition of 2002 to arrive at the household composition of 2003, I relied on the module on perceived health. Like anthropometry measures, which were taken from everyone, probes about perceived health were directed at all villagers regardless of age, with parents answering for children[vi].

After reworking the numbers, the final sample size of households for 2002-2010 (including the baseline of the randomized-controlled trial) reached 2823 observations: TAPS=2,261, RCT=562. An observation refers to one yearly record per household, a household without missing data for any of the 21 foods measured, number of people in the household at the time of the survey, and food prices. The average household across both studies and all years had 5.8 people (median = 6; standard deviation = 2.6)[vii].

Trends per week and per day. When reporting the amount of food consumed, whether by households or per individual, I switch between expressing growth rates per week or per day. The choice depends on what needs stressing. Sometimes I want to highlight the share of households eating a food, or the trend in the share. Then I express consumption per week. When I want to discuss the size of food portions or the value of meals, I express amounts by weeks and days. Days I prefer when talking about income, for it eases comparisons with other studies.

Quality of data on the amount of food consumed.

Excluded foods. We first methodically saw the foods people brought home to eat and then picked those we would ask about in the surveys. Despite our caution, our list left out foods we should have asked about. The list did not include wild edible plants, fruits from planted trees, or products from wild animals, like honey. We did not ask about the prandicles eaten outside the home (Byron, 2003, pp. 219-220; Zycherman, 2013), or about meals in eateries while in towns. Some foods, like dairy products, we did not ask about because Tsimane' do not eat much dairy, but salt we did not ask about until 2007; salt I drop because we did not measure it every year of the panel study. We did not ask about the amount of ready-to-drink *chicha* qua *chicha* available to the household during the week before the interview, but instead, starting in 2005, we asked about the amount of maize or manioc to make it, which is fine to approximate the economic but not the nutritional value of *chicha*.

Mistakes and outliers. Complex heuristics were used to fathom the amounts of wild animals brought to the kitchen. Besides mistakes from faulty recall of spouses, mistakes also happened from using wrong ratios to translate the number of animals into kilograms of edible meat, and from flawed additions of animal weights by respondents and surveyors.

At first sight, the amount of foods consumed had a few outliers, evident when looking at macronutrients. What to do when a household said it ate or brought home a huge amount of a crop, or reported having eaten more than 80 kilograms of wildmeat in the past week? Large amounts could reflect noise or reality. Here are some examples of how outliers could be real. A household making a large batch of *chicha* to imbibe in causerie with compeers, or to prepare a copious amount of food to maffick in a village festivity, would have reported the entire amount brought home to ferment ─ even if the household consumed a small amount of what they reportedly brought. Or consider a quanked respondent who, when asked how much rice the household had eaten the past week, reported the amount brought to the household, some for the household to eat, some to sell, some to give away or to barter. The ramfeezled villager made the mistake because for some foods we asked about the amount gathered, sometimes about the amount eaten; the well-intentioned but tired respondent was not paying attention when surveyors posed the question. Lucky foragers who caught large animals or those who fetched lavish amounts of fish with nets would have reported a large amount eaten. Outliers could also reflect our inability to measure household size accurately. Suppose on the day of the survey we took anthropometric measures from only one person in a household because everyone else in that household had left the day before. In the system for computing household size I followed, I call this a one-person household. The amount of food consumed the past week and reported in the survey would reflect what everyone in the household had eaten, but in my way of accounting I would pin all that food to one person. In retrospect, we should have asked about the foods eaten the day before the interview and about all the people in the household ─ frumberdling, old, children, dewdropper, female and male, parturient, impaired ─ who ate the food, or we should have asked about all the people who ate in the household in the past week. We did not do either, and now pay the price. I leave outliers because I cannot justify excluding them, but often rely on medians to avoid the outliers' sway.

Biases. When asking about the top birds, fish, and game animal a household had eaten, we gave villagers more choices when answering about fish than about other wild animals. We told respondents to list the top six fish their household had consumed the past week, but limited their answers about birds and game animals to the top three or four animals. Done this way, fish, as we shall see, accounted for a large share of the value of food consumption. Flaws in survey design lead me to overstate the significance of fish in total food consumption, but in my defense, the bias jibes with the findings of Nordenskiöld (2001 [orig 1924], p. 161), Pérez (2001), and Byron (2003, pp. 85, 221-222), all of whom found Tsimane' ate fish galore.

Inconsistencies within and between years. There were inconsistencies when asking about *(i)* foods eaten versus *(ii)* manioc brought to the household for unknown ends, or maize to ferment. Inconsistencies also arose over the years in the wording of questions and in the coding of commensal meals. During 2002-2004, we asked about the top tree game animals eaten; in later years we asked about the top four. During 2002-2003, we asked about the top eight types of fish consumed; starting in 2004 we asked about the top six. Questions about the consumption of manioc and maize differed in the early (2002-2004) and later (2005-2010) years. In 2002-2003 we asked about the amounts eaten. By 2004, we asked about the amount of maize eaten and about the amount of manioc brought to the household for any end. Starting in 2005 we asked about the amounts of maize to prepare *chicha* and the amount of manioc collected from the fields. At least for some foods, midstream changes in the wording of question will obscure trends and comparisons between years.

Sometimes two households ate together. We were remiss at recording when this happened. In 2002-2003 we jotted the occurrences in the marginalia of the paper survey and in the electronic version of the dataset, but in later years we forgot to record the events. If 2002-2003 reflects what happened in other years, the inconsistency should not upset findings. In those years, only two households reported eating with another household and across all years and all households only eight households (0.2%) reported consuming no food, probably because they ate with other households; I filleted out from this chapter the eight households.

Results.

Sample of households. The total yearly number of households in the longitudinal study went from a low of 230 households in 2003 to a high of 268 households in 2010, yielding a yearly mean and median of 251 and 253 households (standard deviation [SD]= 13) (Table 10.4A). The baseline survey of the randomized-controlled trial, done in 2008, had an additional 562 households. A big dip in the number of households of the longitudinal study took place between 2003 and 2005; from 257 households in 2002 the sample fell to an average of 237 households per year in 2003-2005, recovering by 2006 with 262 households and wavering around that level until the end of the study in 2010. As always, the sample was slightly, but only slightly, biased; most households agreed to participate (Chapter 4, Table 4.5), but some we missed because they were absent during our stay in the village.

Insert Table 10.4A

Wild animals eaten by households the week before the survey. During the nine yearly dry seasons when we surveyed households, Tsimane' caught a total of 19 different birds, 40 different game animals, and 67 different types of fish. Tsimane' harvested many types of wild animals, but they relied on a handful. One bird (*Emej*) accounted for half of all wild birds caught (Figure 10.1A) while just five animals (*Quiti*, *Naca'*, *Ñej*, *Ojoy*, *Chu*) accounted for half the game animals eaten (Figure 10.1B). Four types of fish (*Vonej*, *Sunare*, *Sheresherej*, *Pincushi*) captured half of what they prowled from rivers and lakes (Figure 101C). The birds, game, and fish in the column "Other" represented 15%, 20%, and 32% of the motley critters caught. The shares do not mean Tsimane' eat more miscellaneous fish than miscellaneous birds or game animals. No. the large share of assorted fish comes from our having given villagers more choices to say what they had fished than what they had hunted.

Insert Figures 10.1A-10.1C

Amounts of food consumed by a household and an individual. The last column of Table 10.4B shows that the week before the survey, households ate mostly what they had harvested from their fields and forests. Only granulated white sugar from stores made it to the top six most frequently eaten foods. Almost all households ate plantains (99%), rice (95%), fish (89%), and sugar (78%) while a good many consumed manioc (69%) and game animals (58%). After the top six foods, Tsimane' diet got festooned with kickshaws from the market, from noodles (52%) and bread (49%), wafting down to cooking oil (45%), beef (31%), lard (27%), and flour (24%). I thought households would have eaten their livestock; apparently, they did not. They rarely ate their ducks (2%), their swine (8%), their chickens (25%), even wild birds (9%)[viii]. Market foods (other than sugar) and meat from yard animals were delicacies to flavor what to them might have been mawkish meals.

Insert Table 10.4B

In Table 10.6 I show the weekly amount of foods consumed each year, and the average for all years. The table serves as an unpolished but limpid step to the more informative Table 10.7, where I take the total amount eaten by a household and divide it by the number of people in the household to see what the average person in the household ate in a day.

Insert Table 10.6 and Table 10.7

Until I examined macronutrients (later in the chapter), I read Table 10.6 as showing a famelicose population. In a week, the average Tsimane' household ate two kilograms of wild game animals, 0.38 eggs, 0.11 kilograms of meat from their livestock, 0.18 kilograms of meat from the market (excluding cow heads), a pittance of cooking oil (0.07 liters), lard (0.04 kilograms), and bread (1 piece), a reasonable amount of sugar (0.20 kilograms), and modest amounts of noodles (0.16 kilograms). The morsels were offset by plentiful amounts of starchy farm crops. In a week, a household consumed 1.26 kilograms of rice, 1.43 kilograms of manioc, and 6.22 kilograms of plantain. After allowances for household size, the daily amounts of food consumed per person drop (Table 10.7). For example, in a week the average household consumed a total of 8.9 kilograms of rice, plantains, and manioc (Table 10.6); the average person ate a total of 1.7 kilograms of these crops in a day (Table 10.7). In a week, a household ate 2.1 kilograms of wild animals and 0.13 kilograms of meat from their own livestock; a person, in a day, consumed 0.4 kilograms of wild animals and 0.02 kilograms of livestock meat[ix]. The large amount of wildmeat consumed needs correcting as outliers raised the average. The average household brought a median of two kilograms of wildmeat in a week. If I redo the numbers for wildlife consumption of Table 10.7, and limit the estimate to households that caught no more than two kilograms of wildmeat, we get a more sensible daily *per capita* estimate of 0.15 kilograms.

Trends from the longitudinal study (TAPS) in the probability of consuming a food and in the amount of food consumed. For each of the 21 foods, tables 10.5, 10.8A, and 10.8B show yearly growth rates in the probability of consuming the food (Table 10.5) and in the daily amount eaten by a household (Table 10.8A) and by a person (Table 10.8B). Together, the three tables tell the same story about change and stasis.

Insert Table 10.5, Table 10.8A, and Table 10.8B

[a] Less eaten foods. Over time, the probability a household would bring manioc to make *chicha*, or pork to eat, declined each year by 1.6% and 0.9% (Table 10.5), as did the amount consumed per household (Table 10.8A) or per person (Table 10.8B). Per household, the amount of manioc and pork consumed daily declined by 5.6% and 1.7% each year (Table 10.8A); expressed per person, the shrinkage was less sharp, but significant nonetheless (manioc = -3.2%; pork = -0.5%; Table 10.8B). Bookending the foods eaten, from manioc, a commonly consumed foods to pork, a rarity, the two items are headed to disappear from Tsimane' meals should Tsimane' nourishments and lifestyles remain unchanged. A moreish dish, pork could vanish from the menu of Tsimane' without anyone noticing, but the wilting of manioc consumption portends the passing of traditional sociability, for sipping manioc-based *chicha* entwines Tsimane' while allowing providers to vaunt their unselfishness. Besides manioc and pork, the amounts eaten of maize, game animals, and lard also contracted. The probability of consuming the three foods did not change, but the amounts did, whether expressed per household or per person. Household consumption of maize, game animals, and lard fell by 2%, 4.2%, and 1.9% each year; in parallel, *per capita*, consumption of these staples declined by 0.6% (maize), 2.4% (game), and 0.5% (lard). Mindful of what we found about the declining consumption of manioc and pork, the shrinking consumption of maize makes sense. Maize and manioc come from their fields, both used to prepare *chicha*. It follows that when the consumption of manioc declines, so would the consumption of maize, its complement. The declining consumption of game animals, if it lingers,

could point to the depletion of wildlife or to changes in the quality of animal proteins and palate toward meats from the market or one's livestock. I distrust the last point because the consumption of none of the other sources of animal proteins from their household (eggs, poultry) or from the market (beef, cow heads, jerky, canned sardines) grew (Tables 10.8A-10.8B). No meat is replacing animal wildlife in meals.

[b[More eaten foods. Tsimane' are eating more noodles and consuming more cooking oil. The likelihood a household would use cooking oil and eat pasta grew by 4.4% and 1.7%/year (Table 10.5) while the yearly amount consumed of cooking oil and pasta rose by 5% and 2.6% per household (Table 10.8A) and by 1.2% (oil) and 0.8% (noodles) per person (Table 10.8B). Murkier is the evidence for increased consumption of other foods. The chances of finding fish, lard, and sugar in a meal rose yearly by 1.1%, 3%, and 1.6% (Table 10.5), but the amounts eaten did not change, except mayhap, for sugar, which, for households, increased by 1.9%/year (Table 108A), but which remained flat at 0.4%/year in *per capita* terms (Table 10.8B).

[c] Stasis. Besides their consumption of manioc, cooking oil, pasta, and pork, Tsimane' did not change whether and how much they ate of other foods. The consumption of crops (rice, plantains), of wildlife (birds, fish), of animal proteins from the market (beef, cow heads, jerky, canned sardines), or from their yard (ducks, chickens, eggs), and of starches from the market (flour, bread) barely swerved in time.

The stability of Tsimane' food consumption. Trends in the quantity of foods eaten tell where a population is heading in the quality of their diet, health, and body weight, but misconstrue reality for general drifts hide breaks. We want to know not merely where a group is going, but how bumpy is the road. To answer the question and see what we get in an easy-to-grasp manner, I plot the average annual daily amounts of staples eaten by a household. I confine the staples to those we jotted down in kilograms as it allows me to put them on the same plane and to compare harsh peaks and bottoms in the consumption of different staples. Shown in Appendix D, the charts repackage much of Table 10.7, but leave aside data from the baseline of the randomized-controlled trial, foods reported in units besides kilograms, and some staples which, though recorded in kilograms, people rarely ate.

For many staples, consumption resembled a rollercoaster, with tall summits and deep nadirs between one year and the next. A few examples. First spikes. Between 2002 and 2003, consumption of plantains and fish spiked; between 2004 and 2005 so did the amount of manioc, and during 2007-2008 consumption of cooking oil jumped. Then falls. Between 2003 and 2004, consumption of beef and jerky dropped, between 2008 and 2009 consumption of pork (and jerky) did, and during 2006-2007 plantain consumption fell suddenly. The graphs smell of vulnerability.

Yearly food consumption: Cash value

Food prices

Module on community food prices: Villages and towns. To value food I needed prices, the search for which in anchorite economies took me into a computational odyssey. I would have liked to use the survey of people's individual expenditures or barter deals to retrieve food prices, but could not for the expenditure survey had data on cash outlays, not on quantities; I could not divide one by the other to find a unit price. The survey on barter had values and quantities, but most times adults swapped to get market foods from towns (Chapter 8), leaving us nearly empty handed to find prices for village foods.

To find prices in towns and villages for all foods, I used the yearly surveys about traits of villages and towns. Parts of those surveys dealt with the buying or the selling price of the foods included in the household survey of food consumption (Table 10.3). For instance, in the household survey of food consumption we asked spouses about the amount of plantains or sugar eaten during the past seven days; in the village survey we asked a village head for the current selling price of plantains and the buying price of sugar in the village[x]. We had the foresight of gathering in towns the selling price of foods itemized in the household survey. The information came in handy when valuing a food eaten which no villager had traded. Other than plantains and wildlife, in the town surveys we asked merchants about the selling price of all foods included in the household survey. In the survey about villages, we inquired about the *selling* price of some foods and the *buying* price of others because some foods Tsimane' buy, others they produce, eat, and trade. In the survey of village traits, we asked a local authority to tell us, for their village, the current:

1) *selling* price of eggs, two wild animals (deer, *jochi*), two fish (*sábalo*, *surubí*), maize, manioc, rice, and plantains and the

2) *buying* price of flour, noodles, canned sardines, beef, lard, sugar, bread, cooking oil, cow heads, and jerky.

To complement the survey of prices in villages, we asked merchants in towns about the current *selling* price of all foods in 2) plus the *selling* price of livestock, eggs, manioc, maize, and rice.

Insert Table 10.3

The way of collecting food prices in villages and towns differed. Several loose steps were followed to assemble food prices in villages. *i)* In each village, surveyors first asked a village authority, such as a *corregidor*, for current food prices in the village. *ii)* If the village authority did not know the answer, surveyors asked them for the most recent price in the past three months. If the village authority could still not answer, surveyors accosted another village leader, like a school teacher, to obtain the information. *iii)* If the question remained unanswered after all these efforts, surveyors searched for any villager who had trucked or sold the food.

While doing the village surveys the team gathered prices in the towns of San Borja and Yucumo by going to several places in each town. *[1]* Most prices came from one well-known and well-stocked grocery shop in the town, which surveyors visited every year. Surveyors asked the clerk for the current selling price of foods Tsimane' buy in towns (e.g., sugar, cooking oil). If surveyors found the store closed or if the store had run out of the food, surveyors searched for another store. *[2]* Because stores did not sell cow heads or livestock, store clerks could not provide prices for these goods. To fill the holes, surveyors approached peripatetic traders selling cow heads. The Department of Beni, in the lowlands, where most Tsimane' live, has long been the meat basket for the Bolivian highlands (Chapter 3). The towns of San Borja and Yucumo have abattoirs on their outskirts. Peddlers buy cow heads and other offal from the slaughterhouses and travel about town selling the goods. Surveyors asked these petty traders for the selling price of a cow head. *[3]* To find livestock prices, the team went to the home of cattle ranchers to ask them about livestock prices, to the home of swine traders to ask them about pork, and to the home of merchants who raised ducks for sale. Last, surveyors visited meat shops to find prices for fresh meat, and to double check on the price of livestock.

Conversions. To fathom the cash value of a food consumed by a household, I had to multiply the amount of a food a household had eaten times the price of the food. For this to happen, amounts and prices had to be in the same units. Table 10.3 shows that the quantity and price of most market foods needed no adjustment because villagers and townspeople used the same units when talking about quantities and prices. For instance, in the household survey we asked about the kilograms of beef eaten because villagers spoke about beef amounts in kilograms; in the village survey we asked about the buying price of beef per kilogram while in the town surveys we asked about the selling price of beef per kilogram because buyers and sellers in the region trade beef by kilograms. No problem there.

The mismatch between units to express amounts and units to express prices turned up with farm crops and animal wildlife. For those commodities, the units to express consumption and prices differed, sometimes by a lot, making me follow byzantine courses to make units agree with each other. Take fish. In the survey we started by asking households about the number of fish eaten, relying on rules of thumb to change the number of fish into kilograms. To assess the worth of fish consumed, in the village survey we inquired about the price of two habitually traded fish. We asked about the price of one fish (*sábalo*) because that fish is priced and sold per unit, and about the price per kilogram of another fish (*surubí*) because Tsimane' sell that fish by weight, not per unit. Before averaging the two prices to value the kilograms of any fish eaten, I had to convert the price per unit of *sábalo* into a price per kilogram. Early in our study an ichthyologist in the team found an average *sábalo* weighed 0.222 kilograms; I use that cipher to convert a price per fish into a price per kilogram (Pérez, 2001). Less baroque, more innocuous examples come from plantains and rice. We asked about the kilograms of plantains or rice eaten, but solicited information about the sales price of a cluster (*racimo*) of plantains or an *arroba* of rice because Tsimane' sell those crops by clusters or *arrobas*. Mismatches between the units to express amounts and the units to express prices happened because the market leads townspeople to express prices in some units while Tsimane' speak about consumption in other units. When faced with an unsuitable match, I corrected amounts, prices, or both to bring units into closer correspondence. In the last column of Table 10.3 I summarize the adjustments made.

Price imputation. I first go for the food price in the village, for it comes closest to villagers' experience. Those prices are what villagers see. If I could not find a price in the village, I imputed the median food price from other villages, and if I could find no such price, I put down the median price from towns. In this way, all foods eaten ended up with a price.

Quality of price data

Respondents. I wish we had been sterner in choosing respondents for the survey on food prices. In hindsight, we should have imbued the village survey with more gravitas by having many knowledgeable villagers answer questions about prices. In towns, too, we could have done better. Several store owners should have been asked to keep hebdomadal diaries of food prices and we should have had surveyors follow the same script to find peddlers, livestock sellers, and proxy shops. None of this we did.

Conversions. The approach to harmonize units were straightforward, for the most part. But trouble arose when valuing wildlife, especially fish, widely consumed since Nordenskiöld's days a century ago. Mistakes in the generic price of fish will skew in unknown ways the monetary worth of fish consumption and its share in the value of all foods eaten.

Imputations. The notes to Appendix A have the yearly glitches found when assessing prices and the steps I took to amend glitches. For instance, during 2002-2003 we did not collect plantain prices in the longitudinal study, so I ascribed median prices from other villages to plantains eaten of the longitudinal study. Occasionally, the village survey did not include queries about the sales price of a food; I then assigned the price from towns to villages. When I consider the array of foods and years and studies, I do not see many snags, and when they happened they happened in the early years of the study.

In Appendix E I show the share of missing food prices in towns and in the countryside for own and market foods for all years combined. Surveys in towns were more likely to lack prices for rural staples. They had no prices for wildlife and plantains, and they had 42.76% missing values for maize, but they had few, only 4.76%, missing values for eggs and no missing values for two crops farmed by Tsimane (manioc, rice). In stores, we were more likely to find prices for widely traded commercial foods. Other than prices for beef, cooking oil, and cow heads, there were no missing prices for market foods in town surveys. Almost five percent (4.76%) of cooking oil and beef prices and 14.29% of prices for cow head were missing in town surveys.

Village surveys had more missing values for prices. More than half the time we went to villages we found no prices for town foods or prices for wildlife or eggs. In villages, we found prices for farm crops, but even then, gaps appeared; in 3.16% of the visits to villages we found no rice prices and in 17.09% of the visits we found no plantain prices. One odd feature is that, in 85% of village surveys, we found prices for jerky and sugar. I say odd because, as market foods from towns, the two staples should have had many missing values in village survey, like we found with flour or canned sardines. But no. I suspect the oddity brings us back to monetary expenditures. Meat in almost any state Tsimane' love, and sugar for dulcet drinks when they slip into allotriophagy Tsimane' yearn as well, even those outfacing modernity. Light, easily portable, sugar and jerky merchants bring everywhere to quench villagers' hunger still unappeased, which would explain the ubiquity of rural prices for the two classic urban staple foods.

When we combine the corpora from villages and towns, we see prices missing in one place show up in the other. Compared with towns, villages had fewer missing prices for rural foods but more missing values for market foods. In towns, we found prices for processed foods but we were less likely to find prices for foods produced by Tsimane'. Surveys in the two locales reinforced each other, helping to round out the ecumenical food prices needed to appraise the monetary worth of the Tsimane' diet.

Outliers. I used median prices to shield myself from rare prices. The approach worked well most times, but failed when the yearly survey uncovered few prices and the outlier became the protagonist. We will see an instance of this when we examine the high value of wildlife in 2010. This happened because of the high prices for the two fish used to value fish consumption. The price of fish crested in 2010 for reasons I do not understand; even the median price swayed results.

Other. I end by noting three flaws, two minor and one major but unavoidable. *[i]* Tsimane' eat fresh and smoked-dried fish, fresh and sun-dried cow heads. The surveys did not distinguish between these conditions. *[ii]* When inquiring about cooking oil, lard, and canned sardines we asked about the price of familiar brands in standard packaged amounts (Table 10.3). By asking about the price of well-known brands we avoided confusion. I imputed these prices to any cooking oil, lard, or canned sardines eaten even if the household had eaten a different brand. *[iii]* Food consumption was valued using selling and buying prices. Ideally, I should have used buying prices to have food consumption embody expenditures or its neighbor, income. I could not because aliments like plantains, manioc, or wildlife Tsimane' seldom purchase. The mix of buying and selling prices to estimate the monetary value of food consumption was inevitable.

Results

Real cash value of daily food consumption per person. Tables 10.9 has the daily real values of the foods people ate; Table 10.10 has values abridged for food groups. The first table, laden with ciphers, lays bare what lies behind the leaner second one. I focus on median values, but report mean and standard deviation for full disclosure and because they help when assessing the worth of all foods or foods seldom eaten.

Insert Tables 10.9 and 10.10

I begin with the monetary value of village foods Tsimane' eat. Among crops, plantains and rice surpassed manioc or maize in value. The average yearly daily median value of plantains and rice eaten reached 0.6 and 0.41 *bolivianos* per person, whereas the median daily value of manioc was far lower, about 0.18 *bolivianos*, and the median daily value of maize was zero, as most households did not consume it. Of wild animals, fish come out ahead, by far. In a day, a Tsimane' ate 4.08 *bolivianos* worth of fish. The high value of fish consumption could reflect the expensive fish prices of 2010; the *per capita* worth of daily fish consumption tripled from 2009 (3.33 *bolivianos*) to 2010 (9.65 *bolivianos*). Turns out, the story does not change if I leave out 2010. Computed during 2002-2009, the median and average daily personal monetary values of fish eaten were 3.11 and 3.39 *bolivianos*, much higher than the daily cash value of any other wild animal consumed. Their own livestock Tsimane' rarely feasted upon; all median values were zero. Averages show they rarely ate eggs or duck, the daily value per person of these two staple foods a mere 0.05 and 0.02 *bolivianos*. In a day, the average Tsimane' ate chicken and pork worth 0.25 and 0.18 *bolivianos*, lower than the median value of meat and fish from the wild. When we group into three fascicles all crops, all wildlife, and all livestock (Table 10.10), we see wildlife is everything. Over the nine years of the study, the median daily value of animal wildlife eaten was 11.37 *bolivianos*/person, eight times higher than the median daily value of the four crops consumed (1.34 *bolivianos*/person). At the bottom lay livestock and eggs. Hands down, either wildlife or crops consumed dwarfed the daily value of livestock and eggs eaten (0.03 *bolivianos*/person).

