



# Seasonality and household diets in Ethiopia

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## TABLE OF CONTENTS

Abstract .....	2
1. Introduction .....	2
2. Data and diet measures .....	3
3. Context .....	4
4. Seasonality in household diets .....	5
5. Concluding remarks .....	8
References .....	8
Appendix A: Description of the method used to calculate the seasonal food price index .....	10
Appendix B: Data used to construct Figures 4.1, 4.2 and 4.3 .....	10

## LIST OF TABLES

Table 2.1: Ethiopian and Gregorian calendars, and main harvest and sales months by the main regions .....	3
Appendix Table B1: Mean daily per capita calorie intake and household diet diversity score, by rural/urban and month .....	10
Appendix Table B2: Percentage share of daily per capita calorie intake by food source and month, by rural/urban .....	10

## LIST OF FIGURES

Figure 3.1: Monthly food price changes in Ethiopia, percentage deviation from annual average, by rural/urban .....	4
Figure 4.1: Seasonal patterns in mean daily per capita calorie intake, by rural/urban .....	6
Figure 4.2: Seasonal patterns in mean household diet diversity score, by rural/urban .....	6
Figure 4.3: Percentage share of per capita calorie intake from non-cereal sources by month, by rural/urban .....	7

## ABSTRACT

The paper revisits seasonality by assessing how the quantity and quality of diets vary across agricultural seasons in rural and urban Ethiopia. Using unique nationally representative household level data for each month over one calendar year, we document seasonal fluctuations in household diets in terms of both the quantity of calories consumed and the number of different food groups consumed. Households in both rural and urban areas consume less calories in the lean season, but interestingly, due to changes in the composition of diets, the diet diversity score increases towards the end of the lean season.

**Keywords:** seasonality, dietary diversity, calorie intake, food consumption, Sub-Saharan Africa

## I. INTRODUCTION

*As a dimension of poverty, seasonality is as glaringly obvious as it is still grossly neglected. Attempts to embed its recognition in professional mindsets, policy and practice have still a long way to go.*

*Robert Chambers (2011, p. vx)*

Seasonality in food consumption patterns in developing countries attracted considerable research attention in the 1990s and early 2000s. Nutritionists and other researchers documented substantial intra-annual fluctuations in children's and adults' anthropometric measures (e.g. Leonard 1991; Alemu and Lindtjørn 1995; Panter-Brick 1997; Ferro-Luzzi et al. 2001; Maleta et al. 2003). Economists found how various welfare indicators, such as consumption, incomes, and prices, moved together with the agricultural seasons in many developing countries (e.g. Behrman and Deolalikar 1989; Sahn and Delgado 1989; Dercon and Krishnan 2000; Dostie, Haggblade, and Randriamamonjy 2002). This body of research greatly improved our understanding of the seasonal stress that rural households in poor countries face (Sahn 1989). It also provided methodological insights into administering household surveys in developing country settings (e.g. Deaton and Grosh 2000). After these contributions were made, seasonality generally has received less research attention and has been largely neglected in policy arenas (Devereux, Sabates-Wheeler, and Longhurst 2013). Kaminski, Christiaensen, and Gilbert (2014) conjectured that this is partly due to the (mis)perception that local food markets are now well-integrated in much of the developing world.

Recently, the focus in the nutrition literature has shifted away from measuring the quantity of diets in terms of nutrient intake, particularly of calories, to assessing the quality of diets. Emerging evidence documents how low diversity in diets is associated with increased risk of chronic undernutrition among children (Arimond and Ruel 2004; Mallard et al. 2014), iron deficiency among children and adult women (Tatala, Svanberg, and Mduma 1998; Bhargava, Bouis, and Scrimshaw 2001) and mortality from cancer and cardiovascular diseases (Kant, Schatzkin, and Ziegler 1995).

Despite this growing interest in diet quality in developing countries, little evidence exists on how diet quality changes with the agricultural seasons. We are aware of only two such studies, both from Burkina Faso. Savy et al. (2006) studied seasonality and diet diversity in rural Burkina Faso using data from a sample of 550 women. Using a 9-point diet diversity indicator, the authors find that an average woman in the sample consumed food from 3.4 food groups at the beginning of the lean season and from 3.8 food groups at the end of the lean season. This 10.5 percent *increase* in the average diet diversity score during the lean season was attributed to changes in diets away from cereals and meat to legumes, vegetables and milk. Becquey et al. (2012) studied changes in households' diets in the city of Ouagadougou during the lean and post-harvest seasons. Analyzing data from a representative sample of 1,056 urban households, they found that households consumed a diet that was less rich in terms of energy and micro-nutrients during the lean season compared to the post-harvest season.

