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Diet transformation in Africa: The case of Ethiopia

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ABSTRACT

Africa's food systems are changing fast amid rapid economic growth, emerging urbanization, and structural transformation. In this study, we use four rounds of nationally representative data from Ethiopia to examine changes in household food consumption patterns over a period of unprecedented economic growth. We find that while there is a general decline in the share of food in the total consumption basket of households in Ethiopia, food quantities and intake of calories have increased considerably over the period 1996 to 2011. This was mostly driven by improvements in household incomes, as shown using decomposition analysis. Furthermore, the content of the food basket is changing with a gradual shift towards high-value foods, such as animal products, fruits and vegetables, and processed foods. However, irrespective of the level of income, a heavy focus on starchy staples in the Ethiopian diet remains. Overall, this diet transformation has important implications for the food security debate and for agricultural and food policy in the country.

Keywords: food consumption, calorie intakes, structural change, decomposition

JEL codes: O12, Q18, D12

I. INTRODUCTION

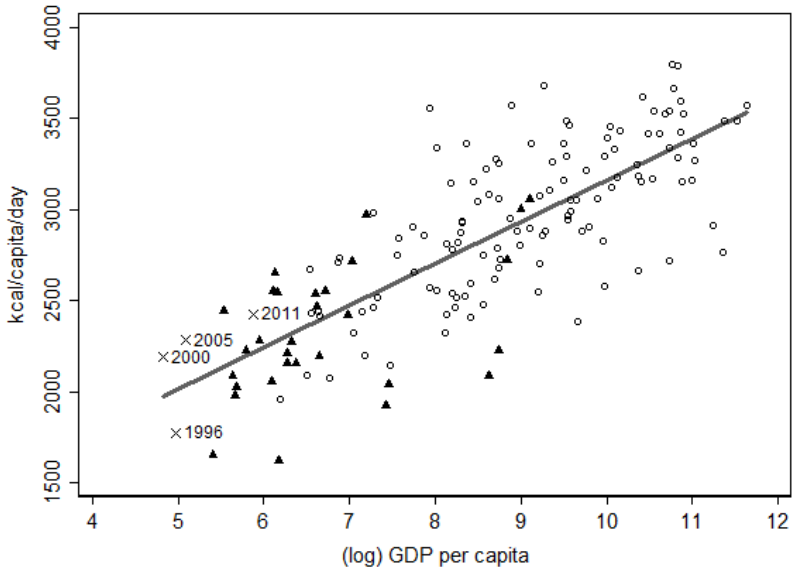
The sub-Saharan African economies are undergoing rapid transformation. Both micro and macro level data show substantial improvements in living standards over the past decade (Radelet 2010; Young 2012; McKay 2013). Moreover, agricultural productivity is on the rise (Badiane, Makombe, and Bahiigwa 2014) and, at the same time, employment is gradually shifting away from agriculture into more productive sectors of the economy (McMillan, Rodrik, and Verduzco-Gallo 2014; McMillan and Harttgen 2014). This growth and structural transformation is likely to bring about considerable changes in domestic food systems. For example, improvements in living standards are typically accompanied by a shift away from starchy staples toward high-value products, such as dairy products, meat, fish, fruits, and vegetables (Popkin 1998, 2003; Pingali 2007). Further, more affluent consumers demand more variety and choice, consume more processed and ready-to-eat foods, and pay more attention to food quality and safety (Jaffee and Henson 2004; Swinnen 2007). Moreover, structural transformation of the economy means that more people are employed in sectors that are characterized by lower energy requirements than the traditional agricultural sector (Popkin 1998, 1999, 2001).[1]

In this paper we focus on Ethiopia, one of the fastest growing economies in sub-Saharan Africa over the last decade (World Bank 2015b), and study how the Ethiopian food economy has changed during a period of unprecedented economic growth. Ethiopia provides a valuable setting in which to study diet transformation due to the fast economic growth, its population and importance in Africa (it is the second most populous country in the continent), and the availability of consistent large-scale household datasets over time. Of particular interest is to understand the linkages between food demand and income levels, as this is likely to indicate any trends in food consumption patterns, especially within a country where urbanization is encouraged and middle-income status by the year 2025 is set as a goal for the country in several policy documents.

Using four rounds of nationally representative household survey data, we document a number of interesting dynamics in the Ethiopian food economy between 1996 and 2011. Many of these dynamics follow the trajectories observed in modern-day middle-income countries. For example, the share of food in total expenditures is declining, falling from 60 percent in 1996 to 48 percent in 2011. At the same time, the quantities consumed (per adult equivalent) have increased by 55 percent. The importance of cereals in total food expenditures is gradually decreasing (from 46 percent in 1996 to 36 percent in 2011) and we also begin to see a shift towards more expensive foods. Moreover, more and more foods are being purchased from the market. On the nutrition side, economic growth has brought about considerable improvements in calorie intake levels – a trend that fits well into the global calorie-income relationship (Figure 1.1). Our decomposition analysis shows that increases in income levels explain the overwhelming majority of the improvements in calorie intake over this period. However, despite economic growth, the share of calories coming from starchy staples remains extremely high.

[1] Various other dynamics are also taking place, including changes in lifestyle, with more women working outside the home; increased access to technology, such as refrigerators and microwave ovens; the development of better packaging technologies; and the entrance of modern food marketing channels, including modern retail outlets, an expanded food processing sector, and a growing food service industry (Popkin 2001; Reardon et al. 2003; Reardon and Timmer 2007; Tschirley et al. 2015).

Figure 1.1. Global calorie-income relationship



Note: X marks Ethiopia in different years (4 observations), triangles are other sub-Saharan African countries (31 countries) and hollow circles non-Sub-Saharan African countries (123 countries). The solid line is the line of best-fit for the global calorie-income relationship. Gross-Domestic Product (GDP) per capita is expressed in current USD.

Source: The data for daily per capita kilocalories (y-axis) come from the FAO food balance sheets, except for Ethiopia for which the HICES data was used. Data on gross-domestic product (x-axis, GDP) is from the World Bank. Latest available observation pairs were used for each country, except for Ethiopia for which the HICES survey years were used.

The structure of this paper is as follows. In Section 2, we describe the data used in this analysis. Section 3 describes food consumption patterns in Ethiopia and how they have changed from 1996 to 2011. Here we also study the linkages between consumption patterns and income. Section 4 focuses on changes in calorie intakes and calorie-income links. We end this section by a decomposition analysis of the changes in calorie intake over the 15-year period from 1996 to 2011. The final section provides conclusions and offers some policy implications.

2. DATA

We exploit the Ethiopian Household Consumption and Expenditure Survey (HICES) dataset from the past four rounds: 1995/96, 1999/00, 2004/05, and 2010/11.[2] In total, 11,678, 17,320, 21,560, and 27,831 households were interviewed over the four periods, respectively. The HICES data are collected by the Central Statistical Agency (CSA) and serve as the official source for poverty statistics in Ethiopia (MoFED 2013). The sampling for the surveys began by stratifying the country into rural and urban areas. After that, 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. Notably, data collection methods have differed over the years, which warrants some caution in the interpretation of the data over time (Stifel and Woldehanna 2014).

Each survey round contained an extensive consumption-expenditure module. In the latest round, the survey module consisted of 275 food items and recorded household's food consumption over the past 7 days. We use these data to study trends in expenditures on different food categories over these periods.[3] To ensure comparability over time in this analysis, expenditures were deflated using the national Consumption Price Index (CPI). The consumption expenditure values are expressed in real terms, in 1996 birr. We also computed the quantities consumed (in kilograms). These quantities were further converted to calories using the standard conversion rates reported by the Ethiopian Health and Nutrition Research Institute (EHNRI) (1968-1997). While not originally designed for nutrition analysis, the HICES data have been found to provide consistent information about various nutrition measures when compared to surveys that are based on 24-hour recall (Fiedler 2013).

[2] Note that income data were not collected in the 2010/11 survey. Therefore, the name of the survey in the latest round was changed from HICES to HCES.

[3] Note that since a different cleaning procedure was followed before statistics were calculated, there are minor differences with the official estimates.

Consumption and calories in this paper are expressed in adult equivalent unit terms calculated by the Central Statistical Agency [Ethiopia] (2012). In contrast to the usual per capita conversion, adult equivalent units take into account differences in household composition. Using the adult equivalent units we can be more confident that the estimated values reflect changes in consumption patterns and not changes in household demographics (e.g. due to changes in fertility rates) over time or across space and income quintiles.

3. FOOD CONSUMPTION AND EXPENDITURES

Table 3.1 shows how the food consumption basket for the average Ethiopian household has changed over the 15-year period. First, the share of non-food items in the total consumption basket has increased considerably over time. In 1996, the share of non-food consumption expenditures accounted for 40 percent of the total consumption, while in 2011 the share accounted for more than half (52 percent) of total consumption-expenditures. Such increases in the share of non-food expenditures are typical in transforming and improving economies, implying substantial improvements in welfare in the country (MoFED 2012; World Bank 2014). This is also in line with Engel's law, according to which the share of non-food products in the consumption basket increases with income. Still, it is worth noting that the role of food in total expenditures remains high for the average Ethiopian consumer – partly reflecting the large importance of agriculture in the country's economy.