Of the ten foods from the market, only sugar, noodles, and cooking oil stood out in monetary worth. In a day, per person, Tsimane' ate 0.24 *bolivianos* worth of sugar and ~0.10 *bolivianos* worth of noodles or cooking oil. A few households ate bread and jerky, which had negligible median daily values of ~0.01 *bolivianos*/person. Most people did not eat flour, beef, cow heads, canned sardines, or lard (Table 10.9), their median values nil. After grouping market foods, one sees that refined foods (chiefly pasta and sugar) and meat (mostly jerky) accounted for the largest share of daily values. Per person, daily, Tsimane' ate 0.58 *bolivianos* worth of refined foods, 0.44 *bolivianos* worth of meat and canned sardines, and 0.21 *bolivianos* worth of cooking oil and lard (Table 10.10).

Figure 10.2 shows the contribution of foods groups to the total daily monetary value of foods eaten. Building on Table 10.10 and the nine years of the two studies, the pie-charts show wildlife and crops ruled the story every year. Close to 80% of the median daily value of food consumption of Tsimane' came from wildlife they caught and the four crops they farmed. Far, far behind came meat (principally jerky) from the market and a ragtag bunch of other foods, their slivers often too small for the unaided eye to see.

Insert Figure 10.2

Returning to Table 10.10, mean and median real daily cash values of all foods eaten by a person were 14.17 and 10.37 *bolivianos* (SD=13.40) (Table 10.10). If I take out the uncommon year 2010, I am left with mean and median daily values of 12.70 and 9.40 *bolivianos*/person. At an exchange rate of about seven *bolivianos* to the USA dollar, and leaving aside Purchasing Power Parity conversions, the figures suggest a daily mean and median income, *per capita*, of

$1.81 and $1.35, higher if we bring back 2010 (mean = $2.02; median = $1.48). Later, I return to the importance of the finding and to how the estimates compare with daily measures of monetary earnings.

Trends from the longitudinal study (TAPS) in real daily per capita value of foods consumed, grouped by food categories. Table 10.11 shows the yearly real value of all foods eaten per person grew by 4.5%, more for crops (6.2%) than for wildlife (4.2%) or refined foods (4.4%) while the real value of livestock and market meats eaten did not change. If Tsimane' bought all their food, the figures would say they were spending more, and if you equate expenditures with income, the growth rates toll they were getting richer by the year.

Insert Table 10.11

Though it might reflect near ideal income or expenditures, the monetary worth of foods consumed tells a spurious yarn. Compare Table 10.11 with Table 10.8B. Table 10.11 says the yearly value of crops eaten rose, columns 1-4 of Table 10.8B say amounts fell. The increase in values of Table 10.11 came from changes in real prices, not from changes in how much people ate. Same with wildlife. Increases in the real price of wildlife means the real value of wildlife eaten by a person went up by 4.2% a year; Table 10.8B shows amounts went down or did not change. The amounts consumed of birds, fish, and wild mammals and reptiles stayed flat or shriveled. Only with refined foods (chiefly noodles) do growth rates in quantities and prices go together. Unassailable increases in the real value of refined foods went along with increases in the amount of pasta eaten without eating less of other refined staple foods (Table 10.8B, columns 18-21).

Gini coefficients: Quantity, cash value, and trends

I take for granted that in inbred rural societies far from conurbations, the financial value of foods eaten stands for a mongrel of income and consumption, making inequality in food consumption an embodiment of deeper material disparities. If households, *pace* the young Marx, hunt and fish in the morning, farm in the afternoon, rest in the evening, and share endowments, meals, and predilections, they should display small differences in food consumption. Since they probably don't follow the script, food portions will vary between families even in the simplest mode of production. Thus, I have three aims.

First, I want to compare inequality between *(i)* households and *(ii)* individuals. Had we seen what each member ate in a household, we would not bother with the comparison because inequality between individuals would surpass inequality between households. This would happen because the estimate of inequality between individuals based on what each ate would absorb differences between individuals and differences between households. This does not happen with our data owing to the way I educed *per capita* values. I took household amounts and divided them by household size to derive *per capita* values. Done so, inequality using *per capita* figures could be higher or lower than inequality using the total figure for the household. Here is why. Envisage a society of two households consuming all the rice they farm. The household that grew and ate more rice had five people and consumed daily ten kilograms of rice; the other household had a singleton who ate one kilogram of rice each day. Measured between households, the gap in rice consumption between the rich and the poor household would reach nine kilograms. Measured *per capita*, the gap would come down to one kilogram[xi]. In this example, inequality between households would surpass inequality between the average of individuals (*per capita*) because of differences in household size. We do not know beforehand which of the two inequalities ─ household or *per capita* ─ is larger. We need to consider both until we find if they differ.

Aim two. I want to pinpoint where inequality lies, whether in things like the staple crops Tsimane' grow, in the wildlife they catch, in the foods they buy. By introducing inexpensive foods, market could level food portions between households, which might be unequal in autarky. In the barest sealed economies, hunting-and-gathering bands, successful foraging rests on skills and knowledge, and, when mixed with stinginess, could result in copious amounts of fish and game among some groups and less or none in others. However, in autarky anyone can grow hardy crops, so perhaps inequality in those foods is small. Since we know little about inequality in what people eat, I go slow. I start by estimating the Gini coefficients of quantity inequality for the 21 foods measured, with quantities computed from household totals and from *per capita* size of food portions. The story should dovetail with the earlier, bald, analysis of the share of households eating a food (Table 10.4B). Canned sardines should have a high Gini because few households ate them. Then I switch to inequality in the monetary value of foods. Again, I tally inequality using household totals and *per capita* values, but this time I aggregate commodities into financial bundles, like the monetary value of crops or refined foods, a doable task because foods come expressed in *bolivianos*.

Third, I want to assess not only the amount of inequality but also its stubbornness, its trends and breaks, hard ups and hard downs. Drifts and ruptures, together, show how inequality changes; one without the other blurs the canvas. Because I am interested in inequality over time I restrict the probe to the nine years of the longitudinal study (2002-2010). My focus being on all Tsimane', I merge all villages to estimate the Gini coefficients for each year and the average yearly Gini. In addition, I indulge in methodological solecism by including everyone in all years in one big group, a group for whom I compute a grand Gini. As a starting point to describe inequality, a grand Gini spanning many years garners more trust than a yearly average because it rests on a larger sample, coming from many years, many villages, many households, and because it flattens the quirks of years. I realize Gini coefficients, by dead hand, are calculated for a year, but why can't they be tallied for a novennial period? Besides allegiance to an old habit, I see nothing special about using a year as the unit of time to portray inequality.

<u>*Quantity: Grand Gini coefficient of per capita quantities*</u>. Tables 10.12 and 10.13 show Gini coefficients for the 21 foods, computed from household totals (Table 10.12) and from *per capita* quantities in a household (Table 10.13).

Insert Table 10.12-10.13

Before describing inequality, I assess the trade-off between using the grand Ginis for all years or yearly Ginis, totals of a household or *per capita* food quantities of a household. *[<u>i</u>] The yearly mean Gini coefficient compared with the grand Gini coefficient for all years*. For the Gini coefficients expressed in *per capita* terms, the mean yearly Gini and the Gini for the grand total were indistinguishable (Table 10.13). The differences range from none for articles such as game animals and most refined foods to 0.03 Gini points for fish. Almost the same results appear with Ginis of household totals; the yearly mean and the grand total were alike except for the Ginis of rice and maize (Table 10.12). Maize one can skip because, as a food, it has modest value, serving to flavor *chicha*. However, with rice, the average yearly Gini and the grand Gini were 0.78 and 0.42, two appreciably different numbers. I come back to this finding below. *[<u>ii</u>] Gini coefficients from household totals compared with Gini coefficients from per capita quantities in a household*. A comparison of the grand Gini from household totals (Table 10.12) and from *per* *capita* values (Table 10.13) shows imperceptible differences. A comparison of yearly mean values between Ginis of household totals and Ginis of *per capita* values reveals no difference, again, with two exceptions: the Gini for rice and the one for maize. The yearly mean Gini of rice assessed from household totals was 0.78 (Table 10.12), 0.43 assessed at the *per capita* level (Table 10.13). Thus, it does not matter whether one uses the yearly mean Gini or the grand Gini, nor whether one uses household totals or *per capita* values. Because it rests on more observations, I pick the grand Gini, and because it comes closer to what an ordinary Tsimane' would eat, I prefer *per capita* figures. Rice requires that we use several Ginis to describe it accurately. For most of the discussion I rely on the grand Gini amalgamating all years, all villages, and all households, shown in the penultimate column of Table 10.13, but inequality in rice consumption I deal with by using several Ginis.

Gini coefficients of inequality in food consumption varied substantially, from staples like plantains (0.35), accessible to the multitude, to delectables like duck (0.99), pork (0.98), wild birds (0.96), and cow head (0.92) eaten by a few (Table 10.13). The finding is evocative of Table 10.4B: 99% of households ate plantains while only 2% ate duck, 8% pork, 9% wild birds, and 14% cow head. The most demotic foods included crops Tsimane' grow (plantain = 0.35; rice = 0.44), fish they caught (0.60), sugar they bought (0.53). There is a greater range in the Gini coefficients of foods Tsimane' produce than in those they purchased. Consumption of small domestic livestock (fowl, swine) and wild birds have the highest Ginis ─ all over 0.85 ─ while consumption of plantain and rice have the lowest: plantains at 0.35, rice at 0.44. The Ginis of market foods also varied, but not as much as the Ginis of town foods. The Gini coefficient of white sugar, a condiment only found in stores, lies bookended by the Ginis of common foods Tsimane' produce: rice and plantain with lower Ginis, and manioc and fish with higher Ginis than sugar. The Ginis for the consumption of delicacies like cow head (0.92), lard (0.87), canned sardines (0.86), and flour (0.86) were high, but not as high as the Gini coefficients for the consumption of wild birds or backyard livestock.

Relying on the numbers in the next-to-last column of Table 10.13, I computed averages of Ginis for all foods and parcels of different foods. The average Gini of the 21 foods was 0.76 (median = 0.79). To enliven the average, I picked three staples with Ginis closest to this mean ─ jerky (0.79), eggs (0.78), game (0.73) ─ and looked at the share of households eating these staples. Table 10.4B says 58% of households ate game meat, 39% eggs or jerky. It does not look like an egalitarian fellowship when more than half the households do not eat a staple. I see no noteworthy difference between the average Gini of market foods (mean = 0.78) and own, village, foods (mean = 0.74). Own foods had a lower average Gini because the average Gini of the four crops cultivated by Tsimane' (0.57), brought down the relatively high average Gini of the three forms of animal wildlife (0.76), and the indisputably high average Gini of livestock (0.90). Compared with market foods, local foods showed a larger spread in Ginis. A gap of 0.33 Gini points separated the average Gini of livestock from the average Gini of crops. The Gini of market foods ranged from a low of 0.70 for the average of refined foods to a high of 0.85 for the average of meats and canned sardines; the gap of 0.15 Gini points is half as large as the gap separating the smallest from the largest Gini of village foods.

Rice craves special attention. Three of the four Gini estimates for rice were nearly the same, 0.42 to 0.44, but the yearly average Gini from household totals was higher (0.78). If we take the higher value, rice would climb the inequality ladder to the middle of the pack, resting next to the Gini of egg consumption (0.78), below jerky (0.79) and above the Gini of game consumption (0.73).

In sum, plantain is the great leveler; everyone had and ate it. Thereafter, inequalities rose by steps to rice, sugar, fish, manioc, a tie between game and refined foods (cooking oil, noodles, bread), then eggs and jerky, climbing to another tie between mostly six store-bought articles (beef, maize, chicken, flour, canned sardines, lard), ending with four meat delicacies (duck, pork, wild birds, cow head), eaten by the select. In the arc of food consumption inequality, staples from the market and village lay mixed throughout. Inequalities in store-bought and village foods were alike.

Cash value: Grand Gini coefficient of per capita values. Tables 10.14 and 10.15 show Gini coefficients of the cash value for three bundles of village staples (crops, wildlife, livestock and eggs) and three bundles of staples purchased in stores (meat and canned fish, lard and cooking oil, refined foods), computed from household totals (Table 10.14) and from *per capita* monetary values of food consumption in a household (Table 10.15).

Insert Table 10.14-10.15

The grand Gini was slightly larger than the average yearly Gini, the difference amounting to 0.02 Gini points for household measures (Table 10.14) and 0.03 points for *per capita* measures (Table 10.15). Ginis from *per capita* values were about 0.03 points larger than Ginis from household totals. The small differences homologate my continued use of Ginis from *per capita* cash values in a household (Table 10.15). However, when describing inequality in the total value of all foods consumed, Ginis from household totals were 0.12 to 0.14 points higher than Ginis from household *per capita* values; unsure, I use both.

In cash values, food from backyard livestock had the largest Gini (0.82), followed by Ginis for store-bought meats and canned fish (0.70), cooking oil and lard (0.66), a tie between refined foods and wildlife (~0.56), bottoming out with farm crops (0.46), the most popular staples. In monetary value, the average Gini of store groceries (0.64) and foods from the village (0.61) were similar.

The size of the grand Gini for all foods consumed depends on how one measures that Gini. If we use household totals, the Gini is 0.58, but if we use *per capita* figures, the Gini falls to 0.46.

Yearly trend and growth rate (%/year) in Gini coefficients of the per capita quantity of food consumed. Building on the yearly values from Table 10.13, in Appendix F I show the year-to-year trend (2002-2010) in the Gini of each food. For nine staples, Ginis increased yearly, by an average of 0.5%, more for lard (1.6%), beef and maize (0.6%), than for rice (0.2%) or game (0.1%). For another nine staple foods, Ginis fell yearly, by an average of 1.4%, from oil (-4.3%), sugar (-2.6%), and fish (-2.1%), to as little as -0.1% for jerky. The Ginis for bread and two commodities with high Ginis (birds, ducks) had flat trend lines.

More puzzling, the graphs show brusque rises and falls. A few examples follow of foods whose Ginis changed by about 0.10 Gini points or more from one year to the next[xii]. The Gini of manioc rose by 0.10 points from 2002 to 2003, then fell by the same amount from 2003 to 2004. Rice inequality spiked from 2003 to 2004, followed by a commensurate shrinkage during 2004-2005. Gini coefficients for game consumption rose and fell several times by large amounts every year from 2007 until 2010. Other examples of hard falls include plantain (2008 to 2009) and cooking oil (2005 to 2006); examples of high jumps include jerky (2008 to 2009) and flour (2007 to 2008).

Why do some Ginis vary so much in a short time? The answer lies not in how I estimated Ginis. In using quantities, I left no room for prices to muddle trends. Ginis of quantities and Ginis of values both had steep climbs and precipitous drops. Nor can one blame my use of *per capita* values; sudden rises and crashes happened, as well, with Ginis from household totals (Table 10.12). Nature's proverbial rack ─ the flood, the pests, the plagues, the unexpected emigration of wildlife ─ could fuel temporary inequality, especially if families are unhabituated to helping others in distress. Maybe. Environmental strains could explain the rise of inequality in silvan foods and farm crops, but how do we explain the sudden rise in the inequality of jerky (2008 to 2009) or flour (2007 to 2008) consumption, or the sudden fall in the inequality of using cooking oil from 2005 to 2006, all edibles bought in towns[xiii]? Perhaps the amounts of foods consumed are linked so when the harvest of an elite cash crop like rice suffers, inequality in rice consumption rises, but so does consumption and inequalities in foods purchased with cash from rice sales, foods such as cooking oil or jerky. Not all inequalities are equal; prime inequalities could affect other inequalities[xiv].

Yearly trend and growth rate (%/year) in Gini coefficients of per capita and household values of food consumed. I now move to a more conventional reading of inequalities in food consumption by examining the Ginis of monetary values (rather than quantities) for three bundles of foods from the market and three bundles of village foods. For all bundles, I show results using household totals (Table 10.14; Figure 2 [Appendix G]) and *per capita* figures from households (Table 10.15; Figure 1 [Appendix G]).

[i] Gini coefficients from per capita values. The grand Gini for all staples averaged 0.46, but the average masks two features: the Gini was mercurial, rising by about 0.10 Gini points from 2007 to 2008, falling by the same amount between 2008 and 2009 (Table 10.15). A study of Tsimane' in 2003 or 2008 (Ginis ~0.48) would find more inequality than one done in 2006 or 2009 (Ginis ~0.36). Years matter. Next, look at trends in Figure 1 of Appendix G. During the nine years of the study, the Gini for overall food consumption contracted by 0.2%/year. Income inequality is rising in much of the world and, if we believe the passage of time allows the market incontrovertible chances to take in remote economies in the countryside, we might believe inequality would rise among Tsimane'; it hasn't.

Inequality in the consumption of village foods had the highest and lowest Ginis. With values, as with quantities, the highest inequalities lay in the consumption of home livestock (0.82) while the lowest inequalities (other than in 2010) lay in crops (0.46) (Table 10.15). Between the extremes was inequality in wildlife consumption (0.56). Trend lines for Ginis of village foods oscillated and declined yearly by an average of 0.7% for wildlife and 0.3% for own livestock and eggs (Figure 1, Appendix G). The trend line of Ginis for crops, too, swung gently until 2009, when the Gini almost doubled from 0.35 (2009) to 0.65 (2010). The peak in 2010 pulled up the trend line of crop inequality, causing the growth rate to reach 4.6%/year. When I drop 2010, the yearly growth rate for the Gini of crop consumption falls to 0.7%, still positive yet smaller and closer to the trend lines of the other two bundles of village foods. Other than the large change in the Gini of crop consumption during 2009-2010, the only other Gini with a keen change was the Gini of village livestock consumption, which rose by 0.18 points during 2007-2008.

In size, the Ginis of market foods were sandwiched between the Ginis of different types of village foods (Table 10.15). Ginis of market foods swerved mildly as they declined yearly by 0.5% (meat and canned sardines), 2.5% (lard and cooking oil), and 1.4% (refined foods). Of the three bundles of market foods, the decline in the Gini coefficient for the consumption of lard and cooking oil is most striking; between 2002 and 2007, this Gini shrank by 0.17 points, from 0.75 to 0.58. In contrast to the Gini of village foods, the Ginis of market foods had no hard ups or hard downs.

[ii] Gini coefficients of the monetary worth of daily food consumption assessed from household totals compared with Gini coefficients assessed from household per capita values. Rather than discussing separately Ginis from household totals and Ginis from *per capita* values, I compare the two by taking the level and growth rate of Ginis from household totals (Table 10.14; Figure 2 [Appendix G]) and subtracting their cognates from household *per capita* monetary values (Table 10.15; Figure 1 [Appendix G]).

What I found. First, Ginis from *per capita* values were larger than Ginis from household totals[xv]. Across the six bundles of food types, Ginis from *per capita* values were, on average, 0.04 points larger than Ginis from household totals. The gap between *per capita* and household total was bigger for town foods (0.05) than for village foods (0.02). Second, if we leave aside bundles and focus on the Gini of all foods together, we find the opposite: Ginis from household totals were much larger than Ginis from *per capita* values. The difference was 0.12 for the grand Gini and 0.14 for the mean yearly Gini. The gulf across years went from a low of 0.04 points in 2010 to a high of 0.23 points in 2004. Third, yearly growth rates for Ginis from household totals or from *per capita* values were almost the same.

The Gini coefficient of inequality in the cash value of all foods eaten deserves notice because, in near autarky, it summarizes the economic disparity of the society. One could reprove the assertion, arguing one doesn't know how far the Gini for the value of all staples eaten mirrors income, expenditures, consumption, or their mixture. Regardless of the exegesis, when and how a Gini is measure tells one how much inequality one finds. Pick 2004 and compute, from household totals, the Gini coefficient in the monetary inequality of all foods consumed and you see a most unequal society, a society with a Gini 0.23 points higher than the Gini from the selfsame society measured in neighboring years, or with *per capita* (rather than household) values.

Macronutrients: Amounts, trends, and Ginis

Despite its details, the tale told has a hole. The amount and value of foods eaten, or their inequality, is a first step in assessing welfare and economic disparities in autarkic Cockaigne. The size of food portions is a blunt measure of nutrition; the monetary value of foods eaten is a coarse measure of income. Inequality in the amounts of particular staples consumed tells us who is poor and who well-to-do; differences between households in the cash worth of their daily meals points us to the supra economic inequality of the society.

Which makes sense until you realize the tale does not align with what we care about: the amount and disparity in macronutrients intake. Food quality aside ─ and I agree it is a heavy aside ─ who cares if people cannot eat many wild game animals because they make up for it with meat from shops? As long as people can switch between foods, they could offset shortfalls in animal proteins from the wild with a plenitude of animal proteins from stores. Same for fats, carbohydrates, and calories. Amounts and disparities in the consumption of particular staples could get rubbed out once we examine underlying macronutrients hidden in the foods. The ability to switch between foods could shield people from changes in their macronutrient intake. Quantity, values, and macronutrients need not correlate tightly. One could have, I suppose, a well-nourished cashless people, or much inequality in income as discerned from the monetary value of meals, but modest inequality in macronutrient intake.

Amounts. Relying on the longitudinal study, I reckoned the daily number of kilocalories (kcal) and grams (gm) of protein, fats, and carbohydrates eaten by a person, by food groups and for all foods. I computed averages (Table 10.16A) and medians (Table 10.16B) for macronutrients, the former larger than the latter. Putting tables 10.16A and 10.16B side by side, you see, for instance, that for the total amount of macronutrients among all foods, averages for kilocalories and carbohydrates were 15% larger than medians. With proteins and fats, averages were 22.32% and 31.43% bigger. Forced to choose between means and medians, I find it fairer to side with medians, as many households did not eat some staples (Table 10.4B).

Insert Tables 10.16A and 10.16B

During 2002-2010, in a day, an average Tsimane' ate a median of 2869 kilocalories, 87 grams of protein, 48 grams of fat, and 514 grams of carbohydrates (Table 10.16B)[xvi]. Figures 10.3A-10.3D show where macronutrients came from. Most macronutrients came from farm crops Tsimane' harvested and from game they caught. Amalgamated across years, the four crops ─ rice, plantain, manioc, and maize ─ supplied 64% of calories (Figure 10.3A) and 86% of carbohydrates (Figure 10.3D). Forty-seven percent of proteins came from fish, game, and birds (Figure 10.3B). These big numbers show Tsimane' remain locked in the villages for their livelihood. Stores filled a gap. Sixty-two percent of fats came towns staple foods: 35% from cooking oil and lard, 27% from fresh meat, jerky, and canned sardines, all commodities purchased from merchants in shops, stalls, or in the village (Figure 10.3C). Depending on the macronutrient chosen, one could end up with different conclusions about Tsimane' autarky. Pick fats and Tsimane' show less economic autonomy than if you pick calories.

Insert Figures 10.3A-10.3C

Trends. The right-most column of Table 10.16B has the yearly rate of change for macronutrients eaten; the rates show an economy shifting fast to market dependence. The consumption of all macronutrients from village foods contracted, though some by small amounts. The amount of calories and carbohydrates from crops Tsimane' grow, and the amount of proteins from wildlife they catch each declined by about two percent each year. Unlike the consumption of macronutrients from village foods, the consumption of macronutrients from town foods increased. Fat from cooking oil and lard grew yearly by 9.7%. Calories, proteins, fats, and carbohydrates from refined foods rose each year by big amounts: calories by 4%, proteins by 6.2%, fats by 2.3%, carbohydrates by 3.6%. The rate of decline in macronutrient consumed from village foods was steeper than the rate of increase in the consumption of macronutrients from town foods, causing the net, combined, macronutrient consumption from towns plus village staples to shrink. Every year, Tsimane' ate 1.2%, 1.7%, and 1.3% less calories, proteins, and carbohydrates.

Ginis. Table 10.17 (part A) and Appendix H show levels and trends of Ginis for the four macronutrients. I see three things. First, Ginis varied from 0.31 for calories or carbohydrates to 0.46 for fats, with wildlife in the middles (0.38). Second, inequality in macronutrient consumption fell yearly among all macronutrients, more for proteins and carbohydrates (-1.8%) than for calories (-1.6%) or fat (-1.2%) (Appendix H). During 2002-2010, Tsimane' became a more egalitarian society in the amount of macronutrients they ate. Last, the trend lines in Appendix H are smooth, especially for inequality in the consumption of calories and carbohydrates, but a few inequalities showed sudden leaps and falls. For instance, between 2007 and 2008 the Gini for fat rose by 0.11 Gini points and between 2003 and 2004 the Ginis for calories and carbohydrates fell by about 0.07 Gini points.

Insert Table 10.17

Part B of Table 10.17 presents Gini coefficients of inequality for the consumption of some macronutrients, by provenance. Over the study period, Ginis of calories from refined foods (0.53) were higher than Ginis of calories from all sources (0.31; part A), but resembled the Gini of protein consumption from wildlife (0.55). The Gini of calories from village crops was low (0.33), akin to the Gini of calories from all sources in part A (0.31), which makes sense since most calories came from crops Tsimane' grew. Depending on their source, the consumption of animal proteins shows big differences in inequality. The Gini coefficient of proteins from all animals reached a modest 0.48, but was high for proteins from backyard animals (0.80) and meats from stores (0.70). The Gini coefficient of protein consumption from wildlife was high (0.55), similar to the Gini coefficient of calories from refined, store-bought comestibles (0.53)

In conclusion, inequalities in the consumption of macronutrients varied by type of macronutrient and by origin. Macronutrient inequality of calories, proteins, and carbohydrates were low, in the 0.30s (part A), but inequality in fat, which came mostly from merchants, was higher (0.46). In this nook of the world, the market has foregrounded inequality in one type of macronutrient, fat. When we look at specific macronutrients by source we see that markets and animal domestication distend inequality in protein intake. Consumption of proteins from market meats and from village livestock were most unequal, with Ginis of 0.70 and 0.80, very high. Step back and consider inequality of macronutrients from village foods, like calories from plantains, rice, maize, and manioc (0.33) or inequality in animal proteins from wildlife (0.55) and you see a more equitable economy. At the risk of over-selling the findings and reading too much into them, I say it is not so much in hunting and gathering societies one is likely to find the greatest equality in nutrition, but in horticultural ones, and that animal domestication and markets deepen macronutrient inequalities, as seen from the animal proteins Tsimane' eat.