This paper revisits seasonality by assessing how the quantity and quality of diets vary across agricultural seasons in rural and urban Ethiopia. Using unique nationally representative household level data for each month over one calendar year, we document seasonal fluctuations in household diets both in terms of the quantity of calories consumed and the number of different food groups from which households consumed food. We find that, compared to the post-harvest season, average per capita calorie intake among rural households is about 10 percent lower during the lean season. Moreover, the average diet diversity score for rural households in the lean season is nearly 7 percent below the annual mean. However, in

line with the findings by Savy et al. (2006), due to seasonal changes in the composition of diets, the diet diversity score increases towards the end of the lean season as a greater diversity of foods is consumed. The diets of urban households follow roughly similar seasonal patterns.

## 2. DATA AND DIET MEASURES

The primary data source used for the analysis described here is the Household, Consumption and Expenditure Survey (HCES). While not originally designed for nutrition analysis, the HCES data have been found to provide consistent information about various nutrition measures when compared to surveys based on 24-hour recall (Fiedler 2013). The Ethiopian HCES data are collected by the Ethiopian Central Statistical Agency (CSA) and serve as the official source for poverty statistics in Ethiopia (MoFED 2013).<sup>1</sup> The latest HCES survey was fielded from 8 July 2010 to 7 July 2011. A novel feature of this round of the survey is that nationally representative data were collected in each month over one calendar year. Field teams of enumerators interviewed about 2,300 households in each calendar month.<sup>2</sup> The survey covered all 11 regions of the country and included 864 rural and 1,104 urban enumeration areas.<sup>3</sup> The sampling began by stratifying the country into rural and urban areas. After that, the enumeration areas were selected using the probability proportional to size approach where more populated units had a higher probability of being selected into the final sample. We use sampling weights, which are based on selection probabilities and provided by the CSA, to compute representative estimates for rural and urban areas of the country. In order to minimize recall error on consumption, each survey household was visited at least twice within one week. For more details on the HCE 2010/11, refer to Central Statistical Agency [Ethiopia] (2012).

The HCE survey recorded dates using the Ethiopian calendar, which is different from the Gregorian calendar used in most Western countries. We map these Ethiopian calendar months onto the Gregorian calendar months (Table 2.1) and use the latter throughout the paper.

**Table 2.1: Ethiopian and Gregorian calendars, and main harvest and sales months by the main regions**

#	Ethiopian	Gregorian	Main (meher) harvest months	Main crop sales months	Main livestock sales month
1	<i>Meskerem</i>	September			
2	<i>Tikimt</i>	October	Tigray		
3	<i>Hidar</i>	November	Amhara, Oromiya, SNNP, Tigray		
4	<i>Tahesas</i>	December	Amhara, Oromiya, SNNP, Somali	Tigray	
5	<i>Tir</i>	January		Amhara, Oromiya, SNNP, Somali, Tigray	
6	<i>Yekatit</i>	February		Amhara, Oromiya, SNNP	Somali
7	<i>Megabit</i>	March			
8	<i>Miazia</i>	April			Amhara, Oromiya, SNNP, Tigray
9	<i>Ginbot</i>	May			
10	<i>Sene</i>	June			
11	<i>Hamle</i>	July			
12	<i>Nehase</i>	August			
13	<i>(Pagume)</i>	(September)			

Sources: Harvest and sales times are based on own calculations from the Ethiopian Rural Socioeconomic Survey-2012 and the Feed the Future Survey 2013

Note: The Ethiopian calendar months typically begin during the first half of the Gregorian calendar month. Exact one-to-one mapping is therefore not possible. The Ethiopian calendar consists of 13 months. The last month (Pagume) is only 5 days (6 in leap years) and is therefore ignored in the analysis. SNNP refers to Southern Nations, Nationalities, and Peoples' Region.

We assess household diets using an extensive consumption-expenditure module included in the survey. The survey module consisted of 275 food items and recorded household's food consumption over the past 7 days.<sup>4</sup> We use daily per capita calorie intake as our measure of diet quantity. The calorie consumption measure is computed using food quantities collected by the HCES and calorie conversion factors reported in EHNRI (1968-1997).