The 15-year period also saw a considerable increase in the quantity of food consumed (bottom panel of Table 3.1). In 1996, the average Ethiopian household consumed 288 kg of food per adult equivalent. In 2011, this was 447 kg per adult equivalent, corresponding to a 55 percent increase in the quantities of foods consumed. Consistent with this trend, expenditures on food have risen in real terms (top panel of Table 3.1). Per adult equivalent food expenditures in 2011 were 25 percent higher than in 1996.

Table 3.1. Food – real expenditures and consumption, by food category, 1996, 2000, 2005, and 2011

	1996		2000		2005		2011	
	Birr	Share (%)	Birr	Share (%)	Birr	Share (%)	Birr	Share (%)
Real expenditures (birr/per adult equivalent/year)								
Food								
Teff	85	11.6	96	12.6	72	8.9	69	7.5
Wheat	53	7.2	66	8.7	71	8.9	68	7.4
Barley	34	4.7	29	3.8	35	4.4	22	2.4
Maize	74	10.1	82	10.8	69	8.6	71	7.7
Sorghum	52	7.1	46	6.1	65	8.1	46	5.0
Other cereals	22	3.0	24	3.2	13	1.7	13	1.4
Processed cereals	15	2.1	15	2.0	26	3.2	42	4.6
All cereals	337	45.7	357	47.1	351	43.8	333	36.0
Pulses	56	7.6	75	9.9	62	7.7	88	9.5
Oilseeds	2	0.3	2	0.3	2	0.2	1	0.2
Animal products	56	7.5	60	7.9	70	8.7	100	10.8
Oil & fat	34	4.6	27	3.6	31	3.9	61	6.6
Vegetables & fruits	28	3.7	34	4.5	37	4.6	59	6.4
Pepper	36	4.9	30	4.0	21	2.6	61	6.6
Enset/kocho	38	5.1	57	7.5	36	4.4	39	4.2
Coffee/tea/chat	72	9.8	52	6.9	62	7.7	84	9.1
Root crops	19	2.6	26	3.4	25	3.1	16	1.8
Sugar & salt	18	2.5	15	2.0	15	1.9	25	2.7
Other foods	42	5.7	23	3.0	90	11.3	57	6.2
Total food	739	100.0	759	100.0	802	100.0	925	100.0
Food versus non-food								
Food	739	59.6	759	63.6	802	54.1	925	47.9
Non-food	502	40.4	434	36.4	681	45.9	1,005	52.1
Total	1,240	100.0	1,193	100.0	1,483	100.0	1,930	100.0

	1996		2000		2005		2011	
	kg	Share (%)	kg	Share (%)	kg	Share (%)	kg	Share (%)
Consumption (kg/adult equivalent/year)								
Teff	31	10.6	38	10.0	32	8.0	33	7.3
Wheat	25	8.7	32	8.4	37	9.1	31	6.9
Barley	17	5.9	12	3.3	16	3.9	12	2.7
Maize	41	14.0	47	12.5	47	11.6	63	14.2
Sorghum	20	7.1	28	7.5	40	9.9	35	7.8
Other cereals	10	3.4	17	4.5	7	1.6	9	2.0
Processed cereals	5	1.9	6	1.6	8	2.0	9	2.0
All cereals	149	51.7	180	47.8	187	46.2	192	43.0
Pulses	23	8.1	21	5.6	21	5.1	22	5.0
Oilseeds	1	0.3	1	0.1	0	0.1	0	0.1
Animal products	17	6.0	16	4.2	18	4.6	21	4.6
Oil & fat	2	0.8	2	0.5	3	0.7	5	1.2
Vegetables & fruits	31	10.9	37	9.7	42	10.5	45	10.0
Pepper	3	1.2	2	0.6	2	0.6	5	1.2
Enset/kocho	13	4.6	71	18.8	52	12.8	58	13.0
Coffee/tea/chat	10	3.6	10	2.6	10	2.5	15	3.4
Root crops	15	5.3	28	7.4	34	8.3	30	6.7
Sugar & salt	8	2.7	6	1.7	7	1.7	10	2.1
Other foods	14	4.8	4	1.0	28	7.0	43	9.7
Total food	288	100.0	376	100.0	404	100.0	447	100.0

Source: Authors' calculations based on HICES, CSA. Real expenditures are expressed in 1996 birr.

Also the content of the average food basket changed. Overall, the share of cereals in total food expenditures is declining. While the share comprised 45.7 percent of food expenditures in 1996, it had declined to 36.0 percent 15 years later. During the same period, animal products (meat, poultry, fish and dairy products) became more important. While the expenditure share of these animal products is still relatively low, their share grew from 7.5 percent of the total food expenditures in 2000 to 10.8 percent in 2011. The consumption of animal products also rose in quantity terms, from 17 kg in 1996 to 21 kg in 2011. These patterns are a reflection of Bennett's (1941) law that describes a relative decline in starchy staples and an increase in animal proteins with an increase in income.[4] The share of fruits and vegetables in total food expenditures also increased over that period, from 3.7 percent to 6.4 percent (or from 31 kg to 45 kg).

While the importance of cereals in food expenditures is on the decline, the quantities of cereals consumed increased by 29 percent. This indicates relatively lower costs of cereals over time. For the categories 'roots and tubers' and 'enset/kocho'[5] , we see similar patterns emerging; their consumption more than doubled in quantity terms but at the same time their share in the consumption-expenditure declined. In contrast, in 2011 animal products constitute 10.8 percent of expenditures and 4.6 percent of the quantities consumed. Animal products are the most expensive items in the food consumption basket.

Within cereal expenditures, teff, wheat, and maize constitute about 62 percent of all expenditures on cereals in 2011. Over time, some minor shifts within the consumption of cereals are observed. For example, the share of expenditures on sorghum declined from 7.1 percent in 1996 to 5.0 percent in 2011. Compared to 1996, the share of maize in cereal expenditures has also decreased. However, in quantity terms, maize is still by far the most important cereal crop. Within the cereal category, we note an increase in processed cereals, from 2.1 percent to 4.6 percent of total food expenditures and from 5 kg to 9 kg in terms of quantities consumed, though still relatively low compared to other African countries (Tschirley et al. 2015).

[4] Ethiopia is generally characterized by monotonous diets (Headey 2014), but this seems to be slowly changing over time. There were, on average, more diverse consumption expenditures in 2011 than 15 years earlier.

[5] Enset, also known as the false banana, is a root crop that is especially important in the southern part of the country. Kocho is a traditional flat-bread made of enset.

Moreover, changes are happening within food categories. We illustrate this in the case of teff (Table 3.2). While red teff made up 41.4 percent and 38.6 percent of teff expenditures in 1996 and 2000 respectively, this share declined to half that level in 2011. Expenditures on white teff were consistently lower than those on red and mixed teff in 1996 and 2000, but they were at an equal level in 2011. Hence, there is a notable shift away from the cheap red teff to the more expensive white teff. The most important change within the teff expenditures is however, the rapid emergence of injera[6] as an important food item in the food basket. It represented 38.0 percent of teff expenditures in 2011, a considerable increase compared to 6.3 percent of total teff expenditures in 1996. This seems to follow the pattern that, as consumers become richer and opportunity costs of women's time in the household are on the rise, ready-to-eat foods become more and more part of the consumption basket (Kennedy and Reardon 1994; Dibley, Boughton, and Reardon 1995).

Table 3.2. Teff – real expenditures, 1996, 2000, 2005, and 2011, birr per adult equivalent per year

	1996		2000		2005		2011	
	Birr	Share (%)	Birr	Share (%)	Birr	Share (%)	Birr	Share (%)
White teff	21	22.4	22	21.7	21	25.7	23	20.4
Mixed teff	28	29.9	34	33.6	22	26.8	24	21.0
Red teff	38	41.4	39	38.6	28	33.4	23	20.5
Injera	6	6.3	6	6.1	12	14.1	42	38.0
Total teff	92	100.0	102	100.0	83	100.0	112	100.0

Source: Authors' calculations based on HICES, CSA. Real expenditures are expressed in 1996 birr.

3.1. Rural versus urban

It is estimated that more than half of the world's population was living in cities in 2010, which was up from 30 percent in the 1950s. Africa is becoming more urban: the urbanization rate is projected to be as high as 60 percent by 2050 (UN Population Division 2010). Urbanization has important implications on the food economy for two reasons. First, urban consumers typically do not grow their own food and, therefore, urbanization is typically associated with increasing commercial food flows.[7] Second, urban consumers typically have different consumption baskets than rural consumers (Pinstrup-Andersen 1986; Popkin 1999). While the share of the urban population in Ethiopia is still small, recent urbanization rates have been high (Schmidt and Kedir 2009) and these rates are expected to remain high in the future, with 30 percent of Ethiopia's population expected to be living in cities in 2028 (World Bank 2015a).

Table 3.3 illustrates the differences in consumption patterns between rural and urban areas. Average expenditures per adult equivalent are higher in urban areas than in rural ones, and the share of non-food expenditures is also higher in urban (61.8 percent) than in rural (48.1 percent) areas. Urban households spend more money on food than their rural counterparts (863 birr versus 1,219 birr, respectively). Despite this, the actual quantities consumed are somewhat lower (462 kg in rural areas versus 376 kg in urban areas). This is likely because of higher food prices paid in urban areas, but also possibly because of lower calorie requirements in these urban settings (Popkin 1999; Deaton and Drèze 2009).