Discussion and conclusions

In the first part of this section I rehearse the strengths and weaknesses of the methods to gather data and estimate statistics, in the second I draw out the main lessons.

***I. Methods*.**

[a] *Shortcomings*. I leave aside well-known weaknesses in any survey of food consumption, like the inability to capture snacking or to eye what people eat. Only watching can address those gaps. Instead, I dissect flaws unique to our surveys.

Season. We gathered data during the dry season; answers could have differed during the rainy one. Depending on the season, amounts eaten will change; rice consumption will rise at harvest time, fishing during the rainless months. Measured by the value of foods eaten, people might appear richer had we surveyed them at other times of the year. Inequality, too, could vary by season. Take hunting, rare in the wet season. Off-season hunting would show more inequality in game consumption since few hunters would have bothered to forage in the rain and even fewer would have been lucky to catch animals.[xvii] *Recall period, household size, and conversions*. Asking people to remember what they ate the past seven days taxed their memory, making them take mental shortcuts. I find evidence respondents, when asked to estimate what they had eaten the past week, tallied the amount consumed the day before the survey and multiplied it by seven to solve for the weekly amount requested by the interviewer[xviii]. The survey was too blunt to pin-point consumption per person. A better survey, in hindsight, should have asked about food consumption the day before the interview and the number of people who ate that food. Especially for wildlife, we leaned on intricate algorithms to convert the catch into kilograms. Math errors likely arose from surveyors when they applied the algorithms and from respondents as they struggle to remember what they had brought home. *Prices*. The methods to glean prices was too loose, albeit formal. Many more villagers should have been asked about prices, and, in towns, many more stores, shops, and traders should have been canvassed about prices. And for both, villages and towns, we should have had guidelines to find a replacement when the person surveyors wanted to interview was not there.

[b] *Strengths*. Since we used a large typical list of quotidian staple foods to assess diet, our portrait of what Tsimane' eat is embracive; I do not think we missed any big item eaten during regular meals. Doing the survey in the dry season had disadvantages, as seen, but also rewards. Trend lines and comparisons between specific years were well-grounded because we retrieved data during the same time of the year; one cannot blame the timing of surveys for the shape of trend lines, its sharp peaks, or deep troughs. The greatest strength comes from having asked the same questions to the same households year after year.

II. Lessons: Amounts, cash values, and macronutrients

Amounts of foods eaten. I like amounts because they keep you near the ground. The analyses of amounts, staple by staple, enhances the resolution of what we see before we bring in prices and package foods into financial bundles.

[a] *Level*. To the untrained nutritionist like myself, the amount of food from forests and farms strike me as large. In one day a typical Tsimane' ate a total of 1.7 kilograms of rice, plantains, and manioc and 0.4 kilograms of wild animals, the latter probably closer to 0.15 kilograms if we rely on median values (Table 10.7). Fish, game, and birds, in that order, chipped in most to their consumption of animal protein, yet Tsimane' relied on a handful of silvan animals: three fish (Figure 10.1C), three mammals (Figure 10.1B), and one bird (Figure 10.1A) accounted for most of the wild animals in meals. One wonders what will happen to the diet of Tsimane' when these animals vanish from overuse, whether Tsimane' will switch to other critters or to meats and canned fish from the market. It caught my eye how seldom they ate backyard animals, or eggs from fowl, because during the early years of our study we gave out chicks to increase the amount of animal protein in the diet of Tsimane' (Chapter 4)[xix]. The amount of chicken meat eaten during the early years parallels the amount in later years, which makes me think, conventionally, that Tsimane' view their livestock as savings or a treat.

From stores Tsimane' did not get much. Between beef and jerky, they got 0.02 kilograms of meat, lower than the median 0.15 kilograms of meat and fish from the wild. Per person, the daily amount consumed of cooking oil (0.01 liters), lard (0.009 kilograms), canned sardines (0.01 cans), flour (0.01 kilogram), and the like was small. Of market foods, white sugar stood out. In a day, per person, Tsimane' ate 0.04 kilograms of sugar, equivalent to one third of a tablespoon, a small amount by our standards but a large one by theirs, unaccustomed as they are to granulated sugar. In volume, if not in quality, their diet seems reasonable: a large amount of local foods splashed with some processed foods from stores.

[b] *Inequality*. Unadorned statistics and Gini coefficients tell the same story: foods fall under a core and a periphery, common and rare. At the top, in popularity, one finds plantain, rice, manioc, fish, and sugar. Nearly all households ate these staple foods, the shares ranging from ~90% or over for most of these foods to 78% for sugar. Below came market foods, which, though common, fewer households ate. About half (52%) the households ate noodles, 49% ate bread, 45% used cooking oil, and 24% used flour. At the bottom, in usage, came delectables from the homestead, such as duck and pork and their byproducts, and cow heads from the market. Between two percent and 15% of households ate these luxuries (Table 10.4B).

Gini coefficients echo these findings (Table 10.13). Gini coefficients for the amount of popular foods like plantain (0.34), rice (0.43), manioc (0.66), fish (0.57), and sugar (0.52) were the lowest. These foods most households fetched and ate. Then came market foods like noodles, bread, and cooking oil with Ginis in the 0.70s, followed by lard, flour, beef, and canned sardines with Ginis in the 0.80s. Ginis for the kilograms of birds, ducks, pork, and the number of cow heads eaten were the highest, all with Ginis over 0.90.

What I cannot tell, and others need to fill in, is what lies behind inequality in food choices ─ whether prices, tastes, income ─ and what caught my attention is the gamut of inequalities. One might believe that in small, rural, non-industrial economies much untouched by the market there would be more equity in food consumption, especially if people shared. What we found does not align with beliefs. Even, or especially, with village foods like backyard animals and wild game we see Ginis over 0.70, on a par with the Ginis of most market foods.

Where I see beliefs confirmed is with farm crops, but not with all. Manioc has a high Gini (0.66) because not all households can grow manioc, or prepare *chicha* with, it. Households that turned Protestant aquabib, households without women to make *chicha*, or households with men working away would be less likely to grow manioc or drink *chicha*. Since maize is used to ferment manioc-based *chicha*, maize inequality and manioc inequality should go together as they mix in the same cauldron. Which leaves rice and plantain. Rice is the premier cash crop and yet has one of the lowest Ginis, a finding unsurprising and surprising. Unsurprising because rice is among the easiest ways a household can earn money; most households grow, sell, and eat rice (Chapter 6, Table 6.3). Jolting because I think of a cash crop as an ambassador of the market economy and as a stoker of inequality. We arrive at plantains, the jewel in the crown of equality. Ancient, hardy, perennial, self-sustaining, indifferent to neglect, plantains lie there like a faithful friend ready to supply food to anyone who grows it. Standing majestically in fields fallow or next to budding crops, plantains are there for anyone to take, sometimes without asking the owner.

[c] ***Trends in level and inequality***. Some foods are on their way out, some expanding. The likelihood of eating manioc and pork and the amounts eaten are falling, as are the meal portions of maize, game, and lard (Table 10.5, 10.8A-10.8B). The declining consumption of pork or lard is not worrisome, for they are treats few eat, but the declining consumption of manioc and its hand-maiden, maize, is troublesome for it could augur the passing of traditional *chicha* drinking, the friendly call Tsimane' use to bring people together. The shrinking amount of game meat eaten per household, 4.2%/year, or per person, 2.4%/year, could mean Tsimane' are switching to other animal proteins, or that nature's bounty is dwindling. We can't tell. The chances of finding game meat in a meal has fallen for a long, long time. At the start of this chapter I quoted Nordenskiöld saying back in 1924 that meat from game animals almost always appeared in meals. By the time we did our study, only 58% of households ate game meat (Table 10.4B).

On the rise are fish from their lands and jejune foods from the market. The chances a family would eat fish from nearby rivers and lakes in a week rose yearly by 1.1 percentage points (Table 10.5), but the amount eaten did not change, whether expressed per household or per person (Tables 10.8A-10.8B). What Tsimane' are unmistakably using more is cooking oil, and what they are unmistakably eating more is pasta. The likelihood a household would cook with oil or eat noodles rose yearly by 4.4 and 1.7 percentage points while the daily amount consumed per person rose annually by 1.2% (oil) and 0.8% (noodles). We saw most households used sugar and, following this, Table 10.5 shows the probability a household would use sugar in a week rose by 1.6 percentage points/year while the daily amount consumed, per household, rose yearly by

1.9% (Table 10.8A). Adjusted by household size, however, the daily amount of sugar a person ate did not change during 2002-2010 (Table 10.8B).

In fact, during 2002-2010 Tsimane' did not change too much how much they ate. Thirteen of the 21 staples had flat trend lines. Rice, plantains, wildlife (other than game), meat and meat products from backyard animals (other than pork), meats and canned sardines from the market, sugar, flour, and bread, none of these changed appreciably during the study. For better or worse, Tsimane' have changed their eating habits for manioc, cooking oil, and pasta. All else in their meals remains the same.

Trends in inequality show a society with growing disparities in the amounts of foods eaten (Appendix F). True, with a sample of one Gini for each of the nine years of the study, one cannot be too sure. But the figures adduced in Appendix F nonetheless show inequality in the *per capita* consumption of manioc, rice, maize, birds, game animals, eggs, duck, pork, beef, canned sardines, lard, and bread, all rose over time, albeit by small amounts, other than lard, which increased by 1.6%/year. The Gini coefficients for the consumption of all other foods declined yearly, often by large amounts: fish by 2.1%, cooking oil by 4.3%, sugar by 2.6%, noodles by 1.6%. The pieces of the jigsaw fit. If more and more people consume cooking oil, sugar, and pasta ─ perhaps because of their propulsive boost of energy, as Appendix C shows ─ and if people eat more and more of these staple foods, inequality in their consumption will fall. Other than fish Tsimane' catch, the staples with noticeable shrinking consumption inequality came from the market. By democratizing access to store-bought foods, the market is aggressing the traditional diet of Tsimane'.

<u>*Cash value of foods eaten*</u>. If differences between households in the size of the food portions they cook gets us near to what daily inequality looks like, the monetary value of what they eat each day lets us appraise the economic status of Tsimane'.

[a] <u>*Level*</u>. Measured through the daily monetary value of foods eaten, Tsimane' are income poor. If we equate the worth of foods eaten with income, the average Tsimane' enjoyed a mean and median daily real income of 14.1 and 10.3 *bolivianos* (Table 10.10). If we take out the aberrantly high value from the year 2010, the average and median drop to 12.7 and 9.4 *bolivianos*, lower than the unedited figures, but not by much. In USA dollars, average daily *per capita* figures were $2.02 and $1.81 with and without 2010, and much lower if expressed with medians: $1.48 and $1.35 with and without 2010. We are safer if we stick with medians and do not get sidetracked by the atypical year 2010 since the income difference tallied with and without the misfit year are small, amounting to a rounding error of ten cents.

What we could not see with quantities, but can with cash values, is where monetary worth lies. And it lies squarely with foods households foraged from nature and crops harvested from farmed plots. Across all years and both studies, 79% of the median daily cash value of foods eaten by Tsimane' came from their lands (Figure 10.2; Table 10.10), mostly from wildlife (64%) followed by crops (15%), bottoming out with livestock from their backyard (0.3%). The remaining 20% came from the marketplace, chiefly in the form of sugar, pasta, jerky, and cooking oil.

[b] <u>*Inequality*</u>. Monetary inequalities in food consumption were, with one exception, smallest for financial bundles of village foods than for financial bundles of town foods (Table 10.15). The smallest Gini coefficients were for crops (0.46) and wildlife (0.56). The Gini coefficients for refined foods (0.57), cooking oil and lard (0.66), and animal proteins from the market (0.70) were higher than the Gini coefficients for village foods. At the top of the pyramid

of monetary inequality was livestock consumption from Tsimane' homesteads, which had a Gini of 0.82.

We gained and lost by adding the monetary value of staples and putting them in bundles. After merging we got a clearer sense that inequality in the consumption of village foods is smaller than inequality in the consumption of town foods. Some of that sharpness was lost when examining inequality in the size of food portions, one staple at a time. With values, as with quantities, one sees that inequality in the consumption of own livestock had the largest Gini coefficient, a finding that meshes with how seldom Tsimane' eat their swine, cattle, and poultry (Table 10.4B). But converting portion size into cash values and adding values erases informative details seen when examining inequality in the portion size of each staple. For instance, in Table 10.15 we relinquished the ability to see that, while inequality in the monetary value of consumption of all market staples was high, inequality in the portion size of grocery victuals like sugar, pasta, bread, and cooking oil was low (Table 10.12). Inequality in sugar consumption was on a par with inequalities in the consumption of the most common foods (plantains, rice) while inequality in the consumption of pasta, bread, and cooking oil was in the same league as inequality in the consumption of two signature traditional dishes: manioc and game.

In sum, I conclude that: *i)* different bundles of market staples, like refined foods, *in toto* have more consumption inequality than different bundles of village staples, like wildlife, *ii)* assembling foods into packages to examine monetary inequality blurs our ability to see that many foods from the market have low inequality ─ somehow most households manage to get those foods so the portions eaten by people of different households are not too far off ─ and, finally, *iii)* among foods, backyard animals few households eat, perhaps because they kept them for special occasions or to relieve the acedia of eating the same thing day after day.

[c] *Trends in level and inequality*. I find it hard to make sense of trends in the monetary worth of foods Tsimane' produce and eat because one does not know if the worth stands for pseudo income or pseudo expenditure. Animal wildlife accounted for the largest share of the diet's worth. If Tsimane' could sell wildlife, they would appear rich. Tagging a cash value to the harvest of wildlife is understandable, as the value would stand for dormant expenditure or dormant income. But Tsimane' cannot readily sell birds, fish, or mammals from the wild because the catch would spoil on the way to the market and because townsfolk lack appetite for many wild critters. Nor could they truck the harvest from the wild with other villagers because wildlife villagers are expected to fetch themselves. The exercise of imputing prices to staple foods has merit in showing roughly the value of ideal income or ideal expenditure if the foods fetched directly with one's labor were easily turned into cash.

The cash value of foods consumed and their trends have more meaning if we restrict the analysis to groceries from stores because those Tsimane' must buy. Table 10.11 shows Tsimane' are spending more each year buying groceries, from 4.4% more for refined foods, to 2.1% for lard and cooking oil, down to 0.2% for fresh meat, jerky, cow head, and canned sardines. Rising expenditures in market foods lead to two questions: Why do Tsimane' spend more and what do the trends say about autarky?

Expenditure increases could come from a rise in the amount eaten, in real prices, or both. Tsimane' spend more on cooking oil and refined foods because they are eating more of these foods. Table 10.8B showed that consumption of these commodities has been growing, albeit by small amounts. A rise in real prices would also increase real expenditures, but price rises I prefer to leave aside because I trust our measure of portion size more than our measure of prices. Trends in expenditures on market foods support what we saw earlier: Tsimane' rely more on groceries from stores. The value of village staples eaten also rose, which does not imply, as with market foods, Tsimane' are eating larger portions of village staples. Columns 1-3 of Table 10.11 show a rise in the real value of village foods eaten, but the rise reflects the price I attached to these foods, for across the board Tsimane' were eating less and less of them: less manioc, less rice, less plantains, less game (Table 10.8B; columns 1-11).

If Tsimane' are eating less of the foods they produce and buying more foods in stores, they are losing self-reliance. Because we cannot compare the worth of own foods with the worth of purchased foods, we cannot tell from the trends of Table 10.11 whether Tsimane' are becoming poorer or richer. Despite the thorn in the comparison, we can see that the real value of foods eaten rose yearly by 4.5%. The finding agrees with the information on individual expenditures of Chapter 8. In that chapter I showed that individual (rather than household-level) real expenditures in all articles in the past two weeks rose yearly by 14.6% (Table 8.14). Whether measured directly through individual cash expenditures, as in Chapter 8, or through the *per capita* imputed value of victuals households bought in stores, cash outlays have risen.

Table 10.15 and Figure 1 of Appendix G show that, notwithstanding a few jagged summits and nadirs, inequalities in the monetary value of foods consumed declined. The Gini coefficients of foods from the market fell each year, sharply by 2.5% for lard and cooking oil, less sharply for refined foods (-1.4%), to a modest -0.5% for meats and canned sardines. Inequality in village foods consumed also contracted yearly, but it did so more modestly ─ -0.7% for wildlife, -0.3% for meat and eggs from the homestead ─ while rising sternly for crops (+4.6%). The rise in inequality of crop consumption comes from the rare high Gini of 2010, which reached 0.65 compared with a mean and median yearly average Gini during 2002-2009 of about 0.35. Once I take out 2010, the yearly change in the Gini of crops falls to 0.7%, closer to the growth rate of the Gini coefficient of inequality for the other food bundles.

One other Gini coefficient of monetary values showed a sudden large change: the consumption of meat and eggs from own livestock rose from 0.72 in 2007 to 0.90 in 2008. I cannot explain the jump, but what I think is more interesting is how fast equality recovered (though not completely), falling gradually to a Gini of 0.78 by 2010 (Table 10.15). If we look at the graphs in Appendix F, we see that sudden jumps in inequality were followed by a gradual comeback to former levels of equality. The exception that stands out is inequality in meats from the market; this inequality rose suddenly in 2008 and stayed high until the end of the study in 2010 (Figure 5 of Appendix F; Table 10.13).

The lessons. First, real cash expenditures in groceries from stores rose. The rise matches the general increase in cash expenditures by adults in all goods during the past fortnight (Chapter 8). Second, inequalities have declined every year for all foods (-0.2%), and for most bundles of goods, other than for crops, which rose slightly by 0.7%/year. Third, high inequality did not last in this ulterior economy. Fourth, sudden peaks and sudden falls in consumption inequality highlight a point made in Chapter 9 when examining asset inequality: the year of measurement shapes the tale of inequality.

Macronutrient intake.

[a] *Level*. Our estimates show a daily median intake per person of 2869 kilocalories and 87, 48, and 514 grams of protein, fat, and carbohydrates. The numbers fall within the range of what other researchers found among Tsimane' and meet the daily recommended intake of macronutrients (Kraft et al., 2018, p. 1187).

[b] *Inequality*. Macronutrient inequality varied from extremely low Ginis of 0.31 for calories and carbohydrates to 0.38 and 0.46 for protein and fat (Table 10.17). These are low numbers compared with most of the other Ginis. Only a few Ginis can compete: the quantity of

two crops consumed (plantain [0.35], rice [0.44]; Table 10.13) and the monetary value of all crops (0.39) and all foods (0.42)(Table 10.15).

[c] *Trends in level and inequality*. Trends show things are getting worse for individual Tsimane' and better for the society. Intake of calories, protein, and carbohydrates declined yearly by 1.2% to 1.7%; only the intake of fat increased (Table 10.16B). Tsimane' nutrition is getting worse, not only because they eat more processed foods from the market, but because they consume less macronutrients. On the bright side, inequality in the consumption of all macronutrients has declined between one and 1.8% per year (Appendix H). Merge the two findings and you conclude Tsimane' are becoming more egalitarian in eating poorer quality meals.

Conclusions. I go back to the motivations behind the chapter: an assessment of Tsimane' income and income inequality.

Income. My estimate of the monetary value of foods eaten could be higher or lower than true income. I understate income's true worth because our surveys left aside foods eaten outside the home and foods eaten at home, but which we neglected to ask about. At the same time, I overstate the value of income because I imputed high prices to inexpensive staples, like small fish, reptiles, birds. The countervailing mistakes could leave us with a value for income near the truth.

To assess *per capita* total income ─ the worth of consumption *sans* purchases + money earnings ─ I now combine data from Chapter 8 with data from this chapter. Table 8.27 from Chapter 8 shows that during 2004-2010, mean daily *per capita* real cash earning from wage labor and sales was 5.27 *bolivianos*. Table 10.10 of this chapter shows that during 2004-2010, mean and median daily monetary real values of meals were 13.5 and 12.5 *bolivianos*; if I exclude 2010, mean and median drop to 11.5 and 11.3 *bolivianos*. Of the 11 *bolivianos*, two *bolivianos* (~19%) were spent on market foods; two was money Tsimane' handed to sellers. Which means nine *bolivianos* worth of food consumption came from one's production. Since *per capita* monetary income was 5.2 *bolivianos* and Tsimane' spent two *bolivianos* on food, they were left with 3.2 *bolivianos* of cash each day to spend on other things besides food. Thus, total income from cash expenditures plus the monetary value of consuming what they directly produced amounted to 14.2 *bolivianos*: 11 *bolivianos* from the value of consuming food they produced + 3.2 *bolivianos* in extra cash from earnings. At an exchange rate of seven *bolivianos* to the USA dollar, Tsimane' would have a daily *per capita* income of ~$2, richer than if we had measured income only with the value of foods they farmed and foraged themselves, or measured only with cash earnings. With any of these ways to measure income, Tsimane' still come out poor.

These ciphers permit a new way to measure Tsimane' autarky. If total income ─ imputed plus cash (without double counting) ─ reaches 14.2 *bolivianos* and 5.2 were coins and bills, then 37% of income came from the market (5.2/14.2). In the drama of the market economy, Tsimane' are seated in the back of the ground floor, neither fully self-sufficient looking from afar in the top balcony nor entirely engrossed with cash next to the stage.

Income inequality. Table 10.18 assembles the Gini coefficients for each staple food, the monetary value of bundles of different staples, and the intake of macronutrients.

Insert Table 10.18

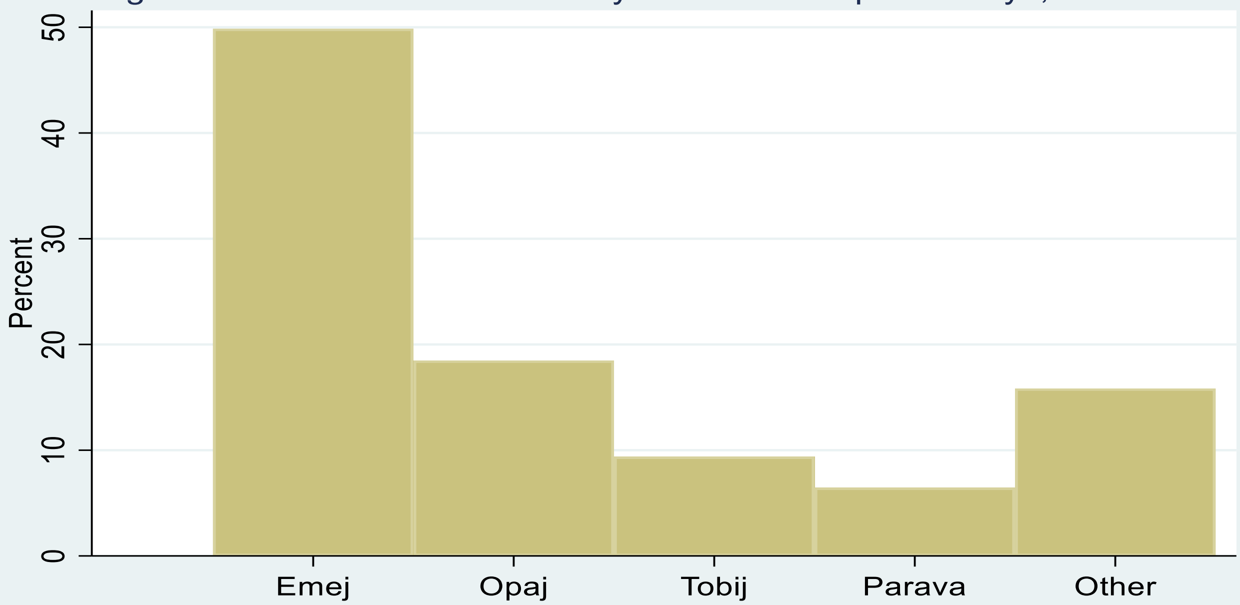
As foods are aggregated with money or macronutrients, their Gini coefficients become smaller. Gini coefficients for the quantity consumed of individual staples had the highest inequality, with a mean and median of ~0.77. The cash value of bundles of different staples had lower inequality (mean and median Ginis ~0.61). The lowest inequality appeared when we merge the monetary value of all foods (Gini 0.46) and when we examine the Gini of each macronutrient (range: 0.31 to 0.46).

What to pick from the gamut depends on motivation. If economic inequality harms the psyche due to invidious comparisons, economic inequality in readily seen, culturally appropriate articles would be the way to go. Among native Amazonians one would want to probe equity in game consumption or *chicha* drinking because neighbors readily notice these happenings and because, depending on one's place in the welfare ladder, the events bestow prestige or spark envy. Inequality in palpable staples is apposite if you want to link inequality with the psyche. However, if you want to speak about overall income inequality in a society to summarize well-being, the total monetary value of all foods eaten is more appropriate.

How much income inequality do we find among Tsimane'? The staples consumed which give meaning to them have a lot of inequality: manioc to produce *chicha* had a Gini coefficient of 0.67 while game meat, which brings prestige to the hunter and joy to the palate, rarely appears in meals (Gini 0.73). The overall income inequality of Tsimane', measured by the value of daily *per capita* food consumption (0.46), is high by international standards (and higher if measured at the level of the household, 0.58). With a Gini of 0.46, income inequality among Tsimane' resembles income inequality in Venezuela, Seychelles, Chile, Cameroon, and Nicaragua, none paragons of equality. Of the 159 countries for which we have recent information on income inequality, Tsimane', if they were a country, would sit in the top quintile[xx]. The high Gini could reflect the economic turmoil that happens as enclosed societies in the hinterland mutate into open ones and expose themselves to the grandness and perils of the world beyond.