The quality of diets is assessed using the Household Diet Diversity Score (HDDS). Following Swindale and Bilinsky (2006), we categorized household consumption into 12 food groups: cereals; root and tubers; vegetables; fruits; meat,

<sup>1</sup> The Ethiopian HCES is a continuation of a series of surveys (1995/96, 1999/2000, and 2004/05) known as Household Income, Consumption, and Expenditure Survey (HICES) with one difference. No attempt was made to collect income data in the 2010/11 survey. Thus, the change of title from HICES to HCES.

<sup>2</sup> A total of 27,835 households were interviewed in the 12-month period.

<sup>3</sup> The HCES did not cover the non-sedentary populations in Afar (three zones) and Somali (six zones). See Central Statistical Agency [Ethiopia] (2012).

<sup>4</sup> Since each household was visited at least twice, the actual recall period in the consumption module was 3 to 4 days. This alleviates concerns of recall bias in our calorie intake and diet diversity estimates.

poultry and offal; eggs; fish and seafood; pulses, legumes and nuts; milk and milk products; oil and fats; sugar and honey; and miscellaneous foods. A household that consumed an item from each food group receives the maximum score of 12. In contrast, a household that consumed only cereals and pulses over the 7-day period, for example, obtains an HDDS of 2. The HDDS score is constructed so that a higher diet diversity score implies that the household consumes a diet that has more diversity in terms of foods consumed and, by extension, in terms of macro- and micronutrients.

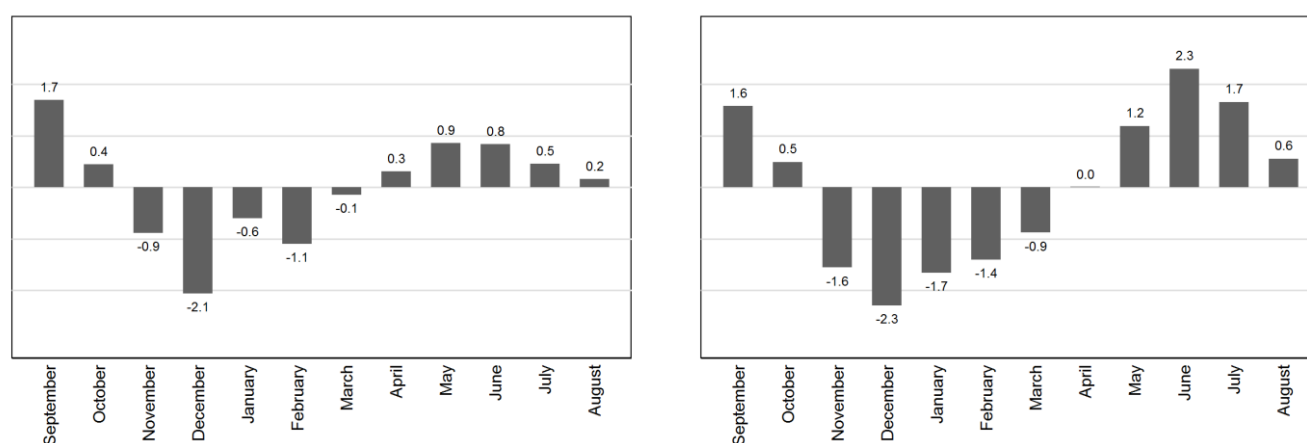
### 3. CONTEXT

More than 80 percent of the 74 million Ethiopians reside in rural areas and depend on agriculture as their main source of income (NBE 2013). Ethiopian farmers rely largely on rain-fed agriculture, and therefore agricultural production in the country takes place in seasonal cycles.<sup>5</sup> The main agricultural areas of the country have two rainy seasons: *belg* and *meher*. More than 90 percent of the total crop production takes place during the *meher* season (Taffesse, Dorosh, and Gemessa 2012). Table 2.1 shows how the timing of the main harvesting season (following the *meher* rains) varies across the main regions, but broadly occurs between October and December. The bulk of crop sales by farm households occur in the months of December, January, and February. Livestock sales are more evenly scattered across the year. However, April, typically the month just after the main Orthodox fasting season (see below), records the largest sales.