Interestingly, there are almost no differences between rural and urban households in the share of cereals in their food consumption baskets, and the quantities of cereals consumed are also similar. However, root crops and enset/kocho consumption is much higher in rural areas, suggesting that overall the rural diet depends somewhat more on starchy staples. Also, the consumption patterns differ considerably within the cereal category. Rural consumers consume considerably more sorghum (40 kg versus 14 kg) and maize (72 kg versus 22 kg) than urban consumers do. In contrast, the share of teff in the urban food consumption basket is substantially higher than in rural areas, more than twice as high. Moreover, urban consumers eat 69 kg of teff per adult equivalent per year, nearly three times the level consumed in rural areas.

Earlier research predicts that urbanization leads to increased demand for vegetables, animal source foods (meat and dairy products), and oils and fats (Pinstrup-Andersen 1986; Popkin and Bisgrove 1988). Our estimates are in line with these predictions. First, urban dwellers allocate much larger share of their food budget to animal products than rural dwellers (14.3 percent versus 9.8 percent). Similarly, the average household in an urban area consumed 11 kg of oils and fats per adult

[6] Injera is ready-to-eat soft flatbread, typically made of teff flour and eaten widely across the country.

[7] This is also noted by local policymakers who often worry about the increasing dependence of African cities on imported foods (Rakotoarisoa, Iafrate, and Paschali 2011).

equivalent, while the corresponding figure for the average rural household was 4 kg. The consumption of fruits and vegetables is also considerably higher in the urban areas, both in terms of expenditures and quantities consumed.

Table 3.3. Food consumption and expenditures in 2011, urban versus rural, by food group

	Rural		Urban							
			Total urban		Addis Ababa		Secondary cities		Other Urban	
	Birr	Share (%)	Birr	Share (%)	Birr	Share (%)	Birr	Share (%)	Birr	Share (%)
Real expenditures (birr/per adult equivalent/year)										
Food group										
Teff	51	6.0	153	12.6	190	14.6	150	10.8	141	12.2
Wheat	59	6.8	113	9.3	124	9.5	171	12.3	99	8.6
Barley	25	2.9	10	0.8	7	0.5	7	0.5	12	1.0
Maize	80	9.3	30	2.4	12	0.9	35	2.5	35	3.0
Sorghum	52	6.0	18	1.5	1	0.1	14	1.0	25	2.2
Other cereals	14	1.6	11	0.9	9	0.7	22	1.6	10	0.8
Processed cereals	28	3.3	109	8.9	133	10.2	125	9.0	97	8.4
All cereals	309	35.8	445	36.5	477	36.6	524	37.6	419	36.2
Pulses	84	9.8	105	8.6	122	9.3	92	6.6	101	8.7
Oilseeds	2	0.2	1	0.1	0	0.0	1	0.1	1	0.1
Animal products	84	9.8	175	14.3	211	16.2	224	16.1	153	13.2
Oil & fat	51	5.9	110	9.0	129	9.9	119	8.6	102	8.8
Vegetables & fruits	51	5.9	99	8.1	109	8.4	127	9.1	91	7.8
Pepper	59	6.8	73	6.0	83	6.4	55	3.9	73	6.3
Enset/kocho	45	5.3	7	0.6	3	0.2	2	0.1	9	0.8
Coffee/tea/chat	85	9.9	78	6.4	52	4.0	99	7.1	83	7.1
Root crops	16	1.9	17	1.4	15	1.1	20	1.4	17	1.5
Sugar & salt	21	2.4	44	3.6	43	3.3	57	4.1	42	3.6
Other foods	55	6.4	67	5.5	60	4.6	71	5.1	68	5.9
Total food	863	100.0	1219	100.0	1,303	100.0	1,391	100.0	1,160	100.0
Food versus non-food										
Food	863	51.9	1,219	38.2	1,303	38.9	1,391	36.9	1,160	38.2
Non-food	799	48.1	1,975	61.8	2,050	61.1	2,380	63.1	1,874	61.8
Total	1,662	100	3,194	100	3,353	100	3,771	100	3,034	100

	kg	Share (%)	kg	Share (%)	kg	Share (%)	kg	Share (%)	kg	Share (%)
Consumption by food group (kg/adult equivalent/year)										
Teff	25	5.4	69	18.4	83	24.0	63	16.3	65	17.0
Wheat	29	6.2	41	10.9	41	11.8	54	13.8	39	10.1
Barley	14	3.0	4	1.1	2	0.5	2	0.6	5	1.4
Maize	72	15.7	22	5.8	6	1.6	18	4.5	28	7.4
Sorghum	40	8.6	14	3.6	0	0.1	7	1.8	19	5.0
Other cereals	10	2.2	4	1.0	2	0.7	6	1.5	4	1.0
Processed cereals	5	1.1	26	7.0	33	9.7	33	8.4	23	6.0
All cereals	195	42.2	180	47.9	167	48.5	182	46.8	184	47.9
Pulses	23	4.9	21	5.6	22	6.3	19	4.8	21	5.6
Oilseeds	0	0.1	0	0.1	0	0.0	0	0.0	0	0.1
Animal products	20	4.4	23	6.1	24	7.1	29	7.5	21	5.5
Oil & fat	4	0.8	11	2.9	13	3.8	14	3.5	10	2.6
Vegetables & fruits	42	9.2	56	14.8	61	17.7	67	17.2	52	13.5
Pepper	5	1.1	6	1.6	6	1.8	5	1.2	6	1.6
Enset/kocho	69	14.9	8	2.0	1	0.4	1	0.3	11	2.8
Coffee/tea/chat	16	3.6	10	2.5	5	1.6	11	2.8	11	2.8
Root crops	32	7.0	19	5.1	13	3.9	18	4.5	22	5.6
Sugar & salt	9	1.9	13	3.5	13	3.7	15	3.8	13	3.3
Other foods	46	10.0	30	7.9	19	5.4	29	7.6	34	8.8
Total food	462	100.0	376	100.0	344	100.0	389	100.0	384	100.0

Source: Authors' calculations based on HICES, CSA. Real expenditures are expressed in 1996 birr.

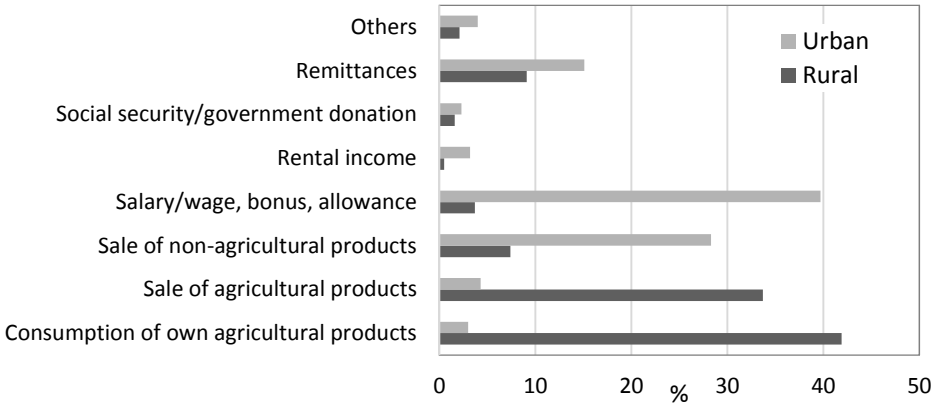
Furthermore, we compare consumption in the national capital, Addis Ababa, versus secondary cities.[8] We note that quantities and expenditures on food are at rather similar levels. The share of the food consumption basket spent on cereals is about 37 percent in both cases. However, we do see some higher consumption levels of teff in Addis Ababa (14.6 percent) compared to secondary cities (10.8 percent). On the other hand, wheat products are relatively more important in secondary cities (12.3 versus 9.5 percent). We also note a somewhat higher importance of processed cereals in Addis Ababa (10.2 percent versus 9.0 percent in secondary cities).

Finally, consumption patterns also vary considerably across regions. A regional breakdown of the food consumption and expenditure shares is provided in Appendix A.

3.2. Sources of food consumption

Respondents during the HICES survey were asked to indicate how they paid for specific food purchases. Figure 3.1 shows the sources of food expenditures in rural and urban areas. As expected, we see large differences between rural and urban areas. Consumption of households' own agricultural products accounts for 42 percent of total food expenditures in rural areas. This reflects the high level of auto-subsistence of the rural Ethiopian economy. However, the level of auto-subsistence is considerably lower than is usually assumed. About 34 percent of the consumption of food by rural households is paid for through the sales of agricultural products. Together then, more than 75 percent of food expenditures in rural areas are directly paid for by agricultural income, illustrating the small importance of off-farm income. Remittances, sales of non-agricultural products, and wage income count for 9, 7, and 4 percent, respectively, of total food expenditures in rural areas.

Figure 3.1. Sources of payments for food, rural and urban, 2011



Source: Authors' calculations based on HICES, CSA.

In urban areas, most food expenditures are paid for by wage income (40 percent). Sales of non-agricultural products account for the second largest share (28 percent). Remittances make up 15 percent of all payments for food and, therefore, are a more important source of income in urban areas compared to rural ones. Finally, government donations and social security are less important as a source of income for food expenditures in both rural and urban areas, making up 2.3 percent and 1.6 percent of total food expenditures in urban and rural areas, respectively. In rural areas, their share seems mostly to have come from food distributed as part of the Productive Safety Net Program (PSNP), as well as through emergency and food aid received from the World Food Program (WFP) and others.