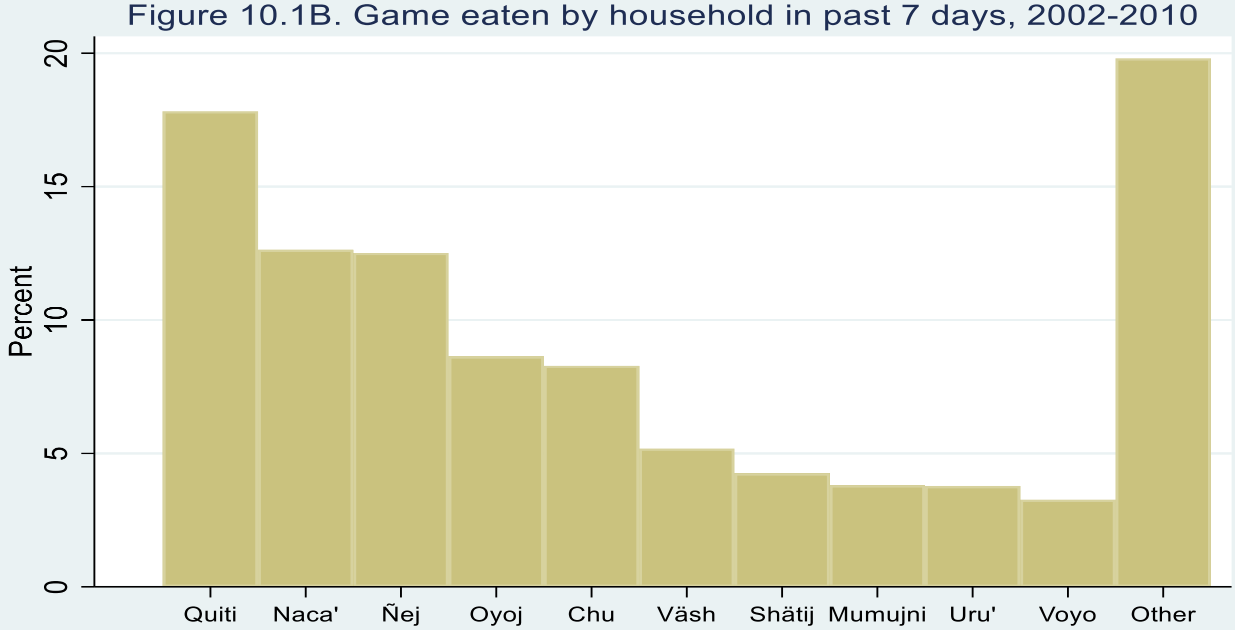
A final point. For a long time, researchers have found it troublesome to assess income inequality in small, remote, non-industrial societies because of the difficulties of defining and measuring income. Return to Table 10.18 and note how near each other are the Ginis of the four macronutrients (range: 0.31 to 0.46) to the Gini coefficient of inequality in all food consumption measured with money (0.46). Inadvertently, we have partly validated the use of disparities in macronutrient intake as a proxy for monetary income inequality. The measures overlap well, though not fully, naturally. For anthropologists studying full-time foragers untouched by the market economy, measuring disparities in macronutrient intake could be a promising way to assess income (consumption) inequality. Like prices, macronutrients allow one to standardize and compare disparate portion sizes from different foods, but unlike prices, macronutrients make imputations less subjective. As long as income = consumption, as happens near autarkic settings, macronutrient inequalities could be a safe way to gauge the equitable spread of income without worrying about the almost hopeless task of sizing monetary income itself.

Figure 10.1A. Wild birds eaten by household in past 7 days, 2002-2010

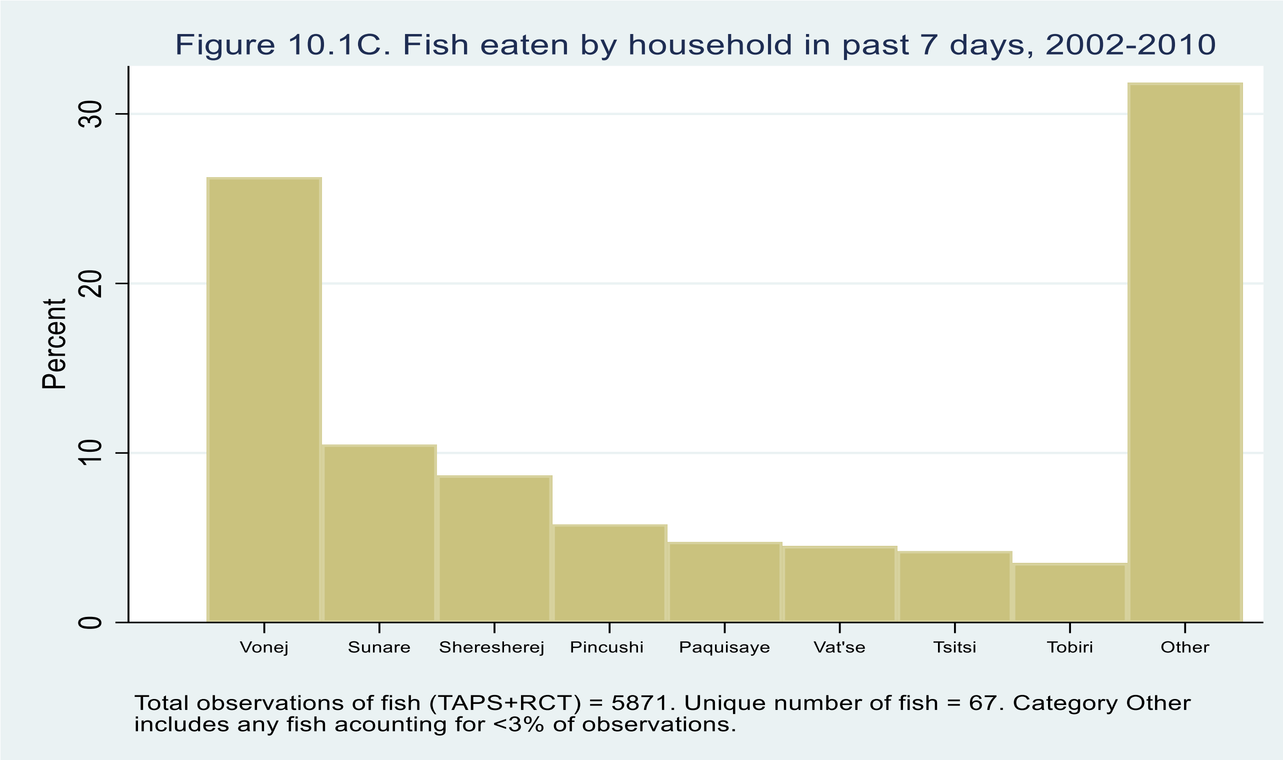


Total observation of birds (TAPS+RCT) = 341. Unique number of birds = 19. Other also includes unidentified birds; each bird in Other accounts for <5% of observations.

Figure 10.1B. Game eaten by household in past 7 days, 2002-2010

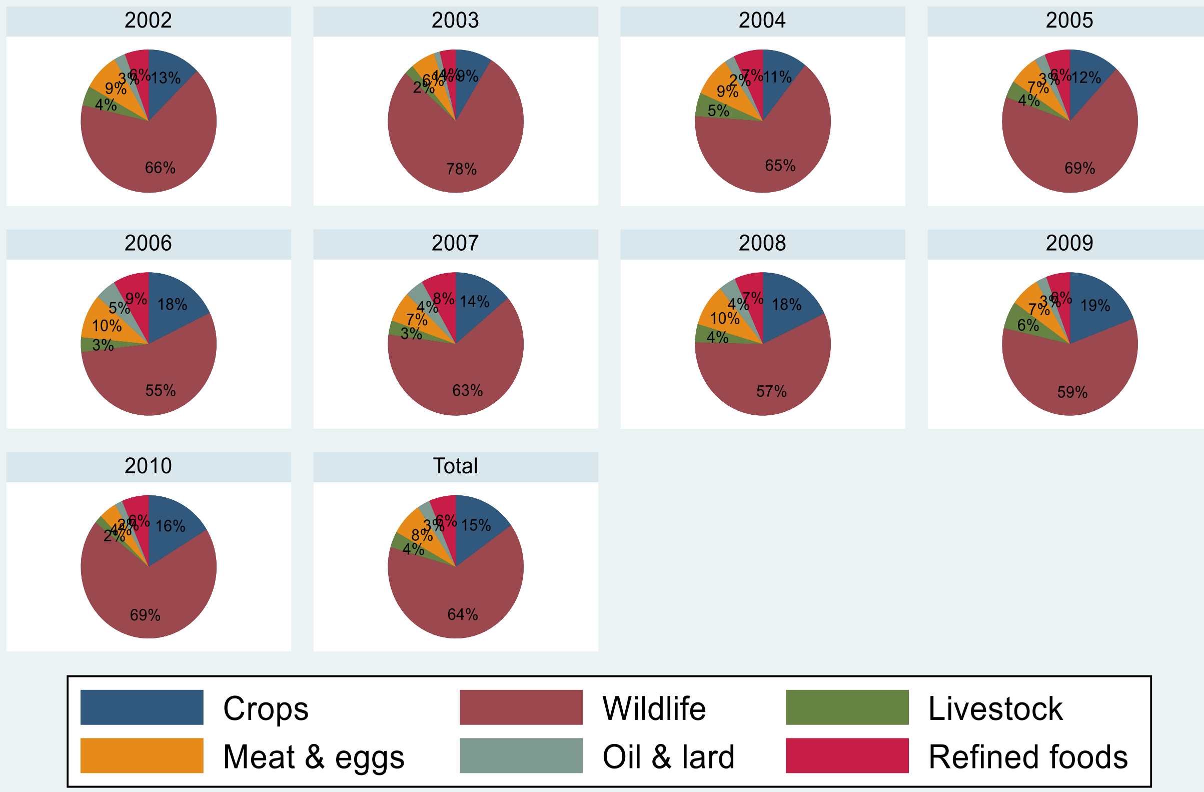


Total observations of terrestrial animals (TAPS+RCT) = 3125. Unique number of animals = 40. Category Other includes any animal accounting for <3% of observations.



Source: Do file, crQuantity_Animals_V2

Fig. 10.2. Composition of median daily real value of food consumption/person:
Yearly & total 2002-2010 [TAPS & RCT]



Source: Table 10.10. Do file anFood_V3

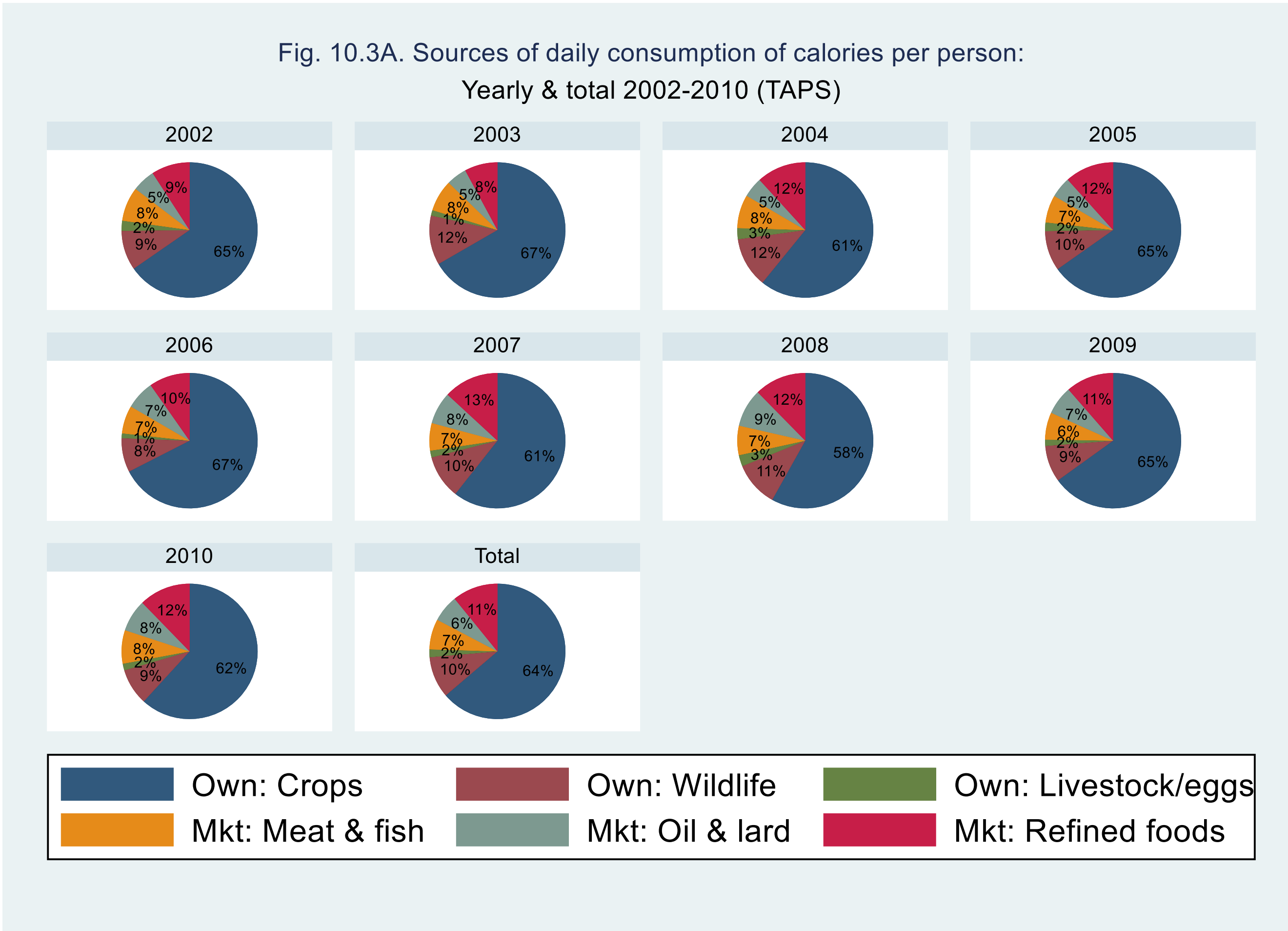
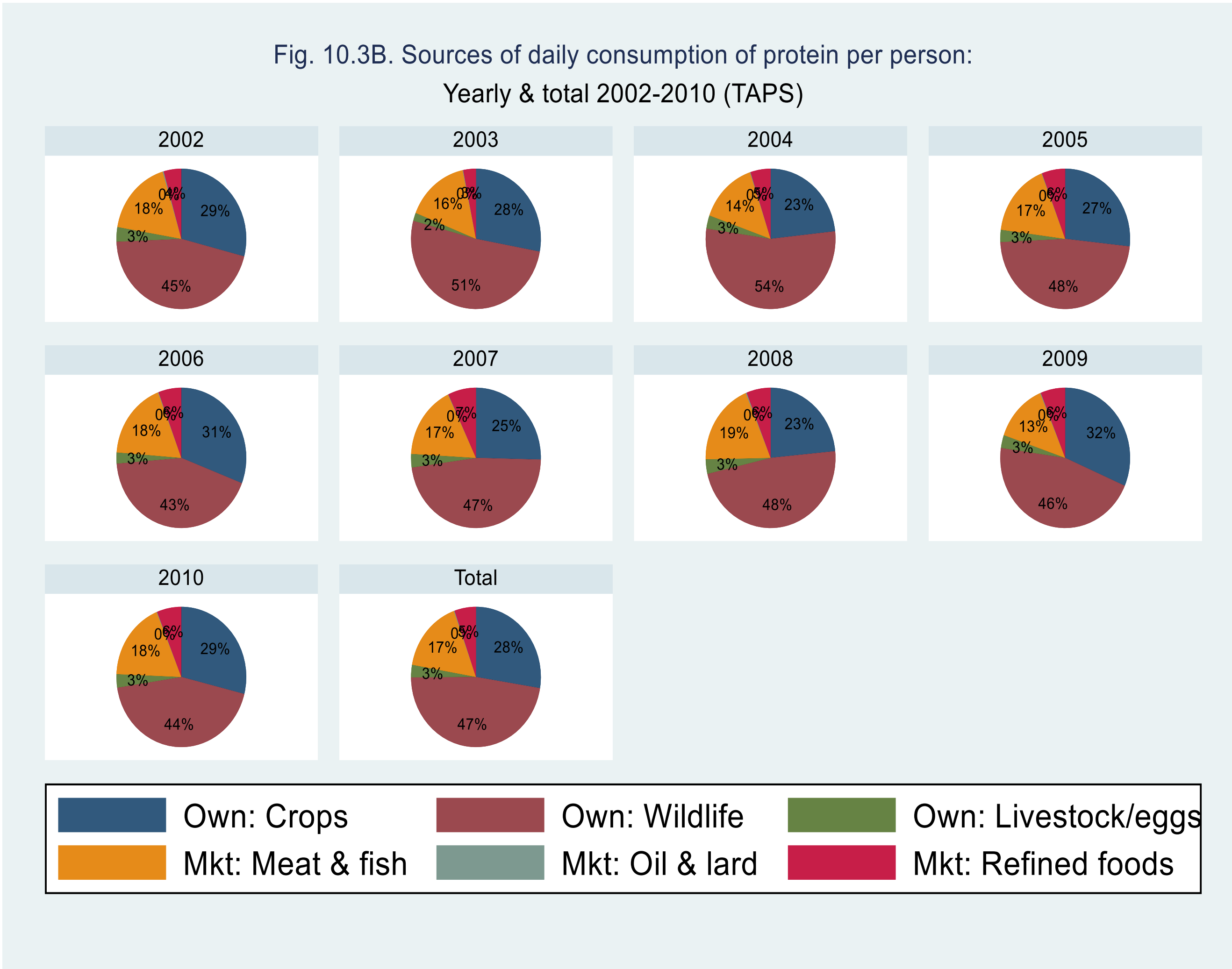
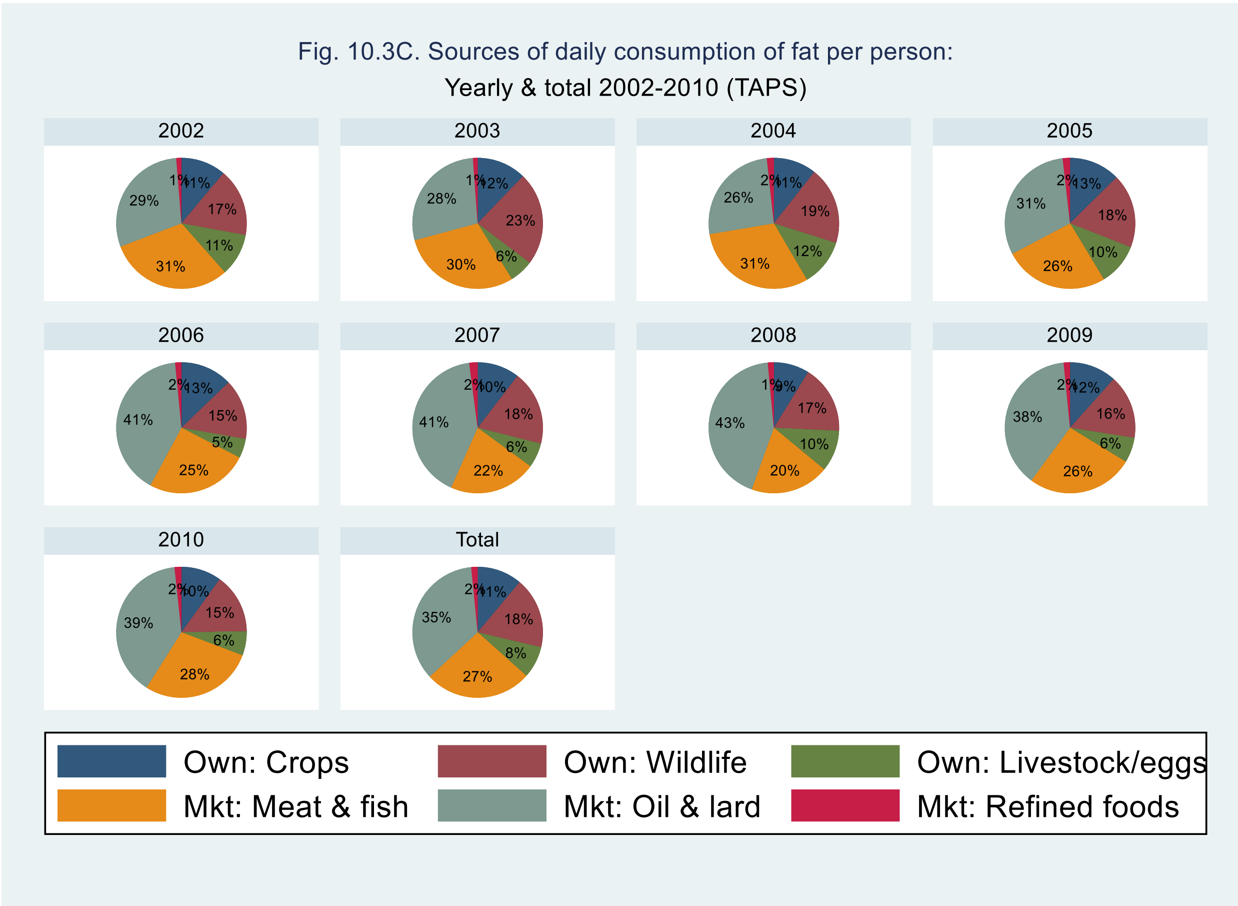


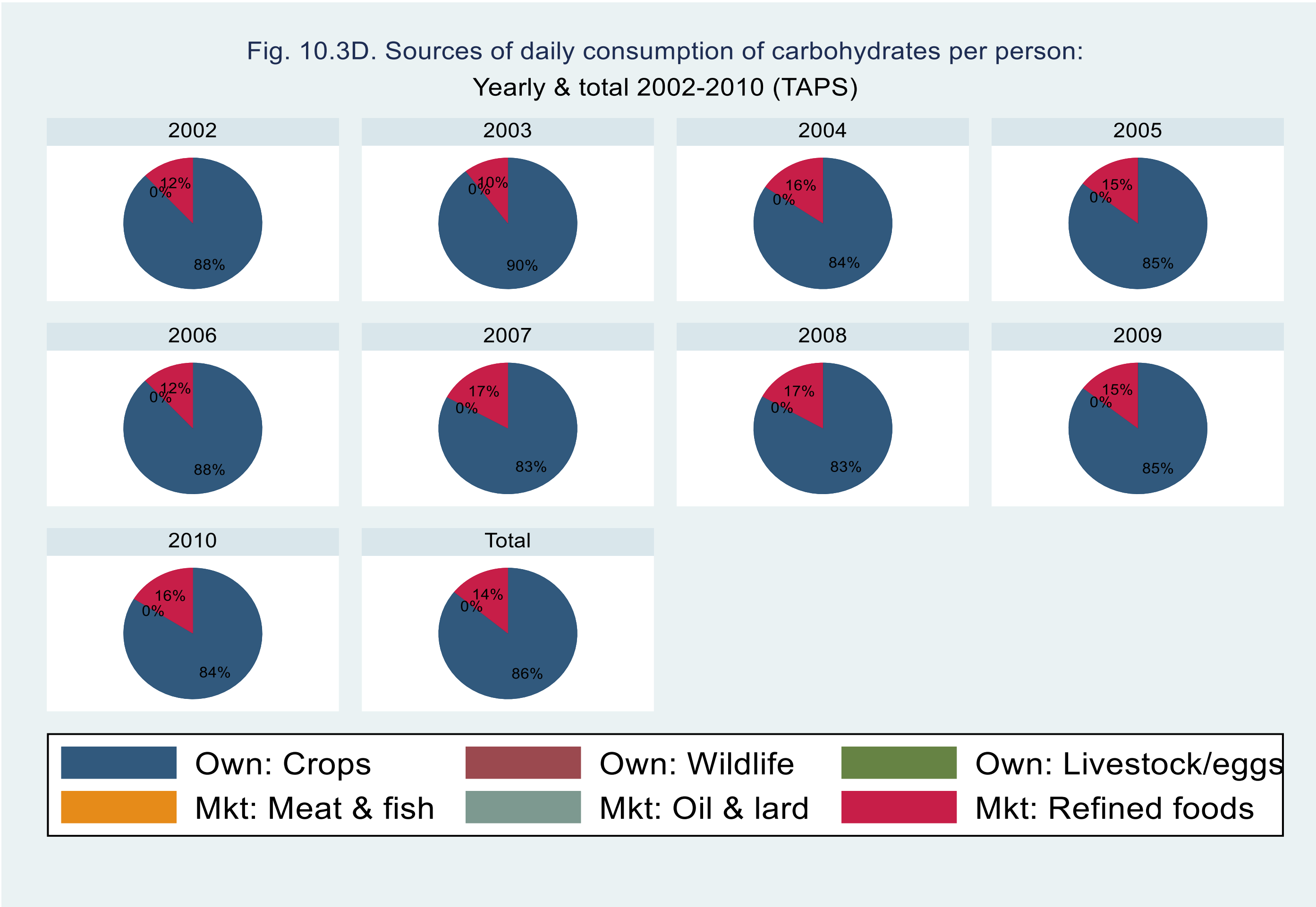
Fig. 10.3A. Sources of daily consumption of calories per person:
Yearly & total 2002-2010 (TAPS)
2002
9%
5%
8%
2%
9%
65%
2003
8%
5%
8%
1%
12%
67%
2004
12%
5%
8%
3%
12%
61%
2005
12%
5%
7%
2%
10%
65%
2006
10%
7%
7%
1%
8%
67%
2007
13%
8%
7%
2%
10%
61%
2008
12%
9%
7%
3%
11%
58%
2009
11%
7%
6%
2%
9%
65%
2010
12%
8%
8%
2%
9%
62%
Total
11%
6%
7%
2%
10%
64%
Own: Crops
Own: Wildlife
Own: Livestock/eggs
Mkt: Meat & fish
Mkt: Oil & lard
Mkt: Refined foods



Source: Do file anFood_V3



Source: Do file anFood_V3



Source: Do file anFood_V3

Table 10.1 Sources for Chapter 10 on household food consumption

Data /a/	***Years***
TAPS	2002-2010
Five quarters /b/	5/2002-8/2003
RCT	2008

Notes:

/a/ TAPS = Tsimane' Amazonian Panel Study. RCT = randomized-controlled trial on income inequality in villages. For the RCT, I use baseline data (2008).
/b/ The five-quarter panel study was part of TAPS and extended from May 2002 until August 2003. For this chapter, I extracted the first record of a household during May-October of 2002 and May-October 2003. I restricted the time to the dry season (May-October) to make the dates comparable to the survey dates of TAPS and picked the first record of a household to avoid losing too many households. The approach to selecting observations from the 2002-2003 survey differs from the approach to measure wealth in the previous chapter; in that chapter where I chose June because it had the largest sample size.