Food prices reflect the seasonal – and trade-mediated – interaction between the supply of and demand for food. The seasonality of food production affects food availability during the calendar year, which is then reflected in food prices. To study the seasonality of food prices, we utilize CSA's Consumer Price Survey.<sup>6</sup> Specifically, the monthly prices dataset spanning July 2001 to October 2011 is used in this study. Using data for the full years, 2002 to 2010, we compute two seasonal food price indices: one for the rural regions and one for the urban regions (Addis Ababa, Dire Dawa, and Harar).<sup>7</sup>

The left panel in Figure 3.1 shows the seasonal food price index for rural Ethiopia. The monthly deviations from the annual average are low, ranging between -2.1 and 1.7 percent. We see that the food prices are lowest between November and February: the months during or just after the main harvest period. After this, the supply of food gradually declines as households' food stocks begin to diminish. The prices are highest during the months when there is less food available. The sharp increase observed in September is likely to be in part due to the Ethiopian New Year and Orthodox religious festivities (*Meskel*) taking place in this month.

**Figure 3.1: Monthly food price changes in Ethiopia, percentage deviation from annual average, by rural/urban**



Source: Calculated from CSA price data spanning 2002-2011.

Notes: Price deviations reflect the average monthly departures from the annual mean of the seasonal food price index. The seasonal food price index is based on the Consumer Price Index and computed using a moving average method (see Appendix A).

<sup>5</sup> The International Water Management Institute estimates that only between 4 and 5 percent of the cultivated land in Ethiopia is irrigated (Awulachew, Erkossa, and Namara 2010). This estimate is consistent with those obtained by CSA's annual Agricultural Sample Survey over recent years (Taffesse, Dorosh, and Gemessa 2012).

<sup>6</sup> This survey is conducted regularly by the CSA to collect prices from 136 markets across all 11 regions of Ethiopia for its monthly Consumer Price Index.

<sup>7</sup> Appendix A explains how the seasonal food price index has been calculated.

Urban areas depend on food produced in the rural areas. As a consequence, food prices fluctuate across the seasons, causing the seasonality of agricultural production in rural areas to affect the food consumption patterns of the smaller urban population of Ethiopia. The right panel in Figure 3.1 displays the seasonal food price index for urban areas. We see that urban prices follow the same seasonal pattern as rural prices. Interestingly, however, the food price fluctuations are considerably stronger in the urban areas. The price deviations range between -2.3 and 2.3 percent.

In addition to weather-cycles, religion plays a central role in shaping diets during a calendar year. This is particularly the case for the Orthodox Christians who comprise 44 percent of the Ethiopian population (Central Statistical Agency [Ethiopia] 2010). The Orthodox Church year has a number of fasting periods. Lent is the longest fasting period spanning 55 days, and usually taking place between February and April.<sup>8</sup> During this period, devout Orthodox Christians follow a vegan diet by refraining from consuming meat or other animal products (e.g. milk, butter). Other shorter fasting periods occur in December-January (40 days) and August (16 days). In our study period, Lent started on 28 February (21 *Yekatit*) and ended on 16 April (8 *Miazia*). For Muslims – who comprise 34 percent of the population (Central Statistical Agency [Ethiopia] 2010) – *Ramadan* is the main fasting period and its timing varies across years. In 2011, Ramadan started on 1 August (25 *Hamle*) and ended on 29 August (23 *Nehase*). During *Ramadan*, Muslims abstain from eating and drinking between sunrise and sunset. The consumption of animal products is not restricted during *Ramadan*.

It is important to take these religious fasting events into account when analyzing seasonality in the Ethiopian context. For example, when analyzing the role of seasonality on diets in the following section, we expect that diet diversity is lower during Lent. On the other hand, as *Ramadan* only affects the timing of meals, rather than restricting the content of the meals, it should not have a similar effect on dietary diversity. If anything, we expect that diets are more diverse during the *Ramadan*, since the evening meals to break the fast generally consist of a wider variety of foods than is normally consumed.