3.3. Income and its link with food consumption

Agricultural economists have for a long time been interested in the link between income and food consumption, (e.g., Deaton and Muellbauer 1980). The parameters resulting from such research are important as they enable economic modeling to assess the impact on consumption of food policy changes, as well for use in projecting food requirements in the future, given reasonable assumptions on income and population growth.[9] Researchers have also sought to improve understanding of how

[8] They include Mekelle, Asaita, Bahir Dar, Adama, Jijiga, Assosa, Awasa, Gambella, Harar and Dire Dawa.

[9] There recently have been substantial methodological advances in this research area. While demand for food items was previously analyzed in single-equation models, these estimates often led to inconsistencies in parameters when total food baskets were considered. To address this issue, a methodology called the Almost Ideal Demand Systems (AIDS) was developed. This method now is widely used to estimate parameters as part of complete food demand systems (Deaton and Muellbauer 1980).

economic development results in food system transformation and the drivers responsible for changes in consumption (e.g. Popkin 2003; Reardon and Timmer 2007). A number of food consumption patterns can be distinguished with increasing income and economic development: 1) processed and ready-to-eat foods take off; 2) cereals become less important; and 3) the share of high-value crops, such as fruits and vegetables, dairy and animal products, and fish, in food consumption baskets increases. Comparing the differences in consumption patterns between richer and poorer households is often indicative of how transformation of food systems will shape food economies in the country.

In an effort to understand these patterns in Ethiopia, all households in the latest HICES survey (2011) were ranked by quintile, from the poorest quintile 1 to the richest quintile 5, based on their total consumption and expenditure level. The shares of different consumption categories were then calculated. Table 3.4 provides the results of this exercise. As expected (Bouis and Haddad 1992; Bouis 1994; Subramanian and Deaton 1996; Pingali 2007), strong differences in the composition of consumption baskets are seen over these quintiles. While food expenditures make up 55.0 percent of total consumption expenditures for the poorest quintile, this declines to 38.6 percent for the richest one. The five major cereals make up 38.6 percent of the total food consumption for poorest quintile. Notably, the share is relatively stable for the poorest three quintiles and drops off only for quintiles 4 and 5, suggesting that transformation in the food basket has only started to occur in the richest two quintiles. Still, the role of cereals remains surprisingly high even for the richest quintile, for which cereals make up 32.0 percent of the total food consumption. The food budget for animal foods for the richest households comprises 17.6 percent, yet this is only 6.6 percent for the poorest ones. As for cereals, the higher consumption of animal products is especially noted for the richest quintiles 4 and 5.

Table 3.4. Share of expenditures by food group, by expenditure quintile, 2011

	Q1 (poorest)	Q2	Q3	Q4	Q5 (richest)	Overall
Food						
Teff	4.4	6.3	7.7	8.5	9.1	7.5
Wheat	6.5	6.9	7.8	7.8	7.6	7.4
Barley	3.4	3.2	2.8	2.1	1.1	2.4
Maize	13.0	10.4	8.8	6.5	2.6	7.7
Sorghum	6.9	6.4	6.3	4.8	1.8	5.0
Other cereals	1.9	2.0	1.6	1.2	0.8	1.4
Processed cereals	2.6	2.6	3.1	4.3	8.9	4.6
All cereals	38.6	37.8	38.0	35.1	32.0	36.0
Pulses	10.1	10.0	10.7	9.7	7.6	9.5
Oilseeds	0.2	0.2	0.2	0.2	0.1	0.2
Animal products	6.6	7.6	8.1	11.4	17.6	10.8
Oil & fat	4.8	6.0	6.1	7.1	8.3	6.6
Vegetables & fruits	6.4	6.4	6.2	6.3	6.7	6.4
Pepper	7.2	7.3	6.9	6.6	5.6	6.6
Enset/kocho	6.4	5.8	4.0	4.2	1.7	4.2
Coffee/tea/chat	9.1	9.5	9.6	9.1	8.2	9.1
Root crops	3.6	2.1	1.6	1.3	1.0	1.8
Sugar & salt	2.4	2.4	2.5	2.9	3.0	2.7
Other foods	4.7	4.9	6.1	6.0	8.3	6.2
Total food	100.0	100.0	100.0	100.0	100.0	100.0
Food versus non-food						
Food	55.0	54.6	51.9	48.2	38.6	47.9
Non-food	45.0	45.4	48.1	51.8	61.4	52.1
Total	100.0	100.0	100.0	100.0	100.0	100.0

Source: Authors' calculations based on HICES, CSA.

The share of cereals in total food consumption is relatively stable over the expenditure quintiles, but there are, however, notable differences in the make-up of the cereal content of the food basket. Maize and sorghum are the two cereals that are typically consumed more by the poor than by the rich. About 13 percent of all food expenditures of the poor goes towards maize. This compares to 2.6 percent for the rich. These numbers are 6.9 and 1.8 percent, respectively, in the case of sorghum. The consumption of barley is low overall, but its share also decreases when incomes increase. There is less variation in wheat, although, it is consumed slightly more by the rich, possibly indicating issues regarding the targeting of

wheat subsidies in the country, as local prices are kept low for this crop through an overall generalized subsidy on imported wheat (Minot et al. 2015).

Teff consumption also shows a distinctive pattern by expenditure level. Teff increases consistently over expenditure quintiles. While it only makes up 4.4 percent of the food expenditures of the poorest quintile, in contrast, it comprises 9.1 percent of all food expenditures of the richest quintile. Teff is therefore clearly a preferred food of the rich. Moreover, within the teff category, there are a number of other interesting patterns (Appendix B). Red teff makes up 29 percent of the teff expenditures for the poorest households (1st quintile), but this decreases to 10 percent for the richest ones (5th quintile). On the other hand, expenditures on injera drop from 49 percent for the richest quintile to 37 percent for the poorest one, likely driven by the considerably higher prices per kg and per calorie for injera.

In a more complete quantitative approach, Tafere et al. (2010) use an Almost Ideal Demand Systems (AIDS) model to estimate income elasticities from the HICES data of 2004/05. As predicted from the previous tables, animal products have the highest income elasticity of all the food product categories considered (Table 3.5). A doubling of income leads to a 172 percent increase in expenditures on animal product foods in urban areas and a 198 percent increase in rural areas. Animal products are therefore an economically superior product (Delgado et al. 1999; Delgado 2003; Berhane et al. 2012). Teff also shows high income elasticities, indicating that a doubling of income increases expenditures by 120 percent in rural areas and by 110 percent urban areas. On the other hand, other cereals show much lower elasticities. Sorghum even has a negative income elasticity in urban areas, indicating that it is an economically inferior commodity: when households become richer, the consumption of such goods is reduced. As the country gets richer, the importance of sorghum is likely to decline, while teff is likely to become a more important food item in the food basket.

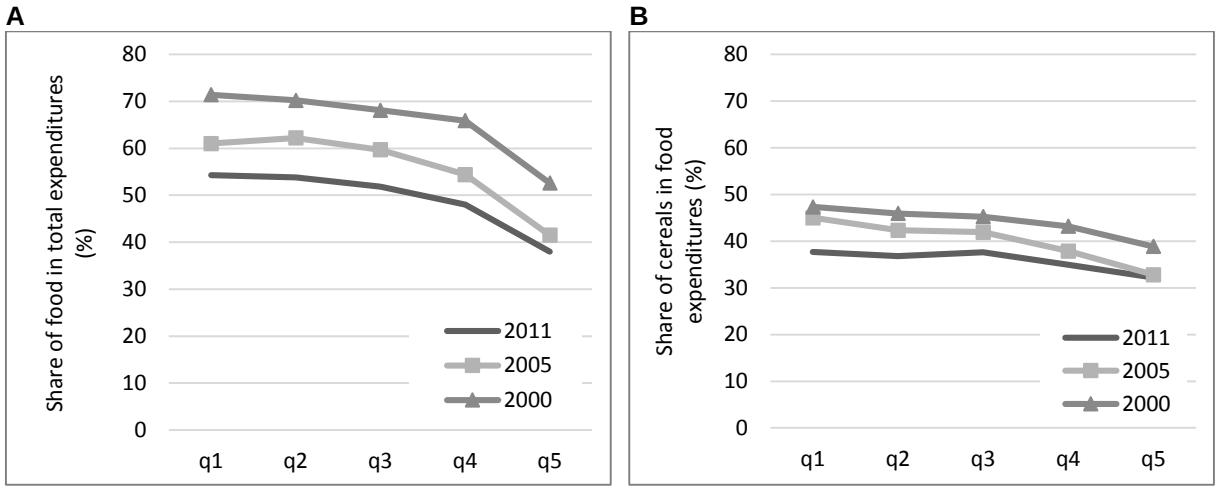
Table 3.5. Own-price and income elasticities for selected food groups, by rural and urban households in Ethiopia, 2004/05

	Urban		Rural	
	Own price elasticity	Income elasticity	Own price elasticity	Income elasticity
Teff	-0.92	1.10	-0.92	1.20
Wheat	-1.00	0.78	-0.94	1.19
Maize	-0.93	0.37	-0.70	0.82
Sorghum	-0.93	-0.36	-0.71	0.51
Pulses and other cereals	-0.88	0.90	-1.03	0.74
Animal products	-0.91	1.72	-0.94	1.98
Fruit, vegetables, and root crops	-0.99	1.22	-1.01	1.18
Other foods	-0.92	0.66	-0.92	0.92

Source: Tafere et al. (2010).