Table 10.2. Types and quantity of foods consumed by household the seven days before the interview from yearly surveys of TAPS (2002-2010) and the RCT study (2008)

Type	**Item**	**Units /a/**	**End /b/**
A. Own, village (n = 11)/c/			
Crops	Manioc	Kilograms	Brought
	Rice	Kilograms	Ate
	Maize	*Mancornas* /d/	Ferment
	Plantain	Kilograms	Ate
Wildlife /e/	Birds	Type and number	Ate
	Fish	Type, size, and number	Ate
	Game	Type, size, and number	Ate
Meat and eggs	Eggs (from chickens or ducks)	Number (units)	Ate
	Chicken /f/	Number, kilograms	Ate
	Duck /f/	Number, kilograms	Ate
	Pork	Kilograms	Ate
B. Market, town (n = 10) /c/			
Meat and fish	Beef	Kilograms	Ate
	Cow head	Number	Ate
	Jerky	Kilograms	Ate
	Sardines	Cans	Ate
Oil and fat	Oil	Liters	Ate
	Lard /g/	Kilograms	Ate
Refined foods	Sugar /h/	Kilograms	Ate
	Flour	Kilograms	Ate
	Noodle	Kilograms	Ate
	Bread	Number (units)	Ate

Table 10.2. Food types and quantity of food items consumed by household the seven days before the interview from yearly surveys of TAPS (2002-2010) and the RCT study (2008) - continue

Notes:

/a/ The units in which surveyors asked about the food item. Sometimes surveyors converted the amounts reported by study participants into other units. For example, they converted data on the type and number of a fish into kilograms and entered all these pieces of information into the dataset. See the chapter for a discussion of units and conversion factors used.
/b/ End: The column refers to information from the surveys about the end uses of the food. Most of the time we asked about the foods eaten. For maize, surveyors asked about the amount used to prepare *chicha* and for manioc they asked about the amount decanted from their fields, not necessarily consumed. . See the chapter for a discussion of these points.
/c/ The distinction between *Own (village)* and *Market (town)* in sections A and B is based on the most common source of the food. For example, most rice comes from the fields of a household, but shortly before the rice harvest households are often out of rice and buy it.
/d/ 1 *mancorna* = 1.91 kg. The question was about the amount of maize used to prepare *chicha*.
/e/ In most years, surveyors asked the respondent to list the three main birds, four main game animals, and six main fish the household had eaten. See text and Appendix A for the method to convert data on wildlife into kilograms.
/f/ 1 chicken = 1 kilogram; 1 duck = 3 kilograms.
/g/ The question was about lard, and explicitly excluded fat from other animals.
/h/ Typically white, granulated

Table 10.3. Village price for food items consumed by household the seven days before the interview as revealed in the yearly surveys of TAPS (2002-2010) and the RCT study (2008)

Food type and item	Unit of measurement in survey of:		Conversion/b/
	Household: quantity	Community (village or town): price /a/	
A. Own, village			
Crops:			
Manioc	Kilograms	Bs/*arroba*. 1 *arroba* = 11.5 kg	Price/11.5
Rice	Kilograms	Bs/*arroba* of rice with hull. 1 *arroba* = 11.5 kg	(Quantity in kg) x (Price/8.6)/c/
Maize	*Mancornas*	Bs/*arroba* of kernels. 5 *mancornas* = 1 *arroba* of maize kernels /d/	Price/5
Plantain	Kilograms	Bs/cluster (*racimo). 1 racimo* = 18 kg	Price/18
Wildlife:			
Birds	Type and number	No data on bird prices collected. Imputed price/kg of game to birds	Bs/kg of game
Fish	Type, size, and number	Two fish: *i) sábalo* (Bs/unit) and *ii) surubí* (Bs/kg). Used 0.222 kg/*sábalo* to express *sábalo* price/kg before averaging *i)-ii)* /e/	Mean price of two fish imputed to kg of any fish eaten; Bs/kg
Game	Type, size, and number	Two animals: *naca* (*jochi pintado; agouti paca*) (Bs/kg) and deer (Bs/kg)	Mean price of 2 animals imputed to kg of any mammal, reptile, or bird eaten; Bs/kg
Meat and eggs:			
Eggs	Units	Bs/unit	None
Chicken	Number, kg	Collected data on price/chicken, duck, pig, not per kg of meat for these animals. Imputed price/kg of beef to chicken, duck, and pork meat /f/	Bs/kg of beef
Duck	Number, kg		
Pork	Kilograms		
B. Market, town			
Meat and fish:			
Beef	Kilograms	Bs/kg	None
Cow head	Unit	Bs/unit	None
Jerky	Kilograms	Bs/kg	None
Sardines	Cans	Bs/can, brand Lidita	None
Oil and fat:			
Oil	Liters	Bs/bottle, brand Brasilera	1 bottle= 900 ml/g/
Lard	Kilograms	Bs/kg, brand Gordito	None
Refined foods:			
Sugar	Kilograms	Bs/kg	None
Flour	Kilograms	Bs/kg	None
Noodle	Kilograms	Bs/kg	None
Bread	Unit	Bs/10 units	Price/10

Table 10.3. Village price for food items consumed by household the seven days before the interview as revealed in the yearly surveys of TAPS (2002-2010) and the RCT (2008) study - continued

Notes:

/a/ Prices are in *bolivianos* (Bs) and refer to prices in the village or town. Other than wildlife and plantains, we asked about prices in the village and town surveys. The price of wildlife and plantains came only from village surveys. Prices were collected in current nominal *bolivianos,* but converted to real prices using Bolivia's CPI index.
/b/ Conversions to express prices and quantities in the same units before computing the cash value of a food. For example, we asked about the number of bread units consumed by the household the seven days before the interview, but in the village survey of prices we asked about the price of buying 10 units of bread; in this example, we divide the price of bread by 10 to express price as the *bolivianos*/bread unit before multiplying it by the total quantity of bread units eaten by the household. The conversions for some items (e.g., maize, rice, cooking oil) are more convoluted and are discussed under the food.
/c/ Households reported the kg of clean rice eaten, but the price of rice is expressed in *arrobas* of rice with hull. Since four *arrobas* of rice with chaff yield three *arrobas* of clean rice, one arroba of rice with hull should yield about 8.6 kg of clean rice (8.6 kg = 11.5 kg in an arroba * 0.75 [the yield of clean rice from rice with husk]). I leave quantities of rice in kilograms as they are expressed in the household survey of food consumption, but divide the price per *arroba* of rice with hull by 8.6 to arrive at a rice price of *bolivianos*/kg of edible rice.
/d/ Four to six *mancornas* of maize yield one *arroba* of maize in kernels. I assumed five *mancornas* of maize whittle down to one *arroba* of maize kernels. I leave quantities in *mancornas*, but divide the price by five to express the price of maize per *mancorna*.
/e/ The average weight of a *sábalo* to convert the price of a *sábalo* into a price/kilogram comes from Pérez (2001, p. 89). I multiplied the price/*sábalo* * 1/0.222 to express *sábalo* prices per kg.
/f/ See text for a discussion of how I converted the number of chickens and ducks eaten into kilograms.
/g/ Since price is for a bottle of 900 milliliters (ml), I adjusted prices by multiplying them by 10/9 to express prices per liter, in the same units as households reported the amount of cooking oil.

Table 10.4A-B. Sample size of households and share of households consuming food items by source and food group: Results by year (2002-2010 [TAPS and RCT]) and total

Table 10.4A. Sample size of households

	Years									
	2002	2003	2004	2005	2006	2007	2008	2009	2010	Total
RCT	0	0	0	0	0	0	562	0	0	562
TAPS	257	230	233	248	262	250	260	253	268	2,261
Total	257	230	233	248	262	250	822	253	268	2,823

Table 10.4B. % of households that consumed a food during the seven days (*week*) before the interview

`					**OWN**					Mean
					Crops					
Manioc	74	70	70	77	70	72	67	66	53	69
Rice	97	97	87	94	98	95	95	95	98	95
Maize	35	38	27	39	35	24	44	28	25	33
Plantain	100	100	100	99	99	98	98	99	100	99
					Wildlife					
Bird	5	3	7	17	17	8	14	8	4	9
Fish	79	88	86	93	93	96	81	91	91	89
Game	58	48	66	62	63	54	64	56	49	58
					Meat & eggs					
Egg	49	33	39	41	40	46	31	36	36	39
Chicken	26	20	26	21	27	29	25	23	25	25
Duck	2	2	2	4	1	2	2	2	2	2
Pork	12	5	13	11	6	5	6	6	6	8
					MARKET					
					Meat & fish					
Beef	42	30	27	30	42	33	27	20	26	31
Cow head	16	16	20	10	10	10	9	19	20	14
Jerky	44	38	25	39	41	44	53	25	37	39
Sardine	30	23	33	27	28	15	32	19	26	26
					Oil & lard					
Oil	29	29	27	37	59	60	53	51	57	45
Lard	47	35	32	25	18	18	26	22	22	27
					Refined foods					
Sugar	74	70	74	79	69	78	86	82	85	78
Flour	23	15	22	22	26	42	18	22	25	24
Noodle	50	34	54	54	53	49	59	55	57	52
Bread	53	52	48	54	43	46	38	49	61	49

Notes: Table 10.2 has definition of foods.

Source: Do file anFood_V3

Table 10.5. Yearly growth rate in the probability a *household* ate a food type during the seven days before the interview, regression results, 2002-2010, TAPS (obs = 2261)

OWN

	Crops (1-4)				Wildlife (5-7)			Meat & eggs (8-11)			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
Variable	Manioc	Rice	Maize	Plantain	Bird	Fish	Game	Egg	Chicken	Duck	Pork
Year	-0.016**	0.0001	-0.012*	-0.001	-0.001	0.011**	-0.012*	-0.007	0.0001	-0.001	-0.009**
	(0.006)	(0.002)	(0.006)	(0.0001)	(0.003)	(0.005)	(0.007)	(0.005)	(0.005)	(0.001)	(0.004)
R-square	0.008	0.0001	0.004	0.0001	0.0001	0.009	0.004	0.002	0.0001	0.0001	0.008

MARKET

	Meat (12-15)				Oil & lard (16-17)		Refined foods (18-21)			
	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)	(21)
Variable	Beef	Cow head	Jerky	Sardine	Oil	Lard	Sugar	Flour	Noodle	Bread
`Year	-0.016*	0.0001	-0.004	-0.010*	0.044***	-0.030***	0.016***	0.006	0.017**	0.000
	(0.009)	(0.008)	(0.008)	(0.006)	(0.008)	(0.007)	(0.006)	(0.005)	(0.007)	(0.009)
R-square	0.008	0.0001	0.0001	0.004	0.051	0.031	0.010	0.001	0.008	0.000

Notes: Regressions are Ordinary Least Squares with robust standard errors clustered by village-year. Regressions include constant (not shown) and one record for each household per year. Outcome is a binary variable if the household consumed the food item in the column heading the seven days before the survey (yes = 1; no = 0). Table 10.2 has definition of foods. *** p<0.01, ** p<0.05, * p<0.10.

Source: Do file anFood_V3

Table 10. 6. Mean quantity of food consumed by a *household* during the *week* before the interview, by year (2002-2010) and for all years (TAPS and RCT)

	Units	2002	2003	2004	2005	Years: 2006	2007	2008	2009	2010	Mean
						OWN					
						Crops					
Manioc	Kg	1.817	1.378	1.156	2.212	1.520	0.995	1.398	1.294	1.109	1.431
Rice	Kg	1.471	1.724	0.952	1.029	1.345	0.963	1.250	1.322	1.321	1.264
Maize	*Mancorna*	0.774	0.603	0.337	0.633	0.530	0.372	0.719	0.473	0.315	0.528
Plantain	Kg	5.878	6.690	6.444	6.776	7.641	5.181	4.711	6.427	6.289	6.226
						Wildlife					
Bird	Kg	0.012	0.006	0.018	0.029	0.031	0.014	0.044	0.011	0.009	0.019
Fish	Kg	1.416	1.950	0.876	1.103	1.007	1.345	1.004	1.242	1.360	1.256
Game	Kg	0.775	0.882	1.349	0.966	0.880	0.567	1.064	0.746	0.575	0.867
						Meat & eggs					
Egg	Units	0.379	0.256	0.329	0.312	0.415	0.593	0.282	0.466	0.393	0.380
Chicken	Kg	0.069	0.056	0.053	0.053	0.075	0.076	0.076	0.067	0.071	0.066
Duck	Kg	0.006	0.006	0.007	0.008	0.003	0.007	0.006	0.005	0.010	0.006
Pork	Kg	0.101	0.079	0.107	0.067	0.026	0.030	0.052	0.029	0.030	0.058
						Market					
						Meat & fish					
Beef	Kg	0.123	0.106	0.083	0.090	0.130	0.081	0.089	0.051	0.080	0.093
Cow head	Units	0.035	0.038	0.042	0.024	0.020	0.014	0.023	0.048	0.042	0.032
Jerky	Kg	0.094	0.093	0.069	0.105	0.098	0.091	0.149	0.059	0.081	0.093
Sardine	Cans	0.073	0.052	0.086	0.086	0.064	0.035	0.088	0.054	0.067	0.067
						Oil & lard					
Oil	Liters	0.034	0.054	0.043	0.061	0.098	0.095	0.088	0.095	0.104	0.075
Lard	Kg	0.073	0.050	0.046	0.038	0.035	0.027	0.058	0.045	0.035	0.045
						Refined foods					
Sugar	Kg	0.177	0.186	0.215	0.228	0.168	0.183	0.217	0.226	0.232	0.204
Flour	Kg	0.059	0.034	0.055	0.072	0.090	0.112	0.048	0.062	0.061	0.066
Noodle	Kg	0.131	0.115	0.172	0.171	0.153	0.132	0.181	0.211	0.171	0.160
Bread	Units	1.133	1.095	1.282	1.229	0.924	1.247	1.008	1.152	1.485	1.173

Notes: Table 10.2 has definition of foods and units of measurement. Sample sizes for columns are in Table 10.4A. Mean = average of nine yearly values, 2002-2010.

Source: Do file anFood_V3

Table 10. 7. Mean quantity of *daily* food consumption *per person* averaged from the seven days before the interview by year (2002-2010) and for all years (TAPS and RCT)

		Years									
Year	Units	2002	2003	2004	2005	2006	2007	2008	2009	2010	Mean
OWN											
Crops											
Manioc	Kg	0.343	0.351	0.217	0.419	0.312	0.184	0.288	0.266	0.229	0.290
Rice	Kg	0.280	0.388	0.186	0.182	0.247	0.182	0.247	0.274	0.245	0.248
Maize	*Mancorna*	0.022	0.024	0.010	0.017	0.016	0.011	0.021	0.017	0.010	0.016
Plantain	Kg	1.116	1.548	1.154	1.219	1.478	0.962	0.945	1.287	1.135	1.205
Wildlife											
Bird	Kg	0.004	0.001	0.003	0.005	0.006	0.003	0.010	0.002	0.001	0.004
Fish	Kg	0.282	0.549	0.170	0.200	0.196	0.261	0.215	0.260	0.272	0.267
Game	Kg	0.152	0.191	0.242	0.176	0.158	0.111	0.222	0.142	0.113	0.168
Meat & eggs											
Egg	Units	0.086	0.057	0.066	0.060	0.081	0.107	0.063	0.096	0.076	0.077
Chicken	Kg	0.014	0.013	0.011	0.010	0.016	0.015	0.016	0.016	0.016	0.014
Duck	Kg	0.001	0.002	0.002	0.001	0.000	0.001	0.001	0.001	0.001	0.001
Pork	Kg	0.016	0.010	0.016	0.013	0.004	0.004	0.012	0.007	0.007	0.010
MARKET											
Meat & fish											
Beef	Kg	0.026	0.031	0.019	0.018	0.029	0.017	0.019	0.011	0.018	0.021
Cow head	Units	0.008	0.009	0.008	0.004	0.004	0.003	0.004	0.009	0.008	0.007
Jerky	Kg	0.020	0.027	0.014	0.021	0.021	0.019	0.035	0.014	0.019	0.021
Sardine	Cans	0.020	0.016	0.018	0.016	0.014	0.009	0.022	0.013	0.015	0.016
Oil & lard											
Oil	Liters	0.008	0.015	0.009	0.013	0.021	0.020	0.019	0.020	0.023	0.016
Lard	Kg	0.016	0.012	0.009	0.006	0.008	0.005	0.012	0.010	0.007	0.009
Processed foods											
Sugar	Kg	0.038	0.046	0.041	0.044	0.035	0.035	0.045	0.047	0.048	0.042
Flour	Kg	0.013	0.010	0.009	0.014	0.019	0.023	0.010	0.013	0.014	0.014
Noodle	Kg	0.028	0.030	0.034	0.036	0.032	0.028	0.041	0.041	0.035	0.034
Bread	Units	0.209	0.263	0.271	0.224	0.205	0.244	0.219	0.233	0.311	0.242

Notes: Table 10.2 has definition of foods and units of measurement. Sample sizes for columns come from Table 10.4A. Mean = average of nine years.

Source: Do file anFood_V3

Table 10.8A. Growth rate (%/year) in the quantity of *daily* *household* food consumption: 2002-2010 (TAPS) (obs = 2261)

OWN

	Crops(1-4)				Wildlife (5-7)			Meat & eggs (8-11)			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
Variable:	Manioc	Rice	Maize	Plantain	Bird	Fish	Game	Egg	Chicken	Duck	Pork
Year	-0.056***	-0.020	-0.020**	-0.015	-0.002	0.025	-0.042**	0.001	0.003	-0.001	-0.017**
	(0.019)	(0.014)	(0.008)	(0.011)	(0.003)	(0.023)	(0.020)	(0.014)	(0.007)	(0.002)	(0.006)
R-squared	0.008	0.003	0.007	0.002	0.000	0.003	0.005	0.001	0.001	0.001	0.007

MARKET

	Meat market (12-15)				Oil & lard (16-17)		Refined food (18-21)			
	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)	(21)
Variable:	Beef	Cow head	Jerky	Sardine	Oil	Lard	Sugar	Flour	Noodle	Bread
`Year	-0.023*	-0.001	-0.003	-0.012*	0.050***	-0.019***	0.019**	0.009	0.026***	0.006
	(0.014)	(0.009)	(0.009)	(0.007)	(0.007)	(0.006)	(0.010)	(0.007)	(0.010)	(0.030)
R-squared	0.008	0.001	0.001	0.003	0.062	0.012	0.006	0.001	0.007	0.001

Notes: Table 10.2 has definition of food types and Table 10.3 has definition of units in which we measured outcomes. Outcomes transformed with an inverse hyperbolic sine function. Regressions are OLS with constant (not shown) and robust standard errors clustered by village-year, and shown in parenthesis. *** p<0.01, ** p<0.05, * p<0.10.

Source: Do file anFood_V3

Table 10.8B. Growth rate (%/year) in the quantity of *daily* food consumed *per person*: 2002-2010 (TAPS) (obs = 2261)

`

OWN

	Crops(1-4)				Wildlife (5-7)			Meat & eggs (8-11)			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
Variable:	Manioc	Rice	Maize	Plantain	Bird	Fish	Game	Egg	Chicken	Duck	Pork
Year	-0.032***	-0.019*	-0.006**	-0.015	-0.001	0.004	-0.024**	0.007	0.002	-0.001	-0.005**
	(0.011)	(0.011)	(0.003)	(0.010)	(0.001)	(0.015)	(0.011)	(0.007)	(0.002)	(0.001)	(0.002)
R-squared	0.007	0.006	0.005	0.003	0.000	0.000	0.006	0.001	0.001	0.001	0.004

MARKET

	Meat market (12-15)				Oil & lard (16-17)		Refined food (18-21)			
	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)	(21)
Variable:	Beef	Cow head	Jerky	Sardine	Oil	Lard	Sugar	Flour	Noodle	Bread
Year	-0.008*	-0.001	-0.001	-0.004	0.012***	-0.005**	0.004	0.003	0.008**	0.009
	(0.005)	(0.003)	(0.003)	(0.003)	(0.002)	(0.002)	(0.003)	(0.002)	(0.003)	(0.016)
R-squared	0.007	0.000	0.000	0.002	0.032	0.006	0.002	0.001	0.004	0.001

Notes: Table 10.2 has definition of food types and Table 10.3 shows units in which we measured outcomes. Outcomes transformed with an inverse hyperbolic sine function. Regressions are Ordinary Least Squares (OLS) with robust standard errors shown in parenthesis and constant (not shown); standard errors are clustered by village-year. *** p<0.01, ** p<0.05, * p<0.10.

Source: Do file anFood_V3

Table 10.9. Daily real value in *bolivianos* of food consumed per person averaged from answers about the seven days before the interview, by year (2002-2010) and for all years (TAPS and RCT)

		Year									
		2002	2003	2004	2005	2006	2007	2008	2009	2010	Mean
						OWN					
						Crops					
Manioc	Mean	0.452	0.453	0.266	0.513	0.439	0.280	0.579	0.507	0.464	0.439
	SD	0.614	0.924	0.401	0.763	0.652	0.420	1.118	0.704	0.848	0.716
	Med	0.216	0.134	0.145	0.277	0.223	0.096	0.189	0.312	0.053	0.183
Rice	Mean	0.512	0.656	0.321	0.379	0.466	0.363	0.869	0.621	2.882	0.786
	SD	0.439	0.602	0.328	0.302	0.351	0.367	0.842	0.819	11.285	1.704
	Med	0.402	0.513	0.270	0.341	0.381	0.263	0.704	0.438	0.415	0.414
Maize	Mean	0.068	0.071	0.031	0.060	0.068	0.042	0.125	0.078	0.049	0.066
	SD	0.161	0.180	0.073	0.117	0.145	0.112	0.250	0.354	0.129	0.169
	Med	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Plantain	Mean	0.483	0.648	0.479	0.589	0.749	0.754	0.982	1.249	0.959	0.766
	SD	0.320	0.528	0.277	0.386	0.556	0.648	0.999	1.084	0.658	0.606
	Med	0.433	0.520	0.429	0.527	0.583	0.589	0.667	0.854	0.833	0.604
						Wildlife					
Birds	Mean	0.051	0.010	0.031	0.075	0.046	0.044	0.127	0.023	0.024	0.048
	SD	0.276	0.063	0.154	0.261	0.137	0.218	0.528	0.113	0.141	0.210
	Med	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Fish	Mean	5.789	13.469	3.387	6.449	4.048	4.980	4.985	5.999	16.546	7.295
	SD	8.779	20.763	4.307	7.506	4.296	6.778	12.582	7.731	18.886	10.181
	Med	3.028	6.997	1.891	3.654	2.838	3.197	2.193	3.332	9.651	4.087
Game	Mean	2.079	2.828	3.292	2.299	1.247	1.500	3.026	1.549	1.967	2.198
	SD	4.041	5.241	6.239	3.461	1.776	2.256	5.254	2.235	3.828	3.815
	Med	0.668	0.000	1.237	0.699	0.562	0.456	1.236	0.418	0.000	0.586
						Meat & eggs					
Egg	Mean	0.040	0.032	0.047	0.041	0.053	0.069	0.055	0.066	0.069	0.052
	SD	0.073	0.068	0.103	0.069	0.100	0.115	0.290	0.152	0.128	0.122
	Med	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Chicken	Mean	0.216	0.224	0.202	0.193	0.206	0.193	0.294	0.484	0.292	0.256
	SD	0.500	0.645	0.527	0.456	0.433	0.371	0.775	1.187	0.631	0.614
	Med	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Duck	Mean	0.025	0.028	0.029	0.023	0.006	0.016	0.017	0.026	0.022	0.021
	SD	0.271	0.260	0.226	0.129	0.069	0.136	0.136	0.219	0.172	0.180
	Med	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Pork	Mean	0.252	0.190	0.268	0.241	0.058	0.055	0.219	0.220	0.123	0.181
	SD	1.390	1.083	1.323	1.190	0.278	0.473	2.748	1.293	0.685	1.162
	Med	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

Table 10.9. Daily real value in *bolivianos* of food consumed per person averaged from answers about the seven days before the interview, by year (2002-2010) and for all years (TAPS and RCT) - continued

						Year					
		2002	2003	2004	2005	2006	2007	2008	2009	2010	Mean
						MARKET					
						Meat & fish					
Beef	Mean	0.391	0.517	0.366	0.340	0.390	0.228	0.344	0.341	0.328	0.360
	SD	0.794	1.433	1.046	0.790	0.994	0.427	0.914	0.817	0.802	0.891
	Med	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Cow head	Mean	0.158	0.172	0.178	0.056	0.080	0.031	0.083	0.174	0.116	0.117
	SD	0.550	0.534	0.580	0.187	0.357	0.108	0.375	0.454	0.388	0.392
	Med	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Jerky	Mean	0.349	0.406	0.264	0.380	0.348	0.340	0.677	0.225	0.483	0.386
	SD	0.739	0.953	0.731	0.687	0.604	0.575	1.498	0.602	1.090	0.831
	Med	0.000	0.000	0.000	0.000	0.000	0.000	0.211	0.000	0.000	0.023
Sardine	Mean	0.130	0.118	0.127	0.123	0.146	0.112	0.257	0.144	0.204	0.151
	SD	0.330	0.350	0.264	0.307	0.383	0.355	0.696	0.491	0.555	0.415
	Med	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
						Oil & fat					
Oil	Mean	0.107	1.000	0.127	0.216	0.350	0.343	0.368	0.200	0.314	0.336
	SD	0.277	0.428	0.273	0.482	0.529	0.587	0.594	0.277	0.526	0.441
	Med	0.000	0.000	0.000	0.000	0.208	0.213	0.219	0.122	0.159	0.102
Lard	Mean	0.218	0.122	0.124	0.123	0.132	0.120	0.210	0.124	0.177	0.150
	SD	0.753	0.251	0.293	0.247	0.734	0.303	1.398	0.429	0.503	0.546
	Med	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
						Refined foods					
Sugar	Mean	0.294	0.386	0.281	0.308	0.309	0.314	0.361	0.291	0.627	0.352
	SD	0.453	0.520	0.319	0.318	0.441	0.323	0.424	0.287	0.670	0.417
	Med	0.223	0.221	0.206	0.224	0.196	0.246	0.252	0.220	0.429	0.246
Flour	Mean	0.092	0.092	0.061	0.120	0.203	0.141	0.078	0.051	0.302	0.127
	SD	0.242	0.304	0.153	0.292	0.502	0.308	0.249	0.129	0.713	0.321
	Med	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Noodle	Mean	0.215	0.225	0.281	0.279	0.239	0.282	0.421	0.220	0.630	0.310
	SD	0.453	0.529	0.439	0.567	0.417	0.665	0.782	0.335	0.917	0.567
	Med	0.042	0.000	0.118	0.110	0.115	0.000	0.179	0.098	0.336	0.111
Bread	Mean	0.083	0.090	0.095	0.070	0.069	0.118	0.106	0.166	0.150	0.105
	SD	0.120	0.166	0.193	0.112	0.142	0.198	0.384	0.284	0.198	0.200
	Med	0.026	0.030	0.000	0.024	0.000	0.000	0.000	0.000	0.086	0.018

Table 10.9. Daily real value in *bolivianos* of food consumed per person averaged from answers about the seven days before the interview, by year (2002-2010) and for all years (TAPS and RCT) – continued

Notes: Table 10.2 has definition of food types, Table 10.3 for units, and Table 10.4 for sample size of households. Values are in *bolivianos*, adjusted by Bolivia's Consumer Price Index. SD = standard deviation. Med = median. The column heading *Mean* = average of the nine yearly values.