## 4. SEASONALITY IN HOUSEHOLD DIETS

Figure 4.1 plots mean per capita daily calorie intake for each month.<sup>9</sup> In line with the findings of Berhane et al. (2012) and the Central Statistical Agency [Ethiopia] (2012), rural households are seen to enjoy better diets in terms of calories consumed. The mean daily calorie consumption for rural households is 2,444 kilocalories per capita, whereas urban households consume, on average, 2,287 kilocalories per capita. This difference in average calorie consumption likely reflects higher average calorie requirements in rural areas partly due to the demands of more physical labor (Popkin 1999). More expensive sources of calories in urban areas may also play a role in these different calorie consumption patterns (Worku et al. 2015).<sup>10</sup>

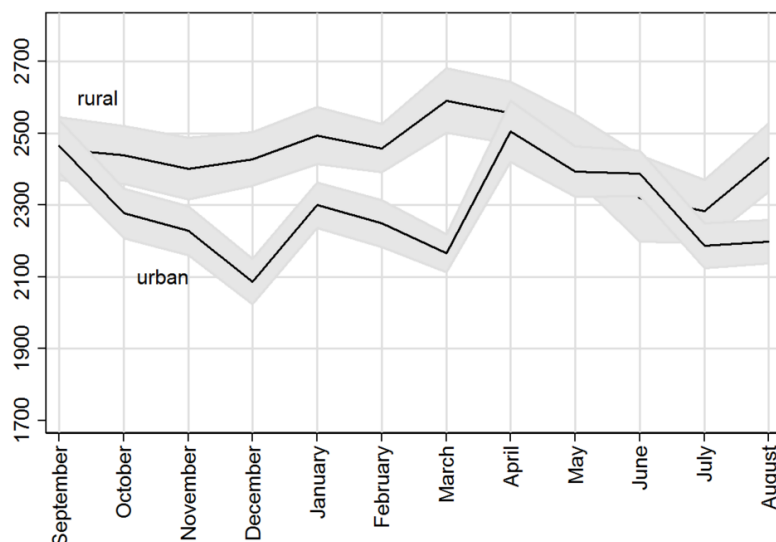
Looking at the seasonal patterns reveals that rural households maintain similar level of calorie consumption throughout the year, except for during the lean season (June-July) when calorie intakes drop sharply. In June and July, average daily per capita calorie intake is 10 percent lower than in the post-harvest period. Average calorie intake for the urban sample show more volatility and seem to be more affected by the Orthodox fasting events. During the two main fasting periods (December and March), calorie consumption in urban areas drops sharply – despite the lower prices (Figure 3.1) – and rises quickly once the fasting period is over. Similarly to rural households, calorie consumption among urban households is low during the lean season – possibly due to the relatively higher food prices during this period (Figure 3.1).

<sup>8</sup> The timing varies from year to year. Lent can start as early as mid-February and end as late as early May. Nevertheless, each year it covers about 55 days.

<sup>9</sup> The left panel of Table B1 in Appendix B reports the data used to construct Figure 4.1.

<sup>10</sup> Note also that inflation was particularly high during 2011.

**Figure 4.1: Seasonal patterns in mean daily per capita calorie intake, by rural/urban**

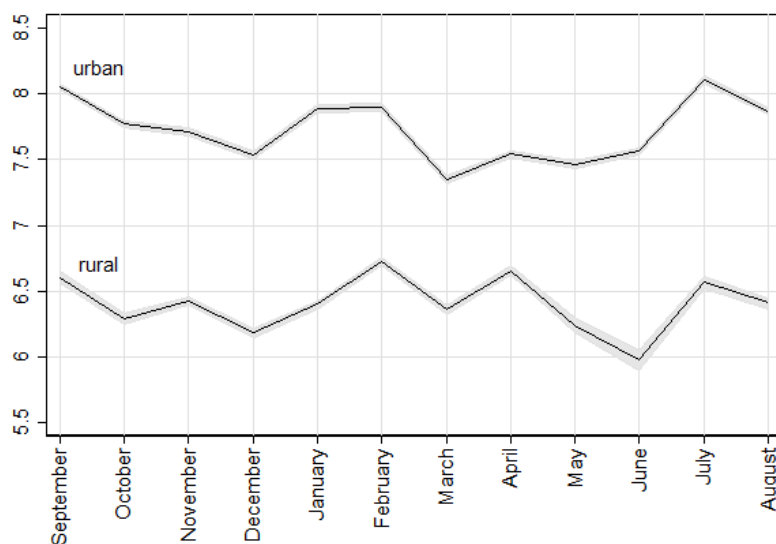


Source: HCE 2010/11 data from CSA.