To further explore patterns of consistency between quintiles and the changes in consumption behavior patterns, Figure 3.2A shows how the share of food in the total consumption basket has evolved over time by expenditure quintile. We see that the Engel's law holds for all time-periods. Moreover, for each quintile, the share of food in total expenditures has consistently diminished over the years. While food expenditures made up 71 percent of total expenditures of the poorest quintile in 2000, this came down to 54 percent in 2011. Similar reductions over time are seen for all quintiles. In Figure 3.2B, the share of cereals in food expenditures is shown for the five quintiles over the last three surveys. The share of cereals for the poorest quintile was 47 percent in 2000, but this declined to 38 percent in 2011. Again, there has been a consistent decrease in the share of cereals for all quintiles in the consumption basket, even though the average quantities consumed increased over time. Overall, these findings indicate that the growth in the last decade in Ethiopia has been equitable and has benefited the majority of the population (World Bank 2014).

Figure 3.2. Share of food in total consumption expenditures (A) and share of cereals in food expenditures (B), 2000-2011, by expenditure quintile



Source: Authors' calculations based on HICES, CSA.

4. CALORIE CONSUMPTION

Table 4.1 reports consumption in terms of calories per adult equivalent. A consistent increase in calorie consumption is seen over the years, reflecting the improving food security situation in the country (MoFED 2012). Average calorie consumption was only 2,197 kcal per day per adult equivalent in 1996 but increased to 3,001 kcal in 2011. Starchy staples remain the major contributor to total calorie consumption.[10] There has been remarkably little change in this regard over the 15-year period. Starchy staples contributed 72.6 percent to total calorie intake in 1996, while in 2010 the share was 75.5 percent. Contrary to what would be expected, the Ethiopian diet has not shifted away from starchy staples during the period of high economic growth. Indeed, the contemporary Ethiopian diet relies more on starchy staples than what would be expected for the country's level of income (Figure 4.1).

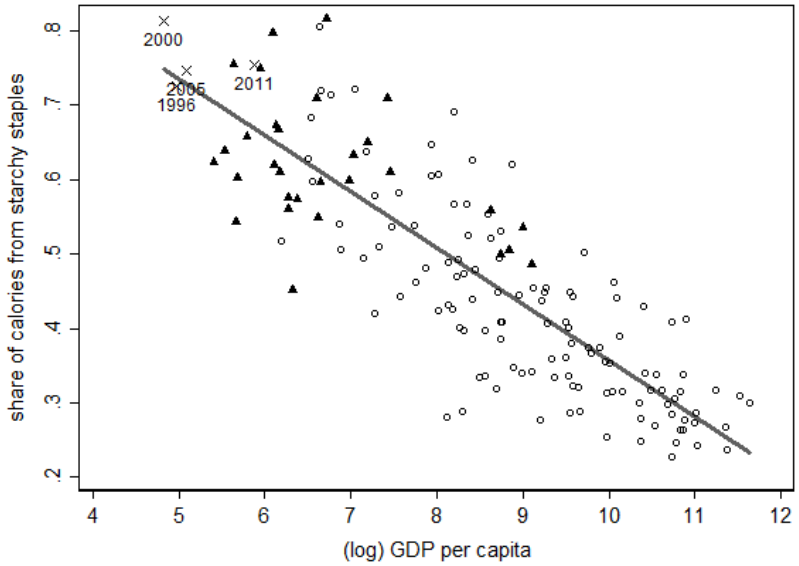
Table 4.1. Calorie consumption by food group per adult equivalent per day

	1996		2000		2005		2011	
Food group	kcal.	Share (%)	kcal.	Share (%)	kcal.	Share (%)	kcal.	Share (%)
Teff	305	13.9	372	13.6	316	11.1	323	10.8
Wheat	261	11.9	316	11.5	364	12.8	301	10.0
Barley	129	5.9	92	3.4	113	4.0	121	4.0
Maize	432	19.7	490	17.9	441	15.5	608	20.3
Sorghum	213	9.7	289	10.5	363	12.7	353	11.8
Other cereals	72	3.3	168	6.1	63	2.2	91	3.0
Processed cereals	52	2.4	57	2.1	86	3.0	57	1.9
All cereals	1,465	66.7	1,784	65.1	1,745	61.3	1,854	61.8
Pulses	240	10.9	205	7.5	203	7.1	214	7.1
Oilseeds	11	0.5	7	0.3	7	0.2	5	0.2
Animal products	72	3.3	64	2.3	76	2.7	59	2.0
Oil & fat	54	2.5	39	1.4	63	2.2	130	4.3
Vegetables & fruits	60	2.7	65	2.4	76	2.7	62	2.1
Pepper	8	0.4	5	0.2	5	0.2	52	1.7
Enset/kocho	63	2.8	323	11.8	235	8.2	306	10.2
Coffee/tea/chat	43	2.0	39	1.4	41	1.5	60	2.0
Root crops	67	3.1	122	4.5	149	5.2	104	3.5
Sugar & salt	85	3.9	67	2.4	72	2.5	58	1.9
Other foods	29	1.3	21	0.8	174	6.1	97	3.2
Total food	2,197	100.0	2,741	100.0	2,847	100.0	3,001	100.0

Source: Authors' calculations based on HICES, CSA.

[10] Starchy staples refer to cereals, root crops (potatoes, sweet potatoes, cassava and other root crops) and enset/kocho.

Figure 4.1. Global relationship between national share of calories from starchy staples and income



Note: X marks Ethiopia in different years (4 observations), triangles are other sub-Saharan African countries (31 countries) and hollow circles non-Sub-Saharan African countries (123 countries). The solid line is the line of best-fit for the global calorie share from starchy staples-income relationship. Gross-Domestic Product (GDP) per capita is expressed in current USD. Starchy staples include cereals and root crops (including enset and kocho).

Source: The data for share of calories from starchy staples (y-axis) come from the FAO food balance sheets, except for Ethiopia for which the HICES data was used. Data on gross-domestic product (x-axis, GDP) come from the World Bank. The latest available data points were used for each country, except for Ethiopia for which the HICES survey years were used.

The most important crop that contributes to calorie intake is maize. It accounts for nearly 20 percent of the average calories consumed per adult equivalent. Sorghum accounts for 12 percent, while teff and wheat make up 11 percent and 10 percent of calories consumed, respectively. Barley and other cereals are less important. While processed cereals account for almost 5 percent of expenditures, they however contribute relatively less towards calories, with only 2 percent of the calories consumed provided by this food category.

Comparing expenditures with calorie consumption allows for prices per calorie to be calculated. Table 4.2 shows that the price per calorie differs considerably between food groups. When the prices for 2011 are considered, prices of cereals are considerably lower than those of most other categories. These other crops are therefore usually called 'high-value' crops. Animal products carry the highest price for calories with a calorie price that is 8 times as high as the average price paid for calories from cereals. The price for fruits and vegetables is also relatively high, being about five times as high per calorie than for cereals. The price for other foods – except for enset/kocho and root crops – is also considerably higher than the average. Within the cereal category, the lowest calorie prices are found for maize and sorghum. These prices are considerably below the level that consumers pay per calorie for teff and wheat products. The prices for barley fall in between maize or sorghum and teff. Note also the considerably higher price per calorie for processed cereals. Among other food items, a noteworthy change is that the calories from oils and fats has more than doubled: from 54 kcal per day per adult equivalent in 1996 to 130 kcal in 2011.

Notably, the shift that is seen over time in food preferences shows a relative reduction in consumption of low-priced calories, while there is an increase in consumption of more expensive ones. The average price that consumers pay per calorie has increased by 8 percent over the last decade. This is mostly driven by a shift to more expensive commodities. For example, Table 4.2 shows that prices paid for calories of basic staples have consistently decreased over time and real prices paid for calories from cereals were 20 percent lower in 2011 than the price paid in 1996. The real prices of other food categories have mostly risen, but especially so for the period between 2005 and 2011.