Source: Do file anFood_V3

Table 10.10. Daily real value in *bolivianos* of food consumed per person averaged from answers about the seven days before the interview, by year (2002-2010) and for all years (TAPS and RCT): Grouped by food categories

		Year									Yearly
		2002	2003	2004	2005	2006	2007	2008	2009	2010	Mean
						OWN					
Crops	Mean	1.374	1.651	1.012	1.436	1.594	1.340	2.315	2.285	3.618	1.847
	SD	0.922	1.582	0.684	1.055	1.101	0.982	1.965	2.136	8.392	2.091
	Med	1.187	1.233	0.869	1.216	1.293	1.100	1.830	1.746	1.645	1.346
Wildlife	Mean	7.918	16.307	6.711	8.823	5.341	6.523	8.138	7.571	18.537	9.541
	SD	10.770	21.145	7.394	8.178	4.873	7.818	14.413	7.958	19.787	11.371
	Med	5.355	9.600	4.680	6.456	4.020	4.146	4.777	5.355	11.508	6.211
Meat & eggs	Mean	0.533	0.474	0.546	0.498	0.323	0.332	0.585	0.797	0.506	0.510
	SD	1.499	1.416	1.424	1.278	0.564	0.638	2.972	1.883	0.971	1.405
	Med	0.076	0.000	0.062	0.056	0.056	0.086	0.000	0.000	0.000	0.037
						MARKET					
Meat & fish	Mean	1.028	1.212	0.935	0.899	0.963	0.712	1.361	0.885	1.131	1.014
	SD	1.758	2.422	1.919	1.336	1.442	1.008	2.234	1.494	1.721	1.704
	Med	0.464	0.430	0.353	0.313	0.502	0.345	0.624	0.314	0.612	0.440
Oil & lard	Mean	0.314	0.286	0.238	0.318	0.447	0.428	0.542	0.304	0.459	0.371
	SD	0.861	0.494	0.369	0.474	1.005	0.565	1.483	0.471	0.762	0.720
	Med	0.111	0.126	0.103	0.196	0.266	0.306	0.368	0.209	0.238	0.214
Refined foods	Mean	0.684	0.793	0.718	0.778	0.821	0.855	0.966	0.728	1.709	0.894
	SD	0.913	1.115	0.748	0.900	1.052	0.972	1.297	0.692	1.835	1.058
	Med	0.445	0.430	0.525	0.536	0.548	0.621	0.581	0.537	1.051	0.586
TOTAL	Mean	11.851	20.723	10.160	12.751	9.488	10.190	13.907	12.570	25.960	14.178
	SD	11.906	23.768	8.546	9.010	7.181	9.323	16.854	9.604	24.455	13.405
	Med	8.661	14.046	7.667	10.806	7.597	7.944	9.461	9.762	17.429	10.375

Notes: Table 10.2 has definition of food types and categories, and Table 10.3 has explanations for how I valued food types. Values are in *bolivianos*, adjusted by Bolivia's Consumer Price Index. SD = standard deviation. Med = median. The column heading *Yearly mean* = average of the nine yearly values. Sample sizes for columns are in Table 10.4A.

Source: Do file anFood_V3

Table 10.11. Growth rate (%/year) in the real daily value of food consumption <u>*per person*</u>, grouped by food categories: 2002-2010 (TAPS)(obs = 2261)

	OWN (1-3)			**MARKET (4-6)**			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Variable:	Crops	Wildlife	Meat & eggs	Meat & fish	Oil & lard	Refined foods	Total
Year	0.062***	0.042*	0.005	0.002	0.021**	0.044***	0.045***
	(0.015)	(0.023)	(0.006)	(0.012)	(0.008)	(0.011)	(0.016)
R-squared	0.073	0.010	0.001	0.001	0.018	0.036	0.022

Notes: Table 10.2 has definition of foods and Table 10.3 has explanations for how I valued foods. I use the inverse hyperbolic sine transformation of the outcome to avoid losing zero values and be able to express coefficients as % change per year. Regressions are Ordinary Least Squares (OLS) with constant (not shown) and robust standard errors clustered by village-year (shown in parenthesis). *** p<0.01, ** p<0.05, * p<0.10.

Source: Do file anFood_V3

Table 10.12. Gini coefficients of *daily quantity* of different foods consumed *by households*, 2002-2010 (TAPS)

	2002	2003	2004	2005	Year 2006	2007	2008	2009	2010	All	Mean
					OWN						
					Crops						
Manioc	0.62	0.63	0.60	0.58	0.59	0.67	0.65	0.59	0.66	0.63	0.62
Rice	0.78	0.74	0.81	0.75	0.75	0.83	0.76	0.81	0.81	0.42	0.78
Maize	0.34	0.28	0.32	0.32	0.28	0.33	0.37	0.28	0.31	0.79	0.31
Plantain	0.41	0.37	0.44	0.41	0.39	0.42	0.45	0.33	0.42	0.32	0.40
					Wildlife						
Birds	0.96	0.98	0.96	0.89	0.89	0.95	0.98	0.94	0.97	0.95	0.95
Fish	0.62	0.53	0.60	0.57	0.49	0.51	0.53	0.52	0.53	0.56	0.54
Game	0.72	0.76	0.71	0.69	0.66	0.68	0.80	0.70	0.75	0.73	0.72
					Meat & eggs						
Egg	0.68	0.78	0.74	0.72	0.75	0.75	0.77	0.79	0.79	0.76	0.75
Chicken	0.80	0.85	0.81	0.83	0.77	0.79	0.85	0.83	0.81	0.82	0.82
Duck	0.99	0.99	0.98	0.97	0.99	0.98	1.00	0.99	0.99	0.99	0.99
Pork	0.96	0.98	0.96	0.96	0.97	0.99	1.00	0.97	0.97	0.98	0.97
					MARKET						
					Meat & fish						
Beef	0.74	0.82	0.82	0.81	0.72	0.76	0.83	0.85	0.83	0.80	0.80
Cow head	0.88	0.88	0.88	0.92	0.92	0.92	0.96	0.87	0.86	0.90	0.90
Jerky	0.71	0.75	0.86	0.75	0.71	0.67	0.68	0.83	0.72	0.74	0.74
Sardine	0.78	0.83	0.76	0.82	0.79	0.88	0.85	0.88	0.81	0.82	0.82
					Oil & lard						
Oil	0.81	0.80	0.80	0.72	0.55	0.53	0.49	0.61	0.57	0.65	0.65
Lard	0.75	0.75	0.77	0.80	0.87	0.86	0.96	0.86	0.83	0.85	0.83
					Refined foods						
Sugar	0.49	0.50	0.50	0.45	0.51	0.44	0.42	0.45	0.42	0.47	0.46
Flour	0.85	0.89	0.86	0.85	0.84	0.71	0.89	0.85	0.83	0.84	0.84
Noodle	0.68	0.78	0.66	0.66	0.65	0.67	0.60	0.68	0.64	0.67	0.67
Bread	0.66	0.65	0.68	0.65	0.72	0.71	0.76	0.68	0.61	0.68	0.68

Note: Table 10.2 has definition of food types and Table 3 has units in which we measured values. Table 10.4 has the yearly sample of households. Under the column heading *All* is the grand Gini coefficient for all households across all years and under the column heading *Mean* is the average yearly Gini coefficient.

Source: Do file anFood_V3

Table 10.13. Gini coefficients of daily *per capita* quantity of different foods consumed, 2002-2010 (TAPS)

	Year										
	2002	2003	2004	2005	2006	2007	2008	2009	2010	All	Mean
OWN											
Crops											
Manioc	0.63	0.72	0.64	0.64	0.65	0.68	0.66	0.64	0.72	0.67	0.66
Rice	0.41	0.41	0.48	0.41	0.39	0.45	0.48	0.40	0.42	0.44	0.43
Maize	0.81	0.82	0.84	0.78	0.81	0.86	0.80	0.87	0.85	0.83	0.83
Plantain	0.34	0.38	0.31	0.34	0.34	0.36	0.41	0.33	0.29	0.35	0.34
Wildlife											
Birds	0.97	0.98	0.96	0.91	0.90	0.96	0.98	0.95	0.97	0.96	0.95
Fish	0.63	0.64	0.61	0.58	0.51	0.54	0.57	0.55	0.54	0.60	0.57
Game	0.74	0.77	0.70	0.70	0.66	0.70	0.81	0.69	0.76	0.73	0.73
Meat & eggs											
Egg	0.72	0.80	0.79	0.74	0.76	0.74	0.79	0.80	0.78	0.78	0.77
Chicken	0.84	0.88	0.85	0.86	0.82	0.80	0.88	0.86	0.83	0.85	0.85
Duck	0.99	0.99	0.98	0.97	0.99	0.99	1.00	0.99	0.98	0.99	0.99
Pork	0.96	0.97	0.95	0.96	0.96	0.98	1.00	0.97	0.97	0.98	0.97
MARKET											
Meat & fish											
Beef	0.77	0.86	0.86	0.84	0.78	0.79	0.86	0.86	0.85	0.83	0.83
Cow head	0.91	0.91	0.90	0.92	0.94	0.93	0.96	0.88	0.88	0.92	0.92
Jerky	0.74	0.81	0.88	0.77	0.75	0.72	0.73	0.86	0.78	0.79	0.78
Sardine	0.84	0.88	0.81	0.84	0.82	0.91	0.88	0.90	0.83	0.86	0.86
Oil & lard											
Oil	0.83	0.83	0.83	0.78	0.64	0.63	0.59	0.66	0.65	0.72	0.72
Lard	0.80	0.79	0.81	0.82	0.92	0.87	0.96	0.88	0.85	0.87	0.85
Refined foods											
Sugar	0.55	0.60	0.56	0.50	0.58	0.49	0.49	0.48	0.47	0.53	0.52
Flour	0.87	0.91	0.86	0.86	0.86	0.74	0.90	0.86	0.84	0.86	0.86
Noodle	0.72	0.82	0.69	0.72	0.69	0.72	0.66	0.68	0.67	0.71	0.71
Bread	0.67	0.70	0.73	0.67	0.76	0.72	0.79	0.70	0.63	0.71	0.71

Note: Table 10.2 has definition of food types and Table 3 has the units in which we measured values. Table 10.4 has the yearly sample of households. Under the column heading *All* is the grand Gini coefficient for all households across all years and under the column heading *Mean* is the average yearly Gini coefficient.

Source: Do file anFood_V3

Table 10.14. Gini coefficients of daily real cash value of *household* food consumption by food groups, 2002-2010 (TAPS)

	Year										
	2002	2003	2004	2005	2006	2007	2008	2009	2010	All	Mean
					Own						
Crops	0.34	0.30	0.30	0.32	0.29	0.36	0.35	0.27	0.66	0.43	0.35
Wildlife	0.54	0.45	0.50	0.48	0.43	0.45	0.55	0.46	0.49	0.52	0.48
Meat & eggs	0.80	0.88	0.82	0.79	0.72	0.71	0.85	0.79	0.76	0.81	0.79
					Market						
Meat & fish	0.61	0.63	0.67	0.68	0.59	0.61	0.67	0.68	0.58	0.64	0.64
Oil & lard	0.72	0.67	0.65	0.62	0.53	0.50	0.58	0.54	0.58	0.62	0.60
Refined foods	0.53	0.56	0.49	0.48	0.51	0.46	0.52	0.50	0.49	0.53	0.50
Total	0.60	0.55	0.64	0.55	0.52	0.53	0.65	0.53	0.50	0.58	0.56

Note: Table 10.2 has definition of food types and Table 3 has the units in which we measured values. Table 10.4 has the yearly sample of households. Under the column heading *All* is the grand Gini coefficient for all households across all years and under the column heading *Mean* is the average yearly Gini coefficient.

Source: Do file anFood_V3

Table 10.15. Gini coefficients of daily real cash value of *per capita* food consumption by food groups, 2002-2010 (TAPS)

	Year										
	2002	2003	2004	2005	2006	2007	2008	2009	2010	All	Mean
					OWN						
Crops	0.34	0.39	0.31	0.34	0.34	0.38	0.37	0.35	0.65	0.46	0.39
Wildlife	0.56	0.55	0.51	0.48	0.45	0.49	0.59	0.49	0.51	0.56	0.51
Meat & eggs	0.80	0.87	0.80	0.81	0.74	0.72	0.90	0.82	0.78	0.82	0.81
					MARKET						
Meat & fish	0.68	0.73	0.73	0.70	0.65	0.67	0.72	0.72	0.65	0.70	0.69
Oil & lard	0.75	0.71	0.69	0.66	0.63	0.58	0.62	0.60	0.64	0.66	0.65
Refined foods	0.57	0.63	0.53	0.54	0.57	0.51	0.59	0.50	0.53	0.57	0.55
Total	0.42	0.48	0.41	0.38	0.36	0.38	0.47	0.37	0.46	0.46	0.42

Note: Table 10.2 has definition of food types and Table 3 has the units in which we measured values. Table 10.4 has the yearly sample of households. Under the column heading *All* is the grand Gini coefficient for all households across all years and under the column heading *Mean* is the average yearly Gini coefficient.

Source: Do file anFood_V3

Table 10.16A. Daily *mean per capita* consumption of macronutrients by food groups, 2002-2010 (TAPS)

Macro-nutrient:	2002	2003	2004	2005	Year 2006	2007	2008	2009	2010	All years
					OWN					
					Crops					
Kcal	2330	3054	1830	2139	2429	1634	1819	2326	2044	2173
Protein	34	45	25	28	34	23	26	34	30	31
Fat	8	11	7	7	9	6	7	8	7	8
Carbs	549	720	439	513	581	389	433	551	485	516
					Wildlife					
Kcal	337	540	360	313	293	280	338	312	288	338
Protein	53	83	59	50	47	44	52	49	45	53
Fat	12	21	12	11	10	10	13	11	11	12
Carbs	0	0	0	0	0	0	0	0	0	0
					Meat & eggs					
Kcal	87	61	80	68	42	44	84	54	53	63
Protein	4	3	3	3	3	3	4	3	3	3
Fat	8	5	7	6	3	3	8	4	4	5
Carbs	0	0	0	0	0	0	0	0	0	0
					MARKET					
					Meat & fish					
Kcal	292	346	240	216	240	177	220	232	265	247
Protein	21	25	16	18	20	16	21	14	19	19
Fat	23	26	19	15	17	12	15	19	21	18
Carbs	0	0	0	0	0	0	0	0	0	0
					Oil & lard					
Kcal	195	223	145	163	248	207	285	245	255	220
Protein	0	0	0	0	0	0	0	0	0	0
Fat	22	25	16	18	28	23	32	27	29	25
Carbs	0	0	0	0	0	0	0	0	0	0
					Refined foods					
Kcal	326	359	353	381	349	353	386	407	405	369
Protein	5	5	5	6	6	6	7	7	6	6
Fat	1	1	1	1	1	1	1	1	1	1
Carbs	75	83	81	88	80	80	88	94	93	85
					ALL FOODS					
Kcal	3566	4583	3009	3280	3601	2695	3133	3577	3309	3409
Protein	117	162	109	106	109	92	110	107	102	112
Fat	73	89	62	59	68	57	74	72	73	70
Carbs	624	803	520	601	661	469	521	645	578	601

Table 10.16A. Daily *mean per capita* consumption of macronutrients by food groups, 2002-2010 (TAPS)

Note: Table 10.2 has for definition of food types and Table 10.4A has the yearly sample size of households. Units for proteins, fats, and carbohydrates are in grams.

Source: Do file anFood_V3

Table 10.16B. Daily *median per capita* consumption of macronutrients by food groups, levels and trends: 2002-2010 (TAPS)

Macro-nutrient:	2002	2003	2004	2005	Year 2006	2007	2008	2009	2010	All years	%Δ/y
					OWN						
					Crops						
Kcal	2030	2389	1609	1817	2073	1365	1472	2029	1753	1798	-2.2***
Protein	28	35	21	25	29	19	22	28	25	25	-2***
Fat	7	8	6	7	7	5	5	7	6	7	-1.8***
Carbs	486	563	388	443	503	328	354	482	424	434	-2.1***
					Wildlife						
Kcal	184	316	221	227	207	193	199	242	187	215	-2.3**
Protein	29	50	35	36	32	29	30	38	30	33	-2.1*
Fat	7	12	8	8	7	7	8	9	7	8	-2*
Carbs	0	0	0	0	0	0	0	0	0	0	NA
					Meat & eggs						
Kcal	9	0	6	5	6	8	0	0	0	5	-8.2
Protein	1	0	0	0	0	1	0	0	0	0	-2.8
Fat	1	0	0	0	0	1	0	0	0	0	-2.7
Carbs	0	0	0	0	0	0	0	0	0	0	NA
					MARKET						
					Meat & fish						
Kcal	94	105	73	47	121	81	81	47	159	91	3.4
Protein	10	10	5	4	8	7	7	4	11	7	2.2
Fat	7	7	5	4	8	5	5	4	10	6	3
Carbs	0	0	0	0	0	0	0	0	0	0	NA
					Oil & lard						
Kcal	86	104	65	101	147	168	185	168	196	147	9.5***
Protein	0	0	0	0	0	0	0	0	0	0	NA
Fat	10	12	7	11	17	19	21	19	22	17	9.7***
Carbs	0	0	0	0	0	0	0	0	0	0	NA
					Refined foods						
Kcal	219	190	263	286	221	276	256	294	294	263	4***
Protein	2	1	3	3	3	4	3	4	3	3	6.2***
Fat	1	0	1	1	1	1	1	1	1	1	2.3***
Carbs	50	48	62	67	53	64	58	71	71	61	3.6***
					ALL FOODS						
Kcal	3025	3714	2629	2851	3056	2275	2624	3116	2817	2869	-1.2**
Protein	91	118	81	88	90	73	78	90	85	87	-1.7***
Fat	49	61	42	43	48	47	49	50	53	48	0.4
Carbs	545	642	453	532	564	396	440	549	519	514	-1.3***

Table 10.16B. Daily *median per capita* consumption of macronutrients by food groups, 2002-2010 (TAPS)

Note: Table 10.2 has for definition of food types and Table 10.4A has the yearly sample size of households. Units for proteins, fats, and carbohydrates are in grams. NA = not applicable; trend could not be estimated either because the food group lacked the macronutrient (e.g., carbohydrates in wildlife) or because the food group had too few observations. An example of the latter is found under the group "Own" "Meat & eggs" consumption. There were only a few observations on carbohydrates from egg consumption (but not from meat consumption). Growth rates come from median regressions, with one yearly record per household. The dependent variable is the *per capita* amount of the macronutrient consumed in the household; for the regressions, I took the logarithm of the outcome using an inverse hyperbolic sine function. Only survey years was used as a predictor. The regressions included robust standard errors and a constant, neither shown. *** p<0.01, ** p<0.05, * p<0.10.

Source: Do file anFood_V3

Table 10.17. Gini coefficients of daily *per capita* consumption of macronutrients, 2002-2010 (TAPS)

	Years									
	2002	2003	2004	2005	2006	2007	2008	2009	2010	All years
			A. Total amount of macronutrients from all sources							
Calories	0.30	0.36	0.30	0.30	0.30	0.29	0.34	0.28	0.27	0.31
Proteins	0.37	0.43	0.41	0.36	0.34	0.36	0.42	0.33	0.34	0.38
Fat	0.48	0.48	0.49	0.45	0.45	0.40	0.51	0.44	0.43	0.46
Carbohydrates	0.30	0.36	0.28	0.30	0.30	0.30	0.31	0.28	0.26	0.31
				B. Inequality by food type and source						
Proteins from:										
All animals	0.47	0.51	0.51	0.44	0.44	0.45	0.51	0.43	0.45	0.48
Wildlife	0.58	0.56	0.57	0.53	0.49	0.51	0.57	0.49	0.51	0.55
Own livestock & eggs	0.77	0.85	0.79	0.80	0.75	0.72	0.89	0.80	0.78	0.80
Market meats	0.68	0.72	0.75	0.71	0.67	0.66	0.70	0.73	0.64	0.70
Total kcal refined foods	0.54	0.61	0.52	0.51	0.57	0.49	0.53	0.50	0.48	0.53
Kcal crops	0.32	0.36	0.30	0.32	0.31	0.33	0.33	0.29	0.29	0.33

Source: Do file anFood_V3

Table 10.18. Comparative summary of Gini coefficients of inequality for different dimension of food consumption, ranked from lowest to highest Ginis

Staple quantity	*Cash value*	*Macronutrient quantity*	*Gini*	*Source: Table*
Duck			0.99	
Pork			0.98	
Birds			0.96	
Cow head			0.92	10.13
Lard			0.87	
Flour, sardine			0.86	
Chicken			0.85	
Beef, maize			0.83	
	Meat & eggs (own)		0.82	10.15
Jerky			0.79	
Eggs			0.78	
Game			0.73	10.13
Cooking oil			0.72	
Bread, noodles			0.71	
	Meat & fish (market)		0.70	10.15
Manioc			0.67	10.13
	Oil & lard		0.66	10.15
Fish			0.60	10.13
	Refined foods		0.57	10.15
	Wildlife		0.56	
Sugar			0.53	10.13
	Crops, all food	Fat	0.46	10.15, 10.17
Rice			0.44	10.13
		Protein	0.38	10.17
Plantains			0.35	10.13
		Calories, carbohydrates	0.31	10.17

Appendix A

Sources for the amount of food consumed by households and food prices for the longitudinal study (TAPS) and randomized-controlled trial of village income inequality

In this appendix I summarize where information came from, data anomalies, and corrections.

Level at which data collected:	**Year:**								
	2002	2003	2004	2005	2006	2007	2008	2009	2010
	Quantity of food:								
Household	√/a/	√/a/	√/b/	√	√	√	√	√	√
	Prices:								
Village	√/c/	√/c/	√/d, e/	√/d, f/	√	√	√	√	√
Town	√/c/	√/c/	√/d, e/	√/d, f/	√	√	√ /g/	√	√

Notes:

/a/

[i] Data for 2002-2003 came from the five-quarter panel study in the same villages as the TAPS panel study and was collected roughly during the same time of the year (May-October, 2002 and 2003). I kept the earliest record of a household during the May-October period.

[ii] The module on game animals asked about the three main types; in other years, the module asked about four game animals, so measures for 2002-2003 are short of one animal. The module on fish asked about the eight main fish consumed; in other years, the module asked about the six main fish. I kept the six main fish to be consistent with measures from other years.

[iii]. In 2002-2003 we did not ask about the price of cow heads or canned sardines in village surveys, but did in the town surveys.

/b/ In the module on wildlife we asked about the five main game animals and eight main fish consumed; in other years we asked about the four main game animals and six main fish. To make the measures for 2004 comparable to the measures of other years, I kept the four main game animals and the six main fish listed by respondents in 2004.

/c/ Price data for 2002-2003 comes from a five-quarter panel study in the villages of the longitudinal study. For 2002-2003, I took the median yearly price for each food. Since no plantain prices were collected, I impute the median 2003 plantain price from communities outside of the study area to plantains consumed in 2002 or 2003. In the five-quarter study we did not collect egg prices in villages, but we did in towns, so town prices are imputed to villages.