Notes: The vertical axis measures daily per capita calorie consumption of households. Calorie intakes are measured in kilocalories. The solid line gives the mean for each calendar month. The grey areas represent 95% confidence intervals.

We now turn to the quality of diets. Figure 4.2 shows how the number of food groups from which food is consumed varies across the calendar year.<sup>11</sup> Here we see that urban households consume a more diverse diet than their rural counterparts. The mean number of food groups from which food is consumed by urban households is 7.7 across the 12 months, while the corresponding figure for rural households is 6.4 out of the maximum of 12 food groups. For both rural and urban households, the two fasting months of December and March induce a drop in the diet diversity score. For rural households, diet diversity is lowest at the beginning of the lean season: in June the HDDS is 6.6 percent below the monthly mean. In contrast, HDDS for rural households is highest after the harvest: in February the HDDS is 5.1 percent above the monthly mean. Urban households' HDDS seems less affected by the scarcity of food in the lean season. In fact, the diet diversity score is the highest in July when HDDS is 5.2 percent above the monthly mean value.

**Figure 4.2: Seasonal patterns in mean household diet diversity score, by rural/urban**



Source: HCE 2010/11 data from CSA.

Notes: The vertical axis measures the number of food groups consumed by households. The solid line gives the mean for each calendar month and the grey areas represent 95% confidence intervals.

<sup>11</sup> The right panel of Table B1 in the Appendix B reports the data used to construct Figure 4.2.



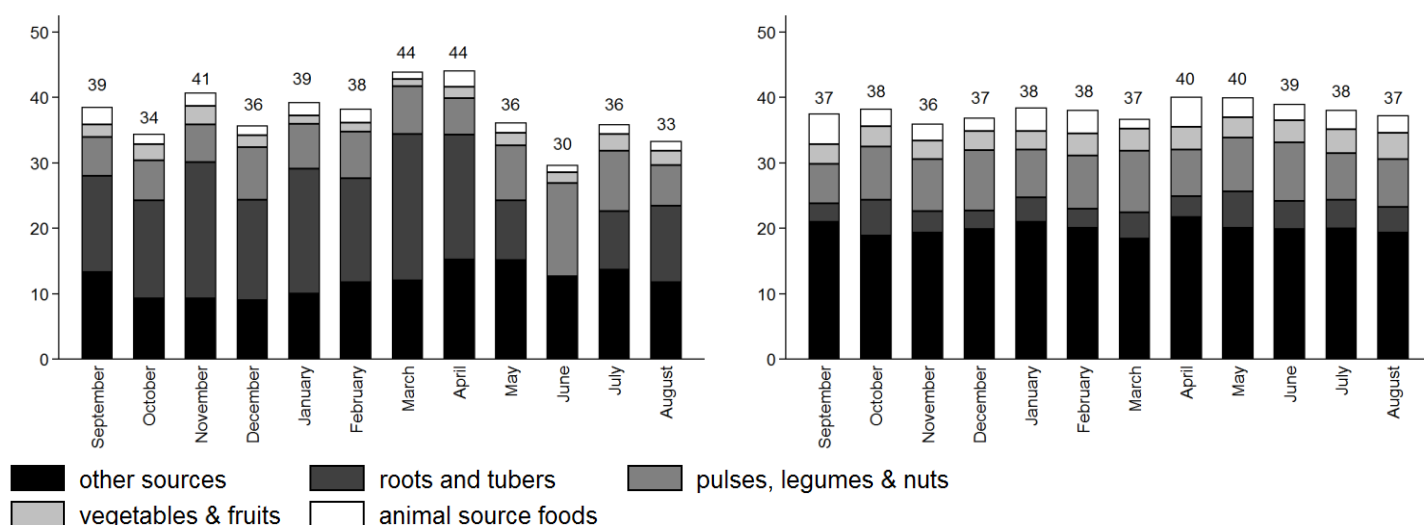
Next, we explore how diet content varies across seasons. Figure 4.3 shows the percentage share of average calorie intake from non-cereal sources for each month.<sup>12</sup> Cereals are the main source of calories for both rural and urban households in Ethiopia. On average, about 60 percent of the calories consumed by households come from cereals, with little difference between urban and rural households. However, there is considerable seasonal variation in the calorie sources in rural areas, less so in urban areas. In the post-harvest period, March and April, 44 percent of calories consumed by rural households originate from non-cereal sources. In the lean season, cereals become more important. The share of calories coming from non-cereals drops below 40 percent in the lean season, with only 30 percent of calories coming from non-cereal sources in June.