Table 4.2. Real price per kilocalorie paid (birr/kcal), 1996, 2000, 2005, and 2011, by food group

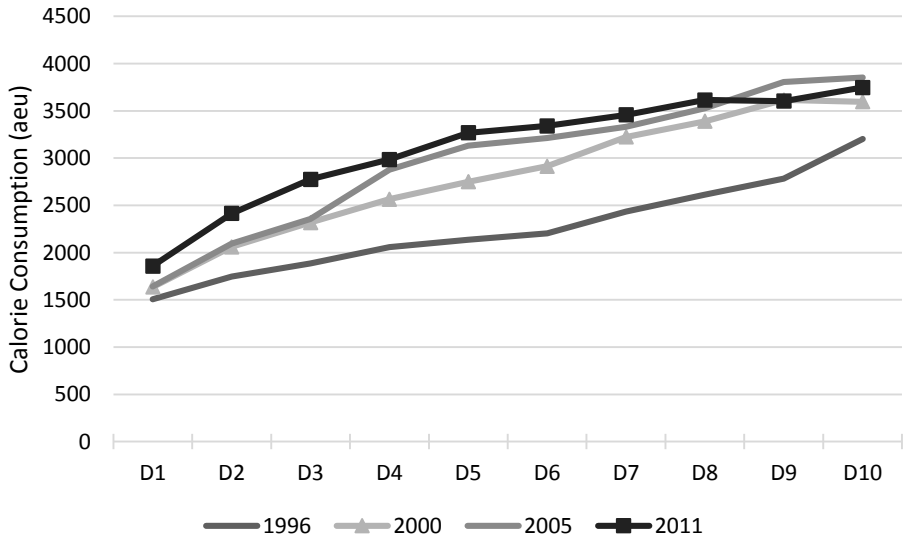
Food group	1996	2000	2005	2011
Teff	0.28	0.26	0.23	0.21
Wheat	0.20	0.21	0.20	0.23
Barley	0.27	0.31	0.31	0.18
Maize	0.17	0.17	0.16	0.12
Sorghum	0.25	0.16	0.18	0.13
Other cereals	0.30	0.14	0.21	0.15
Processed cereals	0.29	0.26	0.30	0.74
All cereals	0.23	0.20	0.20	0.18
Pulses	0.23	0.37	0.30	0.41
Oilseeds	0.20	0.27	0.25	0.29
Animal products	0.77	0.94	0.92	1.71
Oil & fat	0.63	0.70	0.50	0.47
Vegetables & fruits	0.46	0.53	0.49	0.95
Pepper	4.60	5.87	3.94	1.18
Enset/kocho	0.60	0.18	0.15	0.13
Coffee/tea/chat	1.67	1.33	1.49	1.41
Root crops	0.29	0.21	0.17	0.16
Sugar & salt	0.22	0.23	0.21	0.43
Other foods	1.46	1.10	0.52	0.59
Total food	0.34	0.28	0.28	0.31

Source: Authors' calculations based on HICES, CSA. Real prices are expressed in 1996 birr.

4.1. Income and its link with calories

Figure 4.2 shows how calorie consumption per adult equivalent has changed over time by expenditure decile. The overall improvement in food consumption is shown by the (mostly) higher level of calorie consumption in each survey round. While the situation of the poorest decile improved only marginally between 1996 and 2011, we see a considerable and consistent improvement over time for all other deciles. The biggest change in per adult equivalent calorie consumption was seen for most deciles over the period 1996 and 2000. While there were few differences in calorie consumption between deciles in 1996, that changed considerably for the richer deciles in 2000 as we note a strong gradient between poor and rich in that year.

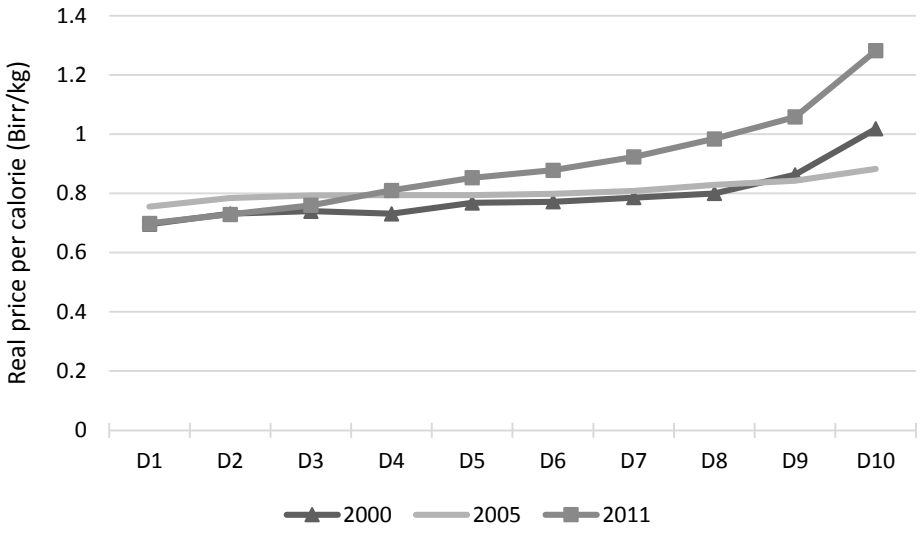
Figure 4.2. Calorie consumption by expenditure decile over time, 1996 to 2011



Source: Authors' calculations based on HICES, CSA.

We investigate the income link further in Figure 4.3 in which the prices paid per calorie are shown as a function of income level, measured by deciles of expenditures. In 2011, prices paid by the richest decile were almost twice as high as the prices paid by the poorest decile. In the earlier rounds of the HICES, this variation in prices between income groups was much lower. While prices for calories, shown in 2011, have come down for the poorest decile compared to 2005, the reverse is seen for richer deciles. This indicates a shift from lower priced-food to higher-priced food on becoming wealthier.

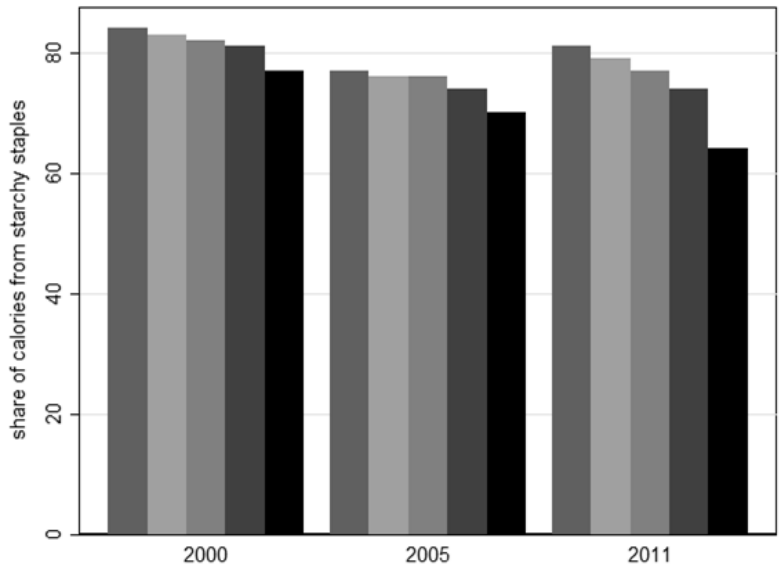
Figure 4.3. Price paid per kcal, by expenditure decile, 2000 to 2011



Source: Authors' calculations based on HICES, CSA. Real expenditures are expressed in 1996 birr.

In the previous sub-section we saw how the average share of calories coming from starchy staples has remained extremely high, despite the considerable economic progress in the country. This suggests that the consumption of starchy staples is not responsive to changes in incomes in the Ethiopian context. In Figure 4.4, we study this further by comparing the starchy staple share across expenditure quintiles over the years. We see that the share of calories coming from starchy staples remain remarkably stable as we move across the expenditure quintiles. Only in 2011 do we see a sizeable drop in the share of calories from starchy staples for the richest quintile.

Figure 4.4. Share of calories from starchy staples by expenditure quintile and over time



Source: Authors' calculations based on HICES, CSA.

Note: Each bar represent a quintile: starting from left (for each year), from 1st (poorest) to 5th (richest) expenditure quintile.

4.2. Decomposition of changes

So far we have seen that calorie intake in the country has substantially increased over the 15-year period. In this sub-section, we use decomposition techniques to understand the drivers of this change. More specifically, following Oaxaca (1973) and Blinder (1973), we decompose the changes in calorie intake. The difference in calorie intake between 2011 and 1996 (*D*) is formally expressed as:

(1) $$D = C_{2011} - C_{1996}\ ,$$

where C_{2011} captures the calorie consumption in 2011 and C_{1996} in 1996. Using linear regression methods, we can decompose the difference using the following equation:

(2) $$\overline{D} = [\bar{X}_{2011} - \bar{X}_{1996}]'\hat{\beta}_{2011} + \bar{X}_{1996}'[\hat{\beta}_{2011} - \hat{\beta}_{1996}],$$

where $\bar{X}$ refers to the mean values of the covariates (observed either in 2011 or 1996) that we use to predict the change. The term $\hat{\beta}$ refers to the estimated coefficients on the covariates. Equation (2) decomposes the changes in calorie intakes over the two periods into two components. The first part of the equation is usually referred to as the 'explained' component $([\bar{X}_{2011} - \bar{X}_{1996}]'\hat{\beta}_{2011})$ – the part of the difference that is due to changes in characteristics or endowments (in 2011 coefficients). The second part of the equation is the 'unexplained' component $(\bar{X}_{1996}'[\hat{\beta}_{2011} - \hat{\beta}_{1996}])$ – the part that is due to the changes in the estimated coefficients.

Equation (2) can be broken down further in order to identify the contribution of each covariate $(\bar{X}_1, \bar{X}_2, \dots)$. Constructing such a detailed decomposition is straightforward. For example, the detailed decomposition for the explained part can be calculated as:

(3) $$\begin{aligned}\overline{D} &= [\bar{X}_{2011} - \bar{X}_{1996}]'\hat{\beta}_{2011} \\ &= (\bar{X}_{1,2011} - \bar{X}_{1,1996})'\hat{\beta}_{1,2011} + (\bar{X}_{2,2011} - \bar{X}_{2,1996})'\hat{\beta}_{2,2011} + \cdots\end{aligned}$$

As covariates in Equations (2) and (3), we use (log) real per capita expenditure per day (+squared term)[11], (log) mean cost of calories per day[12], highest level of education in household, household size, and characteristics of the head of household (age, sex, and sector of occupation). We also include a dummy if the household is located in an urban area.