/d/ In 2004-2005 we asked about the cans of sardines and the number of cow heads eaten, but we did not ask about the price of sardines or cow heads in villages, though we did ask about these prices in the town surveys. For those two years, the town prices are imputed to villages. In 2005, only one town seller reported a price for a cow head; I impute this value to any cow head consumed.

/e/ In 2004 we did not ask about the village selling price of eggs, but we did ask about it in the town survey. I assigned the town price of an egg to estimate the value of household egg consumption.

/f/ In 2005 we did not include a village price module for village 186. We included the village to track attriters from the longitudinal study. I assigned the median prices from the rest of the sample to this village.

/g/ In 2008, we added a third town (Palmar) to collect prices on food for the randomized-controlled trial.

Appendix B

Name of animals

We struggled to find the name of animals in Tsimane’ and Spanish, never mind the scientific name of fish, wild game animals, and birds. Because we did not follow scientific naming conventions, our names probably misclassify animals. I use English when the animal name is unambiguous (e.g., deer), but I use Tsimane’ when there is no accurate word in Spanish or English. For example, I prefer *Emej* for a wild bird that in Spanish translates as *Pava roncadora* and in common English as turkey. During 2020, Tomás Huanca and a Tsimane’ who had worked as a translator and helped with the surveys during most of the studies, went over the list of animals, corrected the Spanish and Tsimane’ names, and jotted discrepancies. The final list of names is included as an Excel spreadsheet in the datasets for this chapter. A sample of the first few animals is included below to give user a flavor of the file. The column “Comments” contains observation of the research assistant as they went through the list of animals in 2020.

Code	Spanish	Corrected	Tsimane'	Corrected	Comments
100		Like blanquillo	Amere	Amere	
182		Like bagre	Ayajtiri	Ayajtrij	
154		Highlanders call it sabalillo	Bojmo	Bojmo'	
195		Ciego	Bujmumujijitsaqui	Bujmu'mu	Jijítsaqui is another fish; it bites in the river
165		Like carancho; lives in mud	Cape'	Ca'pe'	
186		Carao	Sarao	Cojtyi'ro	
183			Carash		Did not know
192		Pacú	Chae	Cha'e'	
178			Cochimio	Cochino	Did not know

Appendix C

Conversion factors for macronutrients

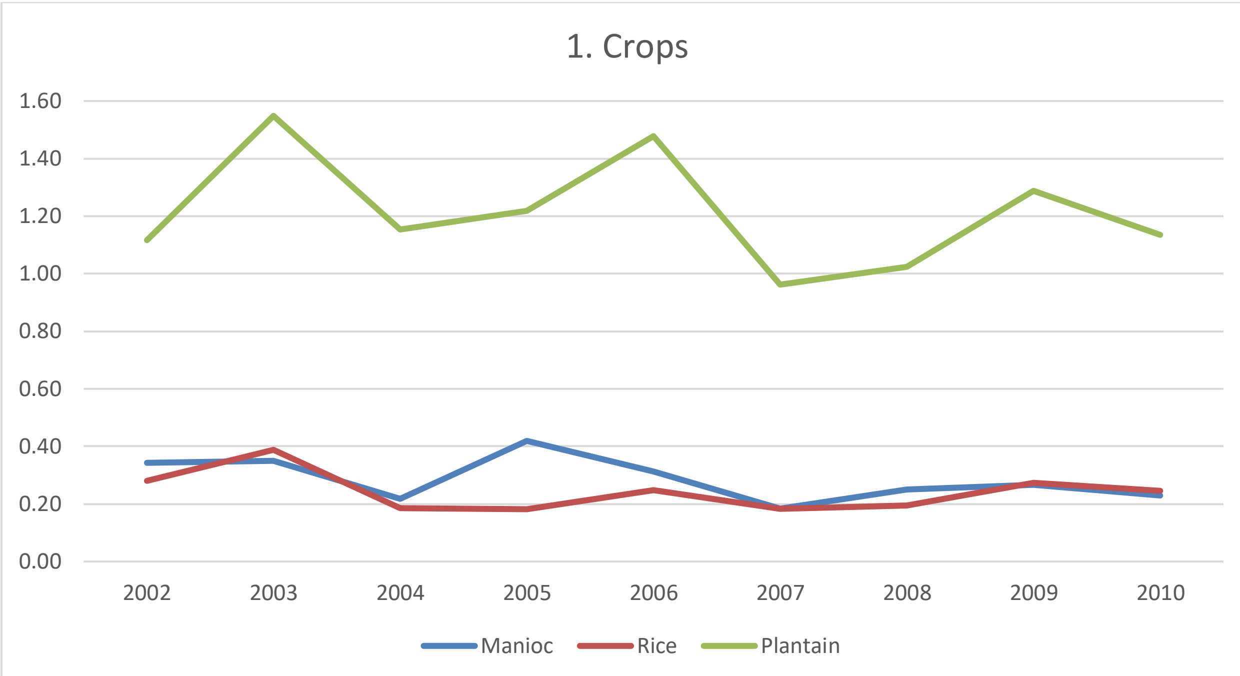
Food	Unit/b/	Unit weight Kg	% edible	Energy (kcal) per 100 gm	Per 100 gm edible (proteins, fat, carbohydrates)/a/: Proteins: Gm	kcal	Fat: gm	kcal	Carbohydrates: gm	Kcal
Animal wildlife /c/			84.0	124.0	21.4	85.6	3.6	32.4	0.0	0.0
Any fish			47.0	132.0	18.8	75.2	5.7	51.3	0.0	0.0
Sardine	Can	0.425	100.0	189.0	21.0	84.0	11.0	99.0	0.0	0.0
Beef			84.0	273.0	17.5	70.0	22.0	198.0	0.0	0.0
Bread	Unit	0.040	100.0	350.0	6.1	24.4	5.2	46.8	69.7	278.8
Jerky			100.0	509.0	60.0	240.0	28.0	252.0	0.0	0.0
Chicken			61.0	200.0	20.2	80.8	12.6	113.4	0.0	0.0
Maize	*Mancorna*		35.0	360.0	9.3	37.2	4.0	36.0	73.5	294.0
Cow head	Unit	14.7	20.0	457.0	11.9	47.6	45.0	405.0	0.0	0.0
Duck			61.0	340.0	16.2	64.8	30.0	270.0	0.0	0.0
Eggs	Unit	0.040	100.0	163.0	12.4	49.6	11.7	105.3	0.9	3.6
Flour			100.0	350.0	11.7	46.8	1.5	13.5	74.3	297.2
Lard			100.0	847.0	2.0	8.0	93.0	837.0	0.0	0.0
Cooking oil	Liters	0.933	100.0	884.0	0.0	0.0	100.0	900.0	0.0	0.0
Noodles			100.0	367.0	11.0	44.0	1.1	9.9	76.3	305.2
Plantain			66.0	113.0	1.2	4.8	0.5	4.5	29.2	116.8
Pork			82.5	457.0	11.9	47.6	45.0	405.0	0.0	0.0
Rice			100.0	359.0	7.1	28.4	1.1	9.9	78.0	312.0
Sugar			100.0	387.0	0.0	0.0	0.0	0.0	100.0	400.0
Manioc			80.0	160.0	1.4	5.4	0.3	2.5	38.1	152.4

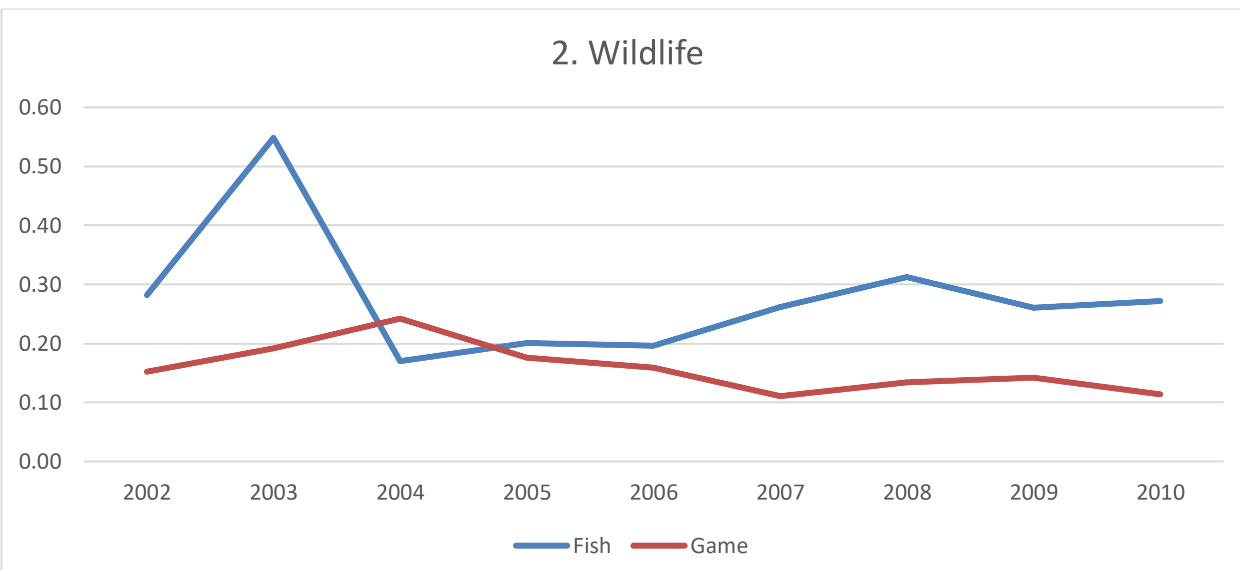
Notes:
/a/ kcal = kilocalories
/b/ Unless noted, all units are in kilograms
/c/ Includes mammals, reptiles, and birds

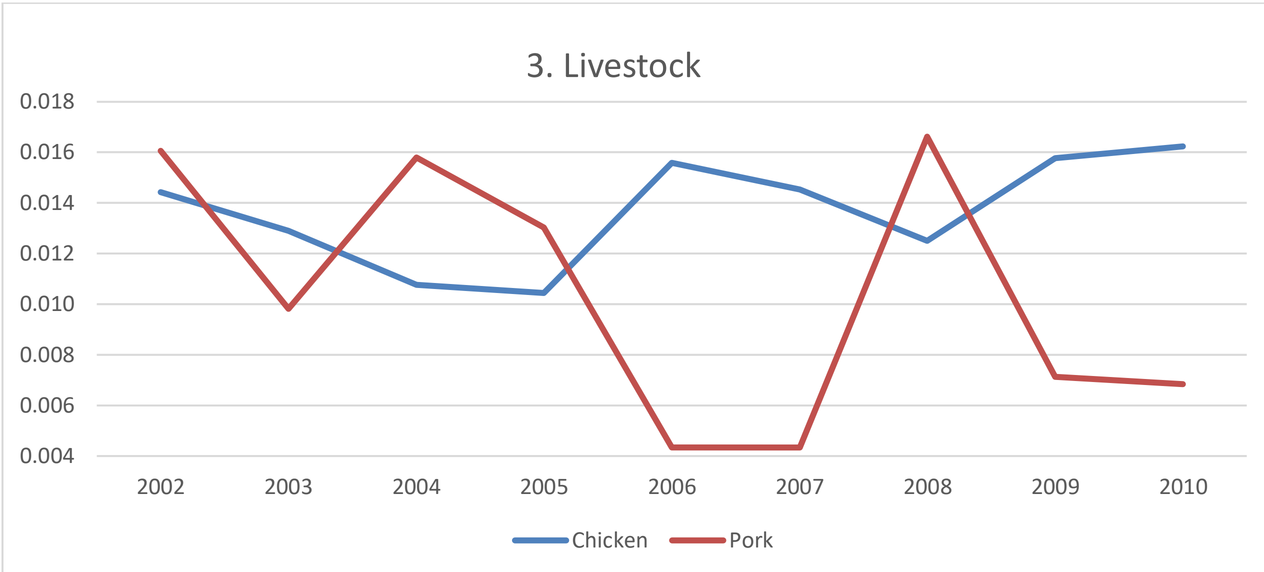
Sources: Flores et al. (1971) and Bethancourt et al. (2019).

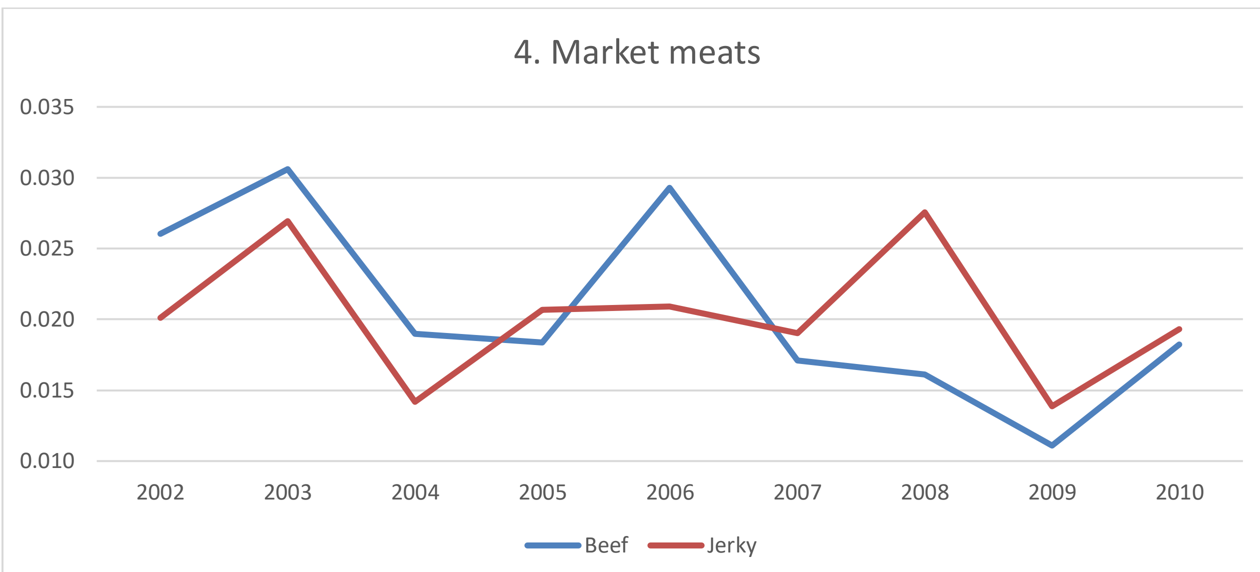
Appendix D

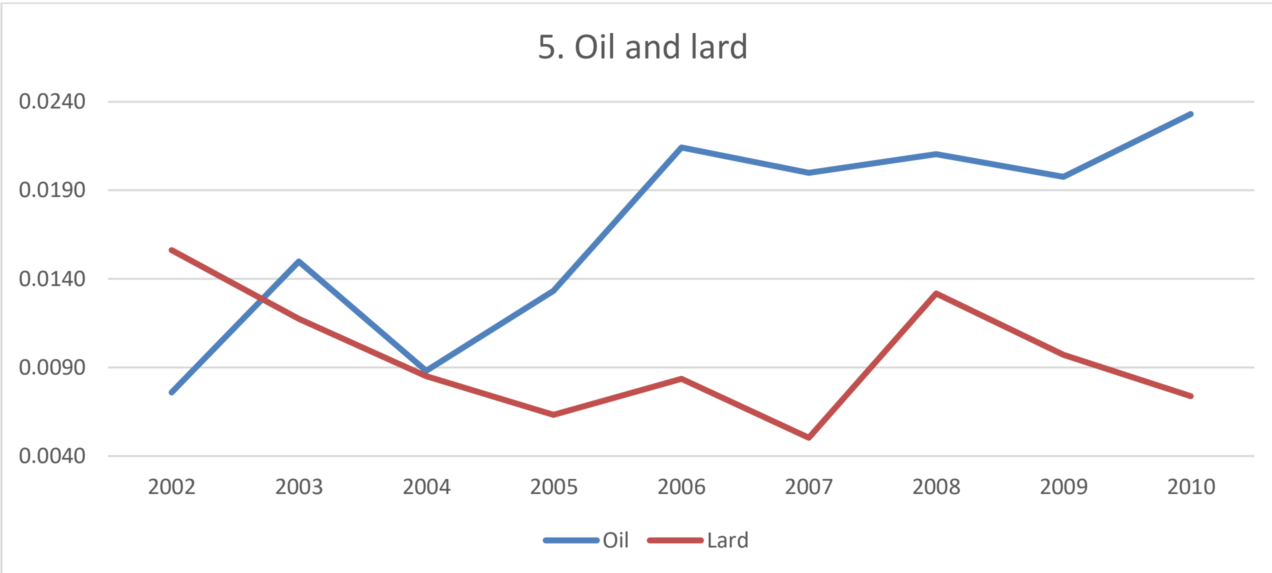
Trends in yearly mean daily *per capita* consumption of staples reported in kilograms in the survey, TAPS, 2002-2010

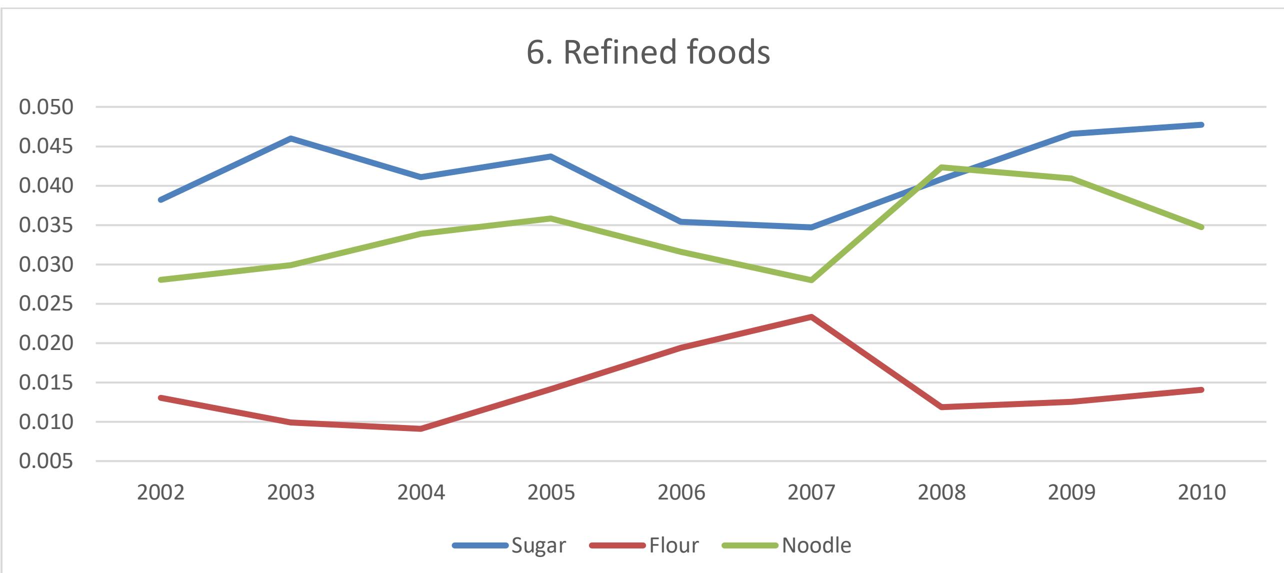





3. Livestock
0.018
0.016
0.014
0.012
0.010
0.008
0.006
0.004
2002
2003
2004
2005
2006
2007
2008
2009
2010
Chicken
Pork


4. Market meats
0.035
0.030
0.025
0.020
0.015
0.010
2002
2003
2004
2005
2006
2007
2008
2009
2010
Beef
Jerky





Source: Table 10.7 but excludes baseline data (2008) from the randomized-controlled trial as it took place outside the area of the longitudinal study. I left out the following staples because we did not record them in kilograms (maize, eggs, cow heads, sardines, bread) or because values, though recorded in kilograms, were too small (birds, ducks).

Appendix E

Percentage of missing values in surveys of community prices for own and market foods, Combined total for 2002-2010 (TAPS and RCT [2008])

		Villages (obs=158)	Towns (obs=21)
OWN			
	Deer	60.13	100
	Jochi	59.49	100
	Sábalo	56.33	100
	Surubí	53.8	100
	Eggs	49.37	4.76
	Manioc	8.86	0
	Maize	5.7	42.86
	Plantains	17.09	100
	Rice	3.16	0
MARKET			
	Cow head	76.58	14.29
	Beef	69.62	4.76
	Sardines	65.82	0
	Jerky	14.56	0
	Lard	61.39	0
	Oil	47.47	4.76
	Bread	45.57	0
	Noodles	42.41	0
	Sugar	15.82	0
	Flour	60.13	0

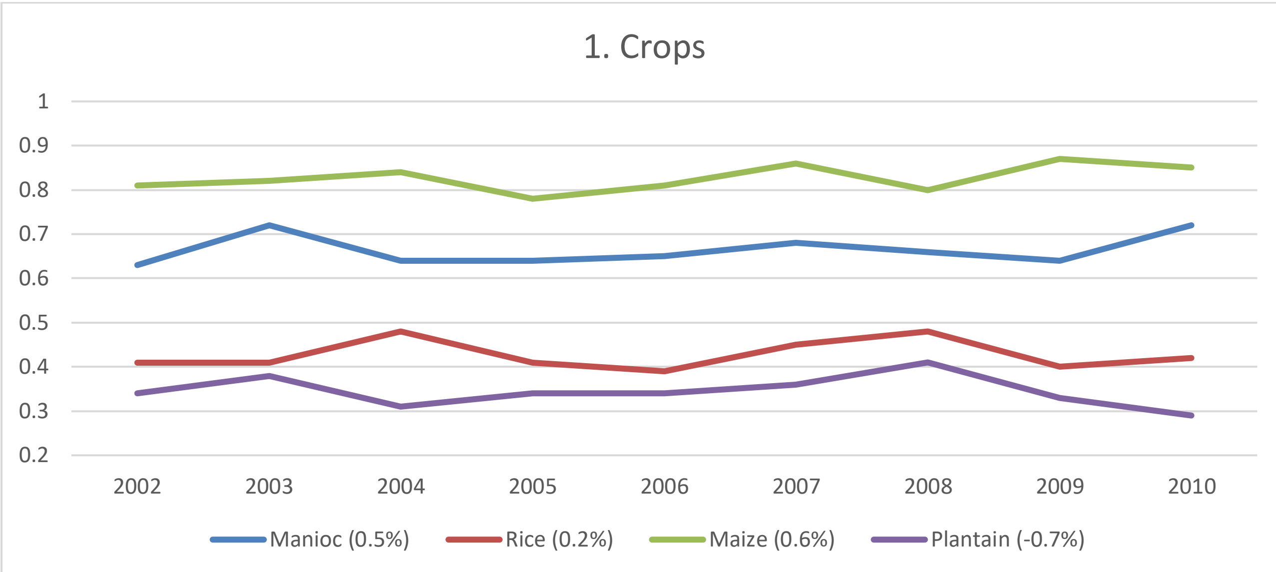
Note:

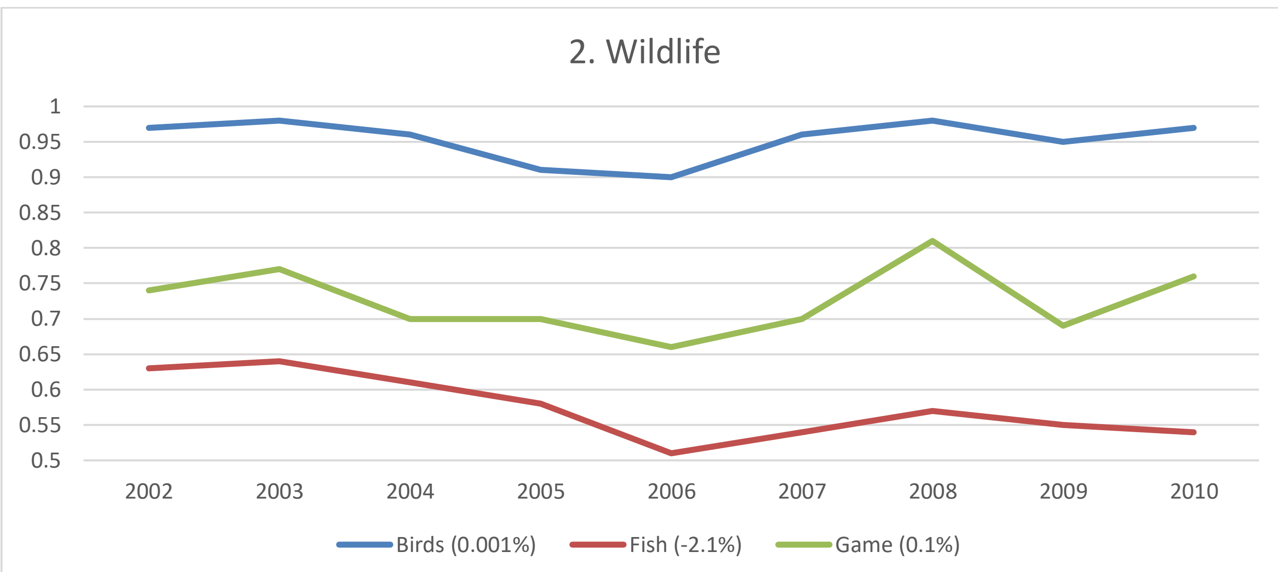
The unit of observation is the community surveyed in a year