Roots and tubers are the second-most important source for calories for rural households, less so for urban households. Throughout the year, about 15 to 20 percent of the calories come from this food group. However, the consumption of roots and tubers plummets dramatically in the lean season. The share of calories consumed that comes from roots and tubers drops to 9 percent in May and then to 0.2 percent in June, while recovering back to 9 percent in July. Only between 2 and 3 percent of the calorie intakes in the full sample come from animal source foods (meat, poultry, fish, and milk and milk products). As expected, the shares fall during the main Orthodox fasting months (December and March). Pulses, legumes, and nuts constitute the greatest source of calories from non-cereal sources. Between 5 and 9 percent of daily calorie intake in both rural and urban areas comes from this food group. However, in June – when households stop consuming roots and tubers – more than 14 percent of calories come from this food group.

**Figure 4.3: Percentage share of per capita calorie intake from non-cereal sources by month, by rural/urban**

#### Rural households

#### Urban households



Source: HCE 2010/11 data from CSA.

Notes: The vertical axis measures the percent of daily per capita calories in each month coming from different food groups. The number at the top of each bar gives the percent of calories coming from non-cereal foods. Cereal foods constitute the omitted category: the percent of calories coming from cereals each month can be obtained by subtracting the number at the top of the bar from 100. The 'other sources' category includes oils and fats, sugar and honey and miscellaneous items.

Fruits and vegetables are an unimportant source of calories, especially in the rural areas. The 'other sources' category includes oils and fats, sugar and honey and miscellaneous items.<sup>13</sup>

Taken together, Figure 4.3 provides clues as to why diet diversity scores increase in rural areas towards the end of the lean season (Figure 4.2). In June, rural households consume extremely monotonous diets consisting mainly of cereals and pulses, legumes, and nuts. Notably, these food items can be stored for several months after the harvest. In July and August, roots and tubers feature more dominantly in the diet again, possibly due the fact that these foods require a shorter growing time, and therefore become available earlier than, for example, most cereals. However, overall calorie intake remains low in these months (Figure 4.1), implying that the content of the household food basket becomes more diversified during this period, while the quantities consumed decrease.

<sup>12</sup> Table B2 in the Appendix reports the data used to construct Figure 4.3.

<sup>13</sup> Oils and fats are a particularly important source of calorie for the urban households with more than 10 percent of the calories coming from this source, on average.



## 5. CONCLUDING REMARKS

The paper provides evidence that the quantity and quality of households' food consumption remain subject to significant intra-annual variations in Ethiopia. Agricultural production in most areas of the country is based on only one rain-fed agricultural season. Together with inadequately integrated food markets this renders large parts of the country vulnerable to the seasonality of the local agricultural production. Policies that promote the expansion of irrigation (so that food can be produced in off-seasons) and market access are likely to increase the quantities of food produced in the country but also make households – and food markets – less dependent on the main agricultural season.

An interesting finding of this study is that the composition of diets vary across the seasons. As a result, the diet diversity score is relatively high at the height of the lean season – a period characterized by lowest calorie intake in rural areas. Previous literature has considered diet diversity as a good indicator of food security (Hoddinott and Yohannes 2002; Swindale and Bilinsky 2006). This decoupling of the diet quantity and diversity measures observed in the lean season suggests that the seasonal validity of this indicator cannot be taken for granted. Indeed, at least in Ethiopia and other similar contexts, researchers should, as a matter of routine, measure food security through different indicators, not only through the diet diversity score.

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## APPENDIX A: DESCRIPTION OF THE METHOD USED TO CALCULATE THE SEASONAL FOOD PRICE INDEX

We use the ratio to moving average method to calculate the seasonal food price index. The approach removes the trend, leaving just the seasonal variation in food prices to the time-series. Compared to the 'simple' average, the moving average is less sensitive to upward or downward trends in prices, and is therefore preferred here. The moving average method involves dividing each monthly Consumer Price Index (CPI) observation by its 13-month moving average (6 months before and after the month in question). To compute the seasonal food price index, the median of this ratio is computed for each calendar month.<sup>14</sup> The figures are then constructed by subtracting the annual mean of the seasonal food price index from the monthly ratio.