Table 4.3 provides the summary statistics of these variables for both survey rounds (1996 and 2011). Apart from the tremendous increase in the real expenditures (per adult equivalent), we see that the real cost of calories has declined over the 15-year period. This is due to increases in agricultural production in the country that has kept prices down despite high population growth.[13] The share of household heads working in the agricultural sector has declined from 85 percent in 1996 to 76 percent in 2011. At the same time, the share of household heads working in the service sector has increased from 11 percent to 19 percent. Moreover, educational attainment levels have also improved during this period. Finally, the share of urban households has increased from 15 percent to 21 percent. [14] The decomposition analysis attempts to understand how these improvements in living standards and educational levels and the changes in occupational structures have contributed to the changes in calorie intakes over the 15-year period.

[11] This variable serves as a proxy for household income levels.

[12] In order to minimize reverse causality concerns, the real cost of calories is imputed at the community level, rather than at the household level. More specifically, we divide the mean per adult equivalent calorie intakes in the community with the mean per adult equivalent expenditures in the community.

[13] Note that the real cost of calories per day is computed by dividing the mean per adult equivalent calorie intakes in the community with the mean per adult equivalent expenditures in the community. As a result, the variable captures both prices and preferences. Therefore, the decline in real calorie cost could be due to lower prices or changes in preferences towards cheaper food items. However, Table 3.1 suggests the opposite: the average household is shifting away from cheaper food items to high-value ones.

[14] Note that the definition of an urban area has not changed across the survey rounds. In the HICES, urban areas comprise all region, zone, and district (woreda) capitals, as well as localities that have a population of 1,000 or more, and whose inhabitants are primarily engaged in non-agricultural activities. In addition, localities with Urban Dweller's Areas (UDAs) are defined as urban. For more information, see Central Statistical Agency [Ethiopia] (2012).

Table 4.3. Summary statistics of the variables used in the decomposition analysis of changes in calorie consumption, 1996 and 2011

Survey round:	1996		2011		
Variables	mean	standard deviation	mean	standard deviation	difference
calories consumed per day per adult equivalent	2515.0	1245.6	3199.3	1360.7	684.23***
(log) per adult equivalent calorie per day	7.73	0.450	7.99	0.409	0.26***
Covariates:					
real per adult equiv. expenditure	3.68	2.230	6.29	5.587	2.604***
(log) real per adult equiv. expenditure	1.17	0.509	1.63	0.613	0.46***
real calorie cost per day	0.96	0.301	0.90	0.338	-0.066***
(log) real calorie cost per day	-0.08	0.311	-0.17	0.345	-0.086***
agricultural sector occupation (reference)	0.86	0.351	0.76	0.427	-0.096***
service sector occupation	0.11	0.310	0.19	0.394	0.085***
manual labor occupation	0.04	0.186	0.05	0.212	0.011**
age of head	44.02	15.06	43.28	15.95	-0.741**
male household head	0.76	0.424	0.75	0.432	-0.013
household size (aeu)	4.03	1.910	3.85	1.903	-0.183***
less than primary (reference)	0.52	0.50	0.27	0.44	-0.25***
primary education	0.39	0.49	0.54	0.50	0.152***
secondary education	0.07	0.26	0.12	0.33	0.052***
higher education	0.01	0.120	0.06	0.239	0.046***
household resides in an urban area	0.15	0.356	0.21	0.410	0.066***
observations:	11,923		27,825		-

Source: Authors' calculations based on HICES, CSA. Real expenditures are expressed in 1996 birr.

Note: The agricultural sector occupation also includes household heads that reported to be unemployed at the time of the survey. aeu refers to adult equivalent units. Statistical significance based on a two-tailed t-test and denoted at *** p<0.01, ** p<0.05, * p<0.1.

For the decomposition, we also need to estimate the β coefficients in Equation (2). These are obtained from a standard Ordinary Least Squares (OLS) regression. More precisely, we regress the (log) household calorie intake (per adult equivalent per day) on the covariates in vector X, separately for each round. Table 4.4 provides these OLS estimates; column 1 for 1996 and column 2 for 2011. As expected (see Figure 4.2), increases in real expenditures are associated with increases in calorie intakes.[15] Moreover, increasing the real cost of calories by one percent in 1996 was associated with a 0.6 percent decline in calorie intake, while in 2011 the corresponding figure is 0.4 percent. Working outside of agriculture, in manual labor or in the service sector, is associated with marginally lower calorie intakes, on average and after controlling for the level of expenditure – but only in 2011. This likely reflects the lower calorie needs in non-agricultural occupations. Higher levels of education are also associated with lower calorie intakes, potentially capturing differences in calorie needs within these broad occupational categories. Interestingly, households in urban areas consumed more calories in 1996, but the opposite was true in 2011, on average and *ceteris paribus*.

[15] The signs of the coefficients on the expenditure variables imply that increases in expenditures is first associated with a decrease and then (as we move right in the expenditure distribution) with an increase in the calorie intakes. However, for 1996, the coefficient on the level term is insignificant. For 2011, the turning point is at about 0.5 log expenditure points, which is at the bottom 5th percentile of the expenditure distribution in 2011.

Table 4.4. OLS regression: household calorie intake on selected covariates, 1996 and 2011

dependent variable: (log) calories per day per adult equivalent	(1)	(2)
survey round:	1996	2011
(log) real expenditure (aeu)	-0.0108	-0.175***
	(0.0454)	(0.0673)
--- squared	0.305***	0.353***
	(0.0225)	(0.0344)
(log) real calorie cost per day	-0.592***	-0.440***
	(0.0122)	(0.0121)
service sector occupation	-0.0112	-0.0653***
	(0.0133)	(0.00819)
manual labor occupation	-0.0108	-0.0553***
	(0.0179)	(0.0115)
age of head	0.000102	-0.000509***
	(0.000226)	(0.000194)
male head	-0.0131	-0.0206***
	(0.00805)	(0.00698)
household size (aeu)	-0.0717***	-0.00907***
	(0.0020)	(0.0020)
primary education	-0.0341***	-0.0121
	(0.00702)	(0.00736)
secondary education	-0.0657***	-0.0477***
	(0.0143)	(0.00985)
higher education	-0.116***	-0.0745***
	(0.0206)	(0.0123)
urban	0.0486***	-0.185***
	(0.0128)	(0.00916)
constant	7.270***	7.202***
	(0.0194)	(0.0206)
R^2	0.657	0.477
Observations	11,923	27,825

Source: Authors' calculations based on HICES, CSA. Real expenditures are expressed in 1996 birr.

Note: aeu refers to adult equivalent units. Standard errors (clustered at the community level) are in parentheses. Statistical significance denoted at *** p<0.01, ** p<0.05, * p<0.1.

Table 4.5 provides the decomposition results.[16] The top panel of the table provides the decomposition results based on Equation (2), and the bottom panels provide the detailed decomposition. First, the changes in endowments (i.e. covariates) between the two survey rounds explain 98 percent of the difference in calorie intakes between 1996 and 2011. The detailed decomposition shows that the increased calorie intake is mostly due to increases in expenditures. The increase in expenditure over the two period explains 84 percent of the observed changes in calorie intake. The remaining 16 percent are mostly explained by the decrease in real price of calories. Changes in occupational structure, educational levels, household size, and urbanization explain an unimportant share of the changes in calorie intake over the 15-year period.

[16] We computed the decomposition using the 'oaxaca' command in Stata 13 (see Jann 2008).

Table 4.5. Results of the decomposition analysis of changes in calorie intake in Ethiopia between 1996 and 2011

overall	
Year 2011	7.99***
Year 1996	7.73***
difference	0.26***
explained	0.255***
unexplained	0.00464
explained	
(log) real expenditure (aeu) + squared	0.219***
(log) real calorie cost per day	0.0477***
occupation	-0.00458***
age of head	8.20E-05
male head	0.00028
household size (aeu)	0.00631***
education level	-0.00843***
urban	-0.00538***
unexplained	
(log) real expenditure (aeu) + squared	-0.0804***
(log) real calorie cost per day	-0.0227***
occupation	-0.00901***
age of head	-0.0266*
male head	-0.00572
household size (aeu)	0.248***
education level	0.0112
urban	-0.0416***
constant	-0.0686*
observations	39,748

Source: Authors' calculations based on HICES, CSA. Real expenditures are expressed in 1996 birr.

Note: aeu refers to adult equivalent units. Statistical significance based on standard errors clustered at the community level (computed using the delta method) and denoted at *** p<0.01, ** p<0.05, * p<0.1.

Appendix C provides the decomposition results for each expenditure quintile. We see that calorie intake increased substantially across all quintiles over the 15-year period, with the largest increases in the mid-quintiles (2^{nd}- 4^{th}). The detailed decomposition shows that improvements in income levels are primarily responsible for the increase in calorie intake for all income quintiles.

5. CONCLUSIONS

Africa has witnessed impressive and unprecedented economic growth in the last decade (Badiane, Makombe, and Bahiigwa 2014). This growth has important implications on its agricultural and food economies. However, there is a lack of evidence on how these economies are transforming and what the implications of this transformation are for the agricultural and food sectors, often due to a lack of reliable and representative data (Jerven 2013). Relying on unique large-scale household surveys over a 15-year period, this research examined the transformations that are taking place in Ethiopia's food economy during a period of high economic growth and emerging structural transformation. Ethiopia is an important case study for this transformation in Africa because of the size of the country (with almost 100 million people), its fast economic growth, and the availability of good household data for the country over a long period.