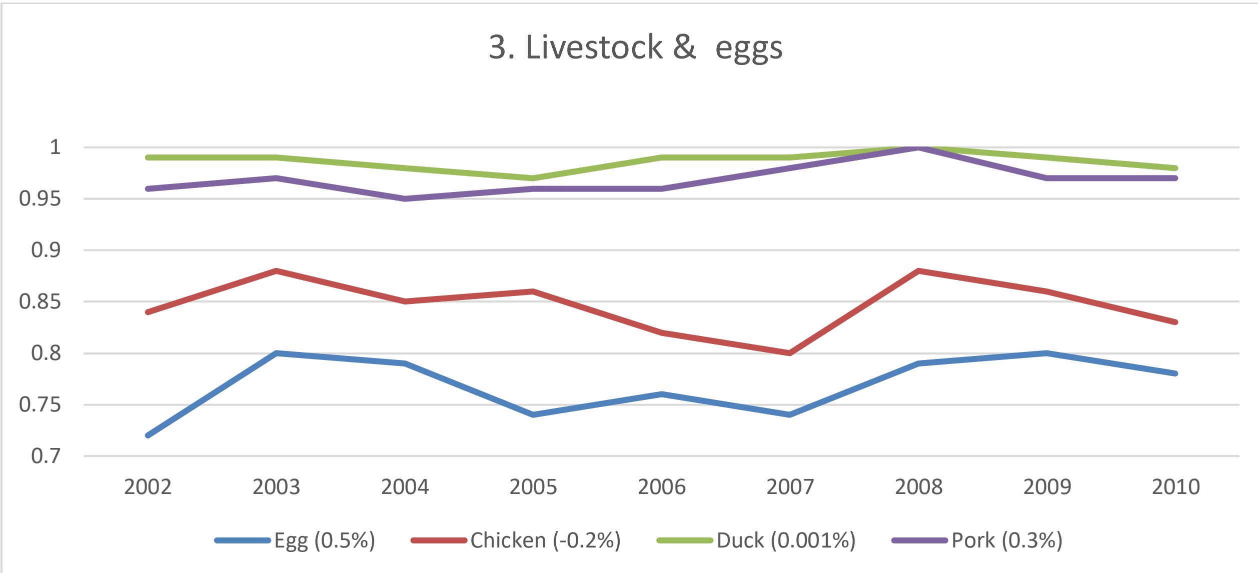
Source: Do file crPrices_Food_V1

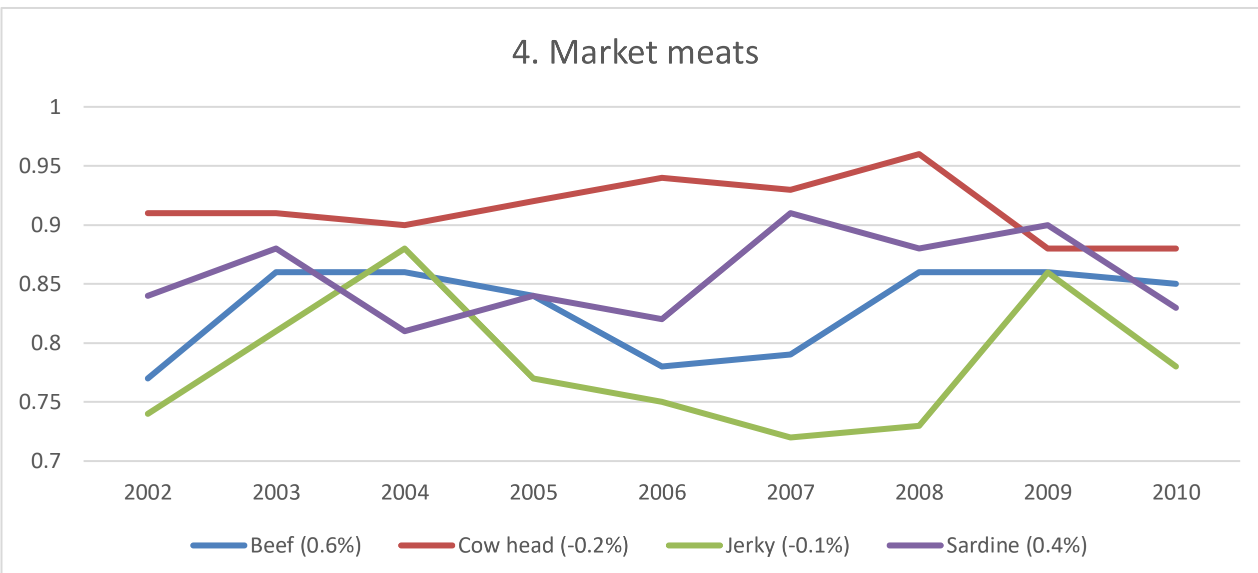
Appendix F

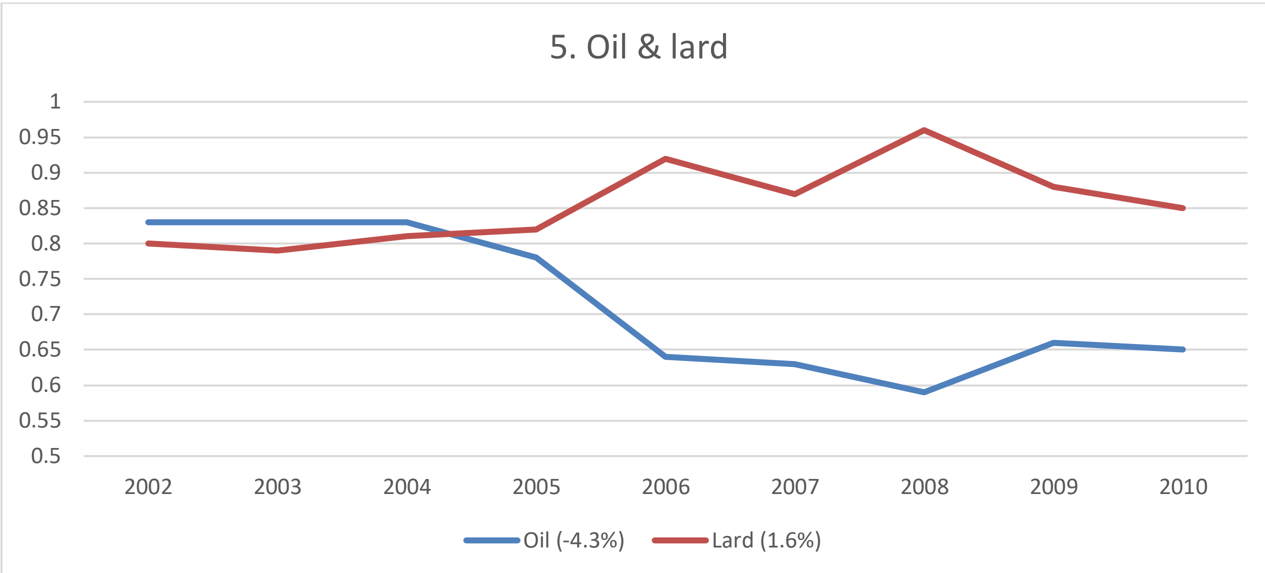
Trend and growth rate (%/year) in Gini coefficient of *per capita* quantity of food consumed: TAPS, 2002-2010

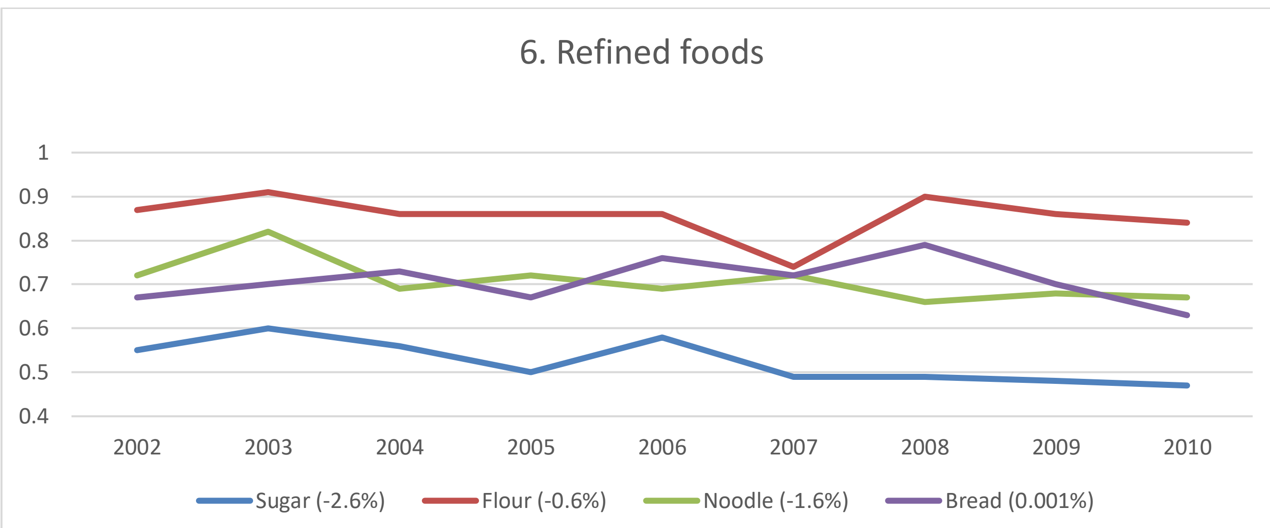





3. Livestock & eggs
1
0.95
0.9
0.85
0.8
0.75
0.7
2002
2003
2004
2005
2006
2007
2008
2009
2010
Egg (0.5%)
Chicken (-0.2%)
Duck (0.001%)
Pork (0.3%)


4. Market meats
1
0.95
0.9
0.85
0.8
0.75
0.7
2002
2003
2004
2005
2006
2007
2008
2009
2010
Beef (0.6%)
Cow head (-0.2%)
Jerky (-0.1%)
Sardine (0.4%)

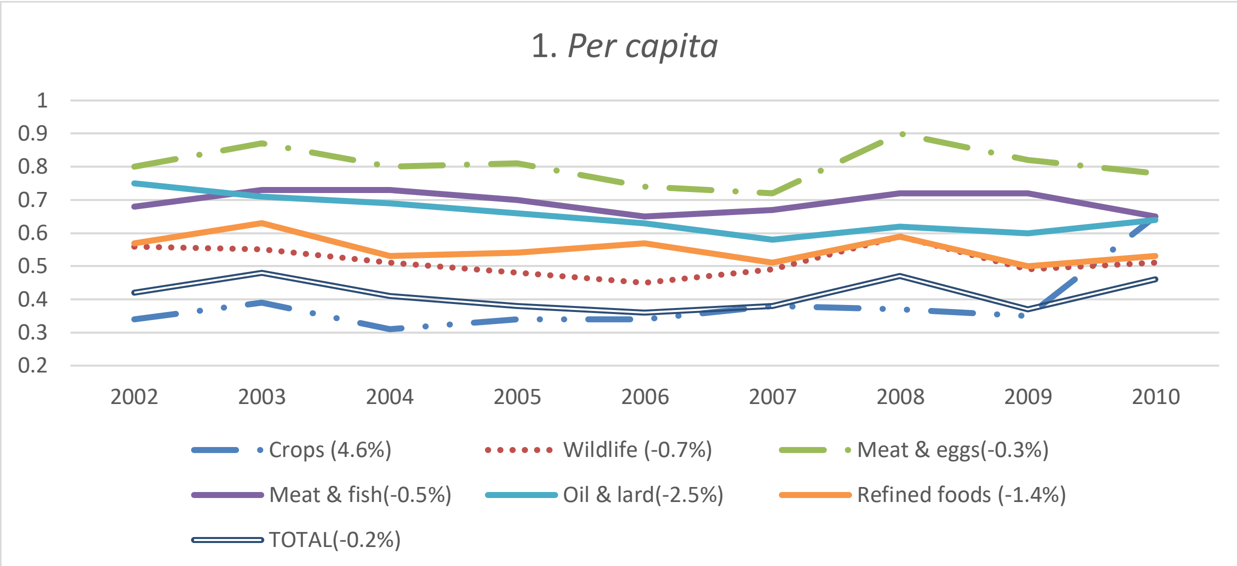


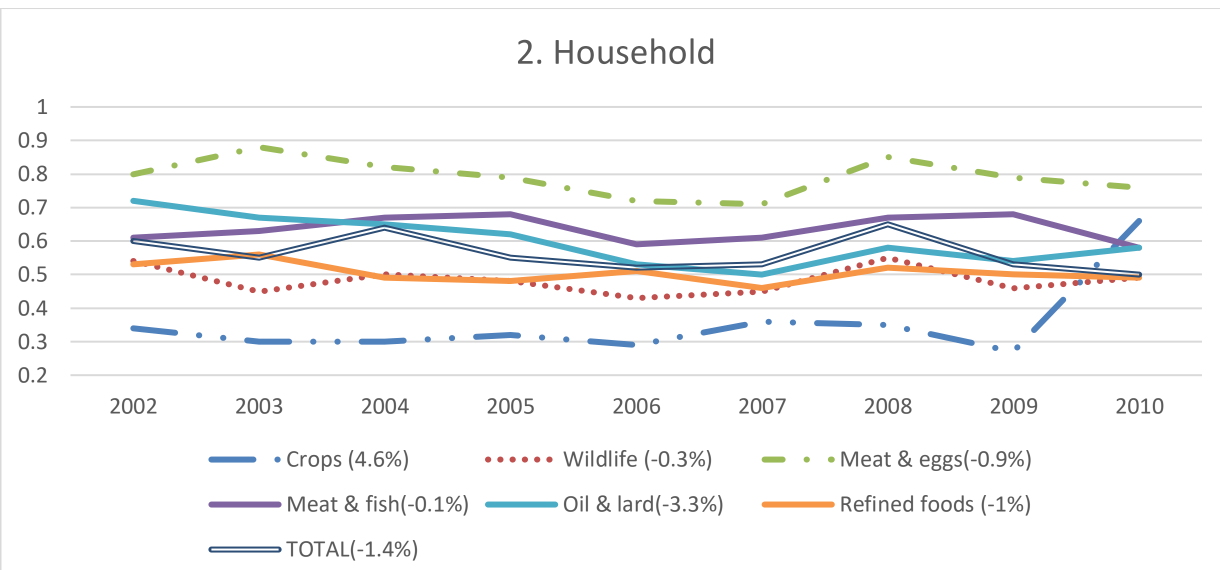


Source: Table 10.13

Appendix G

Trend and growth rate (%/year) in Gini coefficient of daily *per capita* and household cash value of food consumed, grouped by food types and for all foods: TAPS, 2002-2010



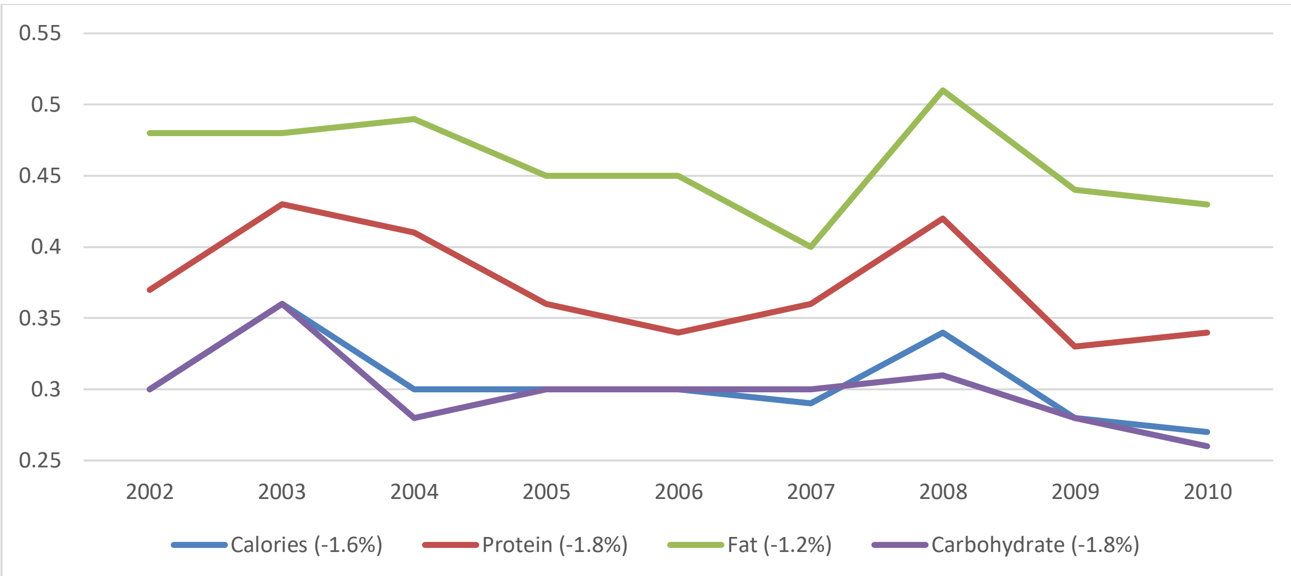


Note: Dashed lines are for own foods and solid lines are for market foods. The line with parallel bars is the Ginis for the total value of all foods.

Source: Table 10.14 for Figure 2 and Table 10.15 for Figure 1.

Appendix H

Trend and growth rate (%/year) in Gini coefficient of total daily *per capita* amount of four macronutrients: TAPS, 2002-2010



Source: Table 10.17 (part A).

Appendix I

Guide to tables and figures for Chapter 10

The Stata do files produce most of the tables and figures reported in this chapter. Tables 10.1-10.3 I constructed manually based on my knowledge of the data and fieldwork conditions. Figures in appendices came from chapter tables, which I exported to Excel to make the figures.

Figure	Table	Source	
		Table	Do file
10.1A-10.1C			crQuantity_Animals_V2
10.2		10.10	anFood_V3
10.3A-10.3D			anFood_V3
	10.4-10.17		anFood_V3
	10.18	10.13, 10.15, 10.17	
Appendix D		10.7; exported to Excel	
	Appendix E		crPrices_Food_V1
Appendix F		10.13; exported to Excel	
Appendix G		10.14-10.15; exported to Excel	
Appendix H		10.17 (part A); exported to Excel	

Reference List

Bethancourt, H., Leonard, W., Tanner, S., Schultz, A., & Rosinger, A. (2019). Longitudinal changes in measures of body fat and diet among adult Tsmiane' forager-horticulturist of Bolivia, 2002-2010. *Obesity 0*, 1-13. doi:10.1002/oby.22556

Byron, E. (2003). *Market Integration and Health: The Impact of Markets on the Nutritional Status, Morbidity, and Diet of the Tsimane' Amerindians of Lowland Bolivia.* (PhD PhD). University of Florida, Gainesville, Florida.

Flores, M., Menchú, M., & Lara, M. (1971). *Valor nutritivo de los alimentos para Centro América y Panamá*. Guatemala: Instituto de Nutrición de Centro América y Panamá (INCAP).

Gutierrez, Y. (2005). *Uso de avifauna por comunidades Tsimane' y estudio de la comunidad: Chirisi, Beni-Bolivia.* (B.Science). Universidad Mayor de San Andrés, La Paz, Bolivia.

Huanca, T. (2008). *Tsimane' oral tradition, landscape, and identity in tropical forest*. La Paz, Bolivia: Wa-Gui.

Kraft, T., Stieglitz, J., Trumble, B., Martin, M., Kaplan, H., & Gurven, M. (2018). Nutrition transition in 2 lowland Bolivian subsistence populations. *American Journal of Clinical Nutrition, 108*, 1183-1195.

Luz, A. (2012). *The role of acculturation in indigenous peoples' hunting patterns and wildlife availability. The case of the Tsimane' in the Bolivian Amazon*. Institut de Ciència i Tecnologia Ambientals (ICTA). Universitat Autònoma de Barcelona (UAB). Bellaterra, Barcelona, Spain.

Nordenskiöld, E. (2001 [orig 1924]). *Exploraciones y aventuras en Sudamérica*. La Paz: Plural Editores.

Pauly, A. (1928). *Ensayo de etnografía americana. Viajes y exploraciones*. Buenos Aires, Argentina: Talleres S.A. Casa Jacobo Peuser, Ltds.

Pérez, E. (2001). *Uso de la ictiofauna entre los Tsimane'.* (BSc). Universidad Mayor de San Andrés, La Paz, Bolivia.

Zycherman, A. (2013). *The changing value of food: Localizing modernity among the Tsimane' Indians of lowland Bolivia.* (PhD). Teacher's College, Columbia University, New York.

---

[i] Valusa (*Xanthosama sagittifolium*), also known as gualusa or walusa, is a tuber.

[ii] "Entre los chimanes (of Chichira) comimos realmente bien. Tienen huevos, pescado, caza, y muchos productos de sus campos agrícolas (p. 158). Raramente falta pesca o caza en el menú de los chimane. Para ellos, así como para los mosetene, la caza es una verdadera fuente de provisión de alimentos, no una mera diversión, como en muchas otras tribus. Cuando uno llega a sus cabañas, casi siempre se está asando un animal en el fuego. Frecuentemente es un jabalí o un oso hormiguero, un mono, un tapir, una capihuara, un coati delicioso u otra cosa rica. En cambio, rara vez se ve un ave; quizás sean difíciles de acertar con arco y flecha, las únicas armas de los chimane."

[iii] "El país de los mosetene y chimane es con seguridad un buen lugar para vivir. No creo que la gente pase hambre. A veces se ven forzados a ser vegetarianos, pues en tiempo de lluvias la caza y la pesca a veces fracasa."

[iv] Cow heads Tsimane' cook fresh or in its sun-dried form (jerky) in a stew called *locro*. The cheeks of the cow are sun dried and salted and sold in towns or brought by merchants to villages. Some Tsimane' buy the cow head and sun dried the meat. I thank Tomás Huanca for clarifying the sources and uses of cow heads.

[v] We did not code in the survey who provided the estimates for the weight of animals. We cannot tell from the dataset whether spouses proffered the estimate in kilograms, or whether the estimates came from surveyors after they used animal-to-weight conversions.

[vi] Anthropometry and perceived health were the only two modules applied to all villagers. Recall that data for 2002-2003 came from a five-quarter panel study. For 2002, I estimated household size for the first anthropometric measure taken during May-October, the dates when we did the surveys in the longer panel. For 2003, for households without anthropometry data, I extended the date from which to extract data on perceived health from May back to February. I did this to ensure I had a head count for most households. Thus, for 2003, I tallied household size as the unique number of people living in a household from February until October; this happened even though the survey of food consumption took place between May and October.

[vii] The household size used to analyze food is almost the same as the household size based on demographic data in Table 5.1 (Chapter 5), but differs slightly because in this chapter I dropped some households and the household demographic survey included all people in the household. The team did not take anthropometric measures of some people in the household (e.g., newborns, physically handicapped).

[viii] Gutierrez (2005) found that bird hunting and eating wild birds peaked during September-October. Since our surveys often ended by September, our finding that Tsimane' ate few birds could reflect the dates when we did the survey.

[ix] For totals, I added the kilograms of the last column.

[x] Villagers buy commercial foods in town stores or from travelling traders when traders come to villages.

[xi] *Per capita* consumption of rice in the larger household = 10 kilograms/five people = 2 kilograms per person. *Per capita* consumption of rice in the singleton household = 1 kilogram/1 person = 1 kilogram/person.

[xii] Ginis can range from a theoretical minimum of zero (perfect equality) to a theoretical maximum of one (perfect inequality). Restricted to staples whose Ginis changed by 0.10 Gini points, my examples highlight cases where Ginis changed a lot between years.

[xiii] The months when the surveys took place could have influenced the amount of wildlife consumed and inequality in wildlife consumption. Tsimane' say prime game mammals gain weight during April-June (Huanca, 2008; Luz, 2012, pp. 21-22). If surveys took place during those months the amounts reported would have been greater than in other months. Likewise with fish. The fish run takes place during August, so surveys during this dry month would have shown greater fish consumption. Some of the inequality in wildlife consumption could reflect the months when surveys happened. Yearly surveys done mostly during June-July would tend to

show lower amounts and probably lower inequality in game consumption than surveys extending over more months. I thank Tomás Huanca for the insight.

xiv Using yearly data from Table 10.13 and Šidák adjusted p values , I did a pairwise comparison of the yearly Gini coefficients for the 21 foods. I found nothing worth reporting.

xv Only with the consumption of livestock and eggs from their household during 2003-2004 and the consumption of crops during 2010, did Ginis based on household totals surpass Ginis based on *per capita* values. In four additional cases there were no differences between household and *per capita* measures: crops 2002, wildlife 2005, livestock and eggs 2002, refined foods 2009.

xvi My estimates are larger than the ones by Kraft et al. (2018) because of differences in the years covered, methods of data collection, and participants' age. Their study took place during 2010-2015, used 24-hour food recalls, and covered people 30-91 years of age. Our study happened during 2002-2010, used a seven-day recall period, and covered all villagers.

xvii I tested whether the 21 foods changed across seasons by using the five-quarter panel study of 2002-2003. I used the crude measures reported by households without correcting for mistakes or household size, and found consumption did not vary by quarter. In a detailed study on Tsimane' hunting, Luz (2012, pp. 102-103) also found no significant seasonal differences in hunting.

xviii For instance, I tabulated the gross amounts of rice consumption by households and found that 20% of households reported consuming seven kilograms of rice in the past week, 9% reported 14 kilograms, and 10% reported 21 kilograms. I cannot blame Tsimane' for rounding, as they could have reported the amount consumed yesterday to the surveyor who, with perhaps better math skills, multiplied the daily amount by seven to obtain the weekly amount.

xix The distribution of chicks was part of the project to encourage the use of a cover crop (pigeon pea), 2001-2004, mentioned in Chapter 4. We thought Tsimane' would be more likely to adopt the cover crop because they could use it as fertilizer and as feed for livestock.

xx I downloaded the information on November 27, 2020 from the following web page: https://www.indexmundi.com/facts/indicators/SI.POV.GINI/rankings. The estimates come from the World Bank and cover 159 countries. The comparison is questionable for two reasons. First, the World Bank's Ginis refer to inequality between households whereas my Ginis refer to inequality between *per capita* household values. If I used household-level measures of inequality, I end up with a much higher Gini (0.58)(Table 10.14). Second, the year of measurement differed between countries: Venezuela (2006), Seychelles (2013), Chile (2017), Cameroon (2014), and Nicaragua (2014). Tsimane' data refers to grand Gini for the period 2002-2010.