## APPENDIX B: DATA USED TO CONSTRUCT FIGURES 4.1, 4.2 AND 4.3

**Appendix Table B1: Mean daily per capita calorie intake and household diet diversity score, by rural/urban and month**

Month	Daily per capita calorie intake		Household diet diversity score	
	Rural	Urban	Rural	Urban
September	2,457	2,465	6.60	8.05
October	2,440	2,277	6.29	7.77
November	2,402	2,230	6.43	7.71
December	2,429	2,087	6.19	7.53
January	2,494	2,300	6.40	7.89
February	2,459	2,249	6.73	7.90
March	2,592	2,166	6.36	7.35
April	2,557	2,506	6.65	7.54
May	2,463	2,394	6.24	7.46
June	2,319	2,389	5.98	7.56
July	2,283	2,187	6.57	8.10
August	2,432	2,199	6.41	7.87

Note: Calorie intakes are measured in kilocalories. The HDDS is based on 12 food groups.

Source: HCE 2010/11 data from CSA.

**Appendix Table B2: Percentage share of daily per capita calorie intake by food source and month, by rural/urban**

Month	Cereals		Animal Source Foods		Roots & Tubers		Pulses, Legumes & Nuts		Vegetables & Fruits		Other Sources	
	Rural	Urban	Rural	Urban	Rural	Urban	Rural	Urban	Rural	Urban	Rural	Urban
September	61.5	62.5	2.6	4.7	14.7	2.9	5.9	6.0	2.0	3.1	13.2	20.9
October	65.6	61.8	1.5	2.6	15.0	5.4	6.2	8.1	2.4	3.1	9.2	18.9
November	59.3	64.0	2.0	2.6	20.9	3.4	5.7	7.9	2.9	2.8	9.2	19.3
December	64.3	63.1	1.5	2.0	15.3	2.8	8.1	9.2	1.8	3.0	8.9	19.9
January	60.8	61.6	2.1	3.5	19.1	3.8	6.9	7.2	1.3	2.9	10.0	20.9
February	61.8	62.0	2.1	3.5	15.9	2.9	7.1	8.2	1.4	3.4	11.7	20.0
March	56.2	63.3	1.1	1.5	22.4	4.0	7.3	9.4	1.1	3.4	12.0	18.4
April	55.9	60.0	2.5	4.6	19.1	3.2	5.6	7.2	1.7	3.4	15.1	21.7
May	63.9	60.0	1.6	3.0	9.2	5.6	8.4	8.2	1.9	3.2	15.1	20.0
June	70.4	61.0	1.1	2.5	0.2	4.2	14.2	9.0	1.7	3.4	12.4	19.9
July	64.1	62.0	1.4	3.0	9.0	4.4	9.2	7.1	2.6	3.7	13.6	19.9
August	66.7	62.8	1.4	2.6	11.7	3.9	6.2	7.4	2.2	4.0	11.7	19.3

Source: HCE 2010/11 data from CSA.

<sup>14</sup> Using the median, instead of the mean, assures that the price index is not excessively responsive to years characterised by very high inflation.

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## Acknowledgements

Funding for this work was received through the Feed-the-Future project funded by the United States Agency for International Development. We thank Derek Headey and Helina Tilahun for useful comments.

## About ESSP

The Ethiopia Strategy Support Program is an initiative to strengthen evidence-based policymaking in Ethiopia in the areas of rural and agricultural development. Facilitated by the International Food Policy Research Institute (IFPRI), ESSP works closely with the government of Ethiopia, the Ethiopian Development Research Institute (EDRI), and other development partners to provide information relevant for the design and implementation of Ethiopia's agricultural and rural development strategies. For more information, see <http://www.ifpri.org/book-757/ourwork/program/ethiopia-strategy-support-program> or <http://essp.ifpri.info/> or <http://www.edri-eth.org/>.

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The Ethiopia Strategy Support Program (ESSP) is financially supported by the United States Agency for International Development (USAID) and the Department for International Development (DFID) of the government of the United Kingdom and is undertaken as part of the CGIAR Research Program on Policies, Institutions, and Markets (PIM) led by the International Food Policy Research Institute (IFPRI). This publication has been prepared as an output of ESSP and has not been independently peer reviewed. Any opinions expressed here belong to the author(s) and do not necessarily reflect those of IFPRI, the Ethiopian Development Research Institute, USAID, DFID, PIM, or CGIAR.

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