We find that average quantities and calorie consumption per adult equivalent have consistently and considerably improved over the last 15 years. Also, the content of the diet is changing with a gradual shift towards high-value foods, such as animal products, fruits and vegetables, and processed foods. While the quantities of cereals consumed slightly increased over the last decade, we see a shift away from lower-priced cereals (e.g., sorghum and maize) to more expensive ones (e.g., teff). With regard to teff, ready-to-eat injera and the more expensive white teff are on the rise, while the cheap red and mixed teff are on the decline.

These changes in diets are largely shaped by improvements in household income levels. Our decomposition analysis shows that the 27 percent increase in calorie intake between 1996 and 2011 is mainly due to increased incomes. The reduction in real costs of calories over the same period has also played a role, albeit a much smaller one. Furthermore, our

cross-sectional analysis of consumption patterns across expenditure quintiles shows that improvements in calorie intake are likely to continue if the economic growth persists, and the growth benefits all income groups. Moreover, while urbanization rates have been low in Ethiopia, the situation is changing fast (Schmidt and Kedir 2009). People in cities are shown to have different diets than rural populations. Increasing urbanization, therefore, will require a different food system. But increased urbanization and income growth will also generate concerns. In particular, income growth and urbanization are associated with increased consumption of oils and fats, animal products, and processed foods. This, together with structural change where calorie needs decline as a result of the shift away from agriculture to low-activity occupations, mean that overweight and obesity could become significant nutritional problems for Ethiopia in the not-so-distant-future (Popkin, Adair, and Ng 2012), especially in urban areas. If so, the next decade will see Ethiopia battling with high undernutrition rates in rural areas and increasing overweight and obesity rates in the cities. This phenomenon has been coined in the literature as the *double-burden of malnutrition* (Gillespie and Haddad 2001). Therefore, on one hand, Behavioral Change Communication is needed to educate the urban population about the importance of healthy and balanced diets. On the other, a further strengthening of targeted safety nets seems essential to improve the food security of deprived people in order to improve their nutrition, health, and wellbeing.

Finally, the changing food consumption baskets have implications for Ethiopia's agricultural sector. First, agricultural policy in Ethiopia has been successful in improving productivity and availability of cereals in the country (e.g. Bachewe et al., 2015), contributing to improved food security for large parts of the population. However, there is a heavy focus on starchy staples in the Ethiopian diet, irrespective of the level of income. This lack of diversity in diets could be linked to the high levels of stunting in the country (Headey 2014). More emphasis on diversification in agricultural production and on diversification of diets is required. Second, agricultural markets play an increasing role in providing consumers with the food that they require.[17] It is therefore important to gain a better understanding of how these markets can cater for consumers with adequate and nutritionally diverse diets. One particular important issue to solve surrounds the distrust that often exists towards processes and traders within food markets. Further understanding of producer, wholesale and retail markets; agricultural processing; trade logistics; and the role each of these factors play in shaping food prices and consumption patterns is required in order to design appropriate policies and interventions to improve diets in Ethiopia.

[17] An emerging body of research shows how market access is an important determinant of diets in Ethiopia (Hirvonen and Hoddinott 2014; Hoddinott, Headey, and Dereje 2015; Stifel and Minten 2015; Abay and Hirvonen 2016).

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APPENDICES

Appendix A: Share of different food groups in total food expenditures, by region, 2011

Food group	Tigray	Afar	Amhara	Oromiya	Somali	Beni-shangul	SNNP	Gam-bella	Harar	Addis Ababa	Dire Dawa	Total
Teff	9.8	5.7	8.2	7.9	0.3	4.0	4.3	2.8	5.8	14.6	4.5	7.5
Wheat	10.5	10.3	6.2	8.4	13.7	2.6	4.0	4.9	16.3	9.5	18.2	7.4
Barley	3.4	0.5	2.8	3.0	0.2	0.2	1.6	0.4	0.4	0.5	0.5	2.4
Maize	4.2	12.7	3.4	8.8	11.1	5.1	13.2	19.7	4.1	0.9	3.3	7.7
Sorghum	9.9	1.7	9.1	4.1	3.8	8.9	1.3	2.0	9.1	0.1	8.3	5.0
Other cereals	1.0	1.1	2.3	1.3	4.4	4.3	0.3	0.5	1.7	0.7	2.6	1.4
Processed cereals	5.6	3.8	7.0	3.4	0.7	3.5	2.7	3.6	3.7	10.2	6.1	4.6
All cereals	44.4	35.8	39.0	37.1	34.1	28.6	27.4	33.8	41.0	36.6	43.6	36.0
Pulses	10.2	5.4	15.0	8.6	1.2	12.6	5.8	6.5	4.4	9.3	4.3	9.5
Oilseeds	0.1	0.1	0.3	0.2	0.0	0.5	0.0	0.0	0.3	0.0	0.2	0.2
Animal products	12.2	23.8	8.9	10.1	16.7	11.9	11.3	21.7	12.9	16.2	8.8	10.8
Oil & fat	5.9	5.6	5.0	7.7	6.7	7.8	5.9	5.6	6.5	9.9	7.2	6.6
Vegetables & fruits	5.8	5.5	3.3	6.4	3.0	10.4	10.1	12.2	6.4	8.4	9.4	6.4
Pepper	7.4	3.7	11.8	5.5	0.8	7.0	3.5	2.4	2.3	6.4	2.2	6.6
Enset/kocho	0.0	0.0	0.0	4.0	0.0	0.1	13.5	0.6	0.0	0.2	0.0	4.2
Coffee/tea/chat	5.0	12.7	4.7	12.3	19.5	8.7	8.8	5.9	18.8	4.0	13.6	9.1
Root crops	0.4	0.3	1.4	1.3	0.7	1.1	4.1	0.9	1.6	1.1	2.1	1.8
Sugar & salt	2.7	4.9	1.6	2.8	16.2	3.5	1.6	4.3	3.6	3.3	4.3	2.7
Other foods	5.8	2.2	9.2	4.2	1.0	7.9	7.9	6.0	2.1	4.6	4.2	6.2
Total food	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

Source: Authors' calculations based on HICES, CSA.

Appendix B: Share of teff expenditures by expenditure quintile, by type of teff, 2011

Quintile:	1st (poorest)	2nd	3rd	4th	5th (wealthiest)
White teff	15.9	18.1	20.4	20.5	22.0
Mixed teff	18.2	22.3	22.6	23.2	19.1
Red teff	28.9	28.8	29.1	23.0	10.4
Injera	37.0	30.8	27.9	33.3	48.5

Source: Authors' calculations based on HICES, CSA.

Appendix C: Results of analysis of decomposition of changes in calorie intake in Ethiopia between 1996 and 2011, by expenditure quintile

expenditure quintile:	1st (poorest)	2nd	3rd	4th	5th (wealthiest)
overall					
Year 2011	7.63***	7.93***	8.07***	8.14***	8.18***
Year 1996	7.43***	7.62***	7.72***	7.84***	8.03***
difference	0.194***	0.313***	0.347***	0.29***	0.155***
explained	0.224***	0.334***	0.337***	0.33***	0.229***
unexplained	-0.0304*	-0.0218	0.0105	-0.0398**	-0.0734***
explained					
(log) real expenditure (aeu)	0.187***	0.266***	0.249***	0.283***	0.236***
(log) real calorie cost per day	0.0594***	0.071***	0.0878***	0.0535***	-0.0149**
occupation	-0.00033	-0.00046	-0.00082	-0.00319*	-0.0129***
age of head	0.00061	-2.70E-05	-0.00018	0.00015	-0.00259**
male head	-0.00018	6.20E-05	0.00033	0.00056	0.00093
household size (aeu)	-0.0142***	-5.40E-05	0.00643**	0.00993***	0.0519***
education level	-0.00669	-0.00268	-0.00333	-0.0045	-0.00706**
urban	-0.00131	0.0005	-0.00237	-0.00881***	-0.0227***
unexplained					
(log) real expenditure (aeu)	0.00109	0.0466	-0.0563	-0.143	-0.605***
(log) real calorie cost per day	-0.00991	-0.00802	-0.0299***	-0.0223***	0.0409***
occupation	-0.00414	-0.00157	-0.00426	-0.0138***	-0.0098
age of head	-0.0707**	-0.00697	-0.0619**	-0.0141	-0.0308
male head	0.0526**	-0.0261	-0.0335*	0.0239	-0.0313**
household size (aeu)	0.364***	0.246***	0.262***	0.232***	0.197***
education level	-0.00225	0.0153	0.0167	0.0275*	0.00408
urban	-0.00459	-0.0206***	-0.0296***	-0.0453***	-0.125***
constant	-0.356***	-0.266**	-0.053	-0.0851	0.486***
observations	4,933	5,626	6,463	8,270	14,456

Source: Authors' calculations based on HICES, CSA.

Note: aeu refers to adult equivalent units. Statistical significance based on standard errors clustered at the community level (computed using the delta method) and denoted at *** p<0.01, ** p<0.05, * p<0.1.

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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; http://essp.ifpri.info/; or http://www.edri-eth.org/.

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