Chapter 2

TEFF AND ITS ROLE IN THE AGRICULTURAL AND FOOD ECONOMY

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To fully appreciate the transformation of the Ethiopian agricultural and food economy, and to illustrate the role teff plays in this, this chapter explores rapid changes since 2003 in the agricultural sector (on the production side) and food economy (on the consumption side). During this period Ethiopia's economy has been characterized by high economic growth rates, making the country one of the fastest-growing economies in the world (World Bank 2014). Considering this, important implications on its agricultural and food economy become apparent.

The chapter first discusses the role of teff on the production side. Ethiopia is an extremely diverse country, with large variation in ecosystems and agricultural potential, ranging from pastoralist areas to moisture-reliable lowlands and highlands as well as drought-prone highlands and lowlands (Chamberlin and Schmidt 2012). Moreover, there is large variation in population density and access to markets. These factors contribute to a diversified agricultural economy with spatial specialization of agricultural activities and very diverse livelihood strategies. Next, the chapter analyzes teff consumption. Data are analyzed from national consumption surveys over a 15-year period to illustrate the extent to which transformation in consumption patterns is occurring (for an overview of patterns in nutritional transition in developing countries overall, see Popkin [2003]) and what exactly the role is of teff in Ethiopia's changing food economy. To better understand that transformation, the link between food demand and income levels in particular is examined later in the chapter. This might give an indication of the trend in food consumption patterns, especially within a country where urbanization is encouraged and mid-income status is set as a goal by the year 2025 in several policy documents.

Data

We use production and consumption data collected by Ethiopia's Central Statistical Agency (CSA). We chose to use these data because they are the only ones that are systematically available over time and because they are representative at the national and regional levels. Ethiopia is blessed with such datasets, and although the quality of CSA data has been challenged by some authors (for example, Dercon and Hill 2009; Gollin 2011; Mandefro and Jerven 2015), they are nevertheless considered to be among the best in Africa. These datasets should therefore allow us big picture overviews in this area.

Data on agricultural production information is collected annually through an agricultural sample survey implemented by the CSA. This survey is typically fielded in more than 2,000 enumeration areas, and more than 40,000 farmers are visited. For example, in 2010/2011, almost 45,000 agricultural households were interviewed. The survey collects data, among others, on area allocation, production levels, yields, use of harvest, and land management practices. The sample is set up in such a way that the results are representative of the regional and zonal levels. The annual data from these surveys for the period 2003/2004–2013/2014 are used in the analysis.

The consumption analysis relies on the Ethiopian Household Income, Consumption and Expenditure Survey (HICES) dataset from the past four rounds—that is, 1995/1996, 1999/2000, 2004/2005, and 2010/2011. These data were also collected by the CSA. In total, 11,678, 17,320, 21,560, and 27,831 households were interviewed over the four periods, respectively. The survey contains detailed information on consumption and expenditures of both food and nonfood items. The number of calories contributed by each of the consumable items is also available within the dataset. These data are explored to analyze trends in the consumption of different food categories over these periods.[1] In particular, the focus is on quantity consumed, expenditures, and calorie contribution of the three varieties of teff (white, mix, and red) and of injera. It is to be noted that there have been some differences in data collection methods over the years, and some caution in the interpretation over time is warranted (Stifel and Woldehanna 2014). In addition to the HICES dataset, the retail price dataset of the CSA is used to account for inflation over this period.

1 Note that since a different cleaning procedure was followed before statistics were calculated, there are slight differences with the national estimates.

Teff in Ethiopia's Agricultural Economy

Using a number of indicators, teff is estimated to be the most important crop in Ethiopia's agricultural economy. In 2013/2014 it was estimated by the CSA that teff made up 22 percent of all the cultivated area by private smallholders in the meher season, covering about 3 million hectares, and that it was grown by 6.6 million farmers.[2] As there are a total of 15.3 million farmers in Ethiopia, this implies that 43 percent of all Ethiopian farmers grow teff. The second most important crop is maize at 15 percent of all cultivated land, followed by sorghum accounting for 12 percent. Teff makes up 31 percent of all the cultivated land in the cereal sector. This sector is the most important in Ethiopia's agricultural economy, accounting for 72 percent of all cultivated land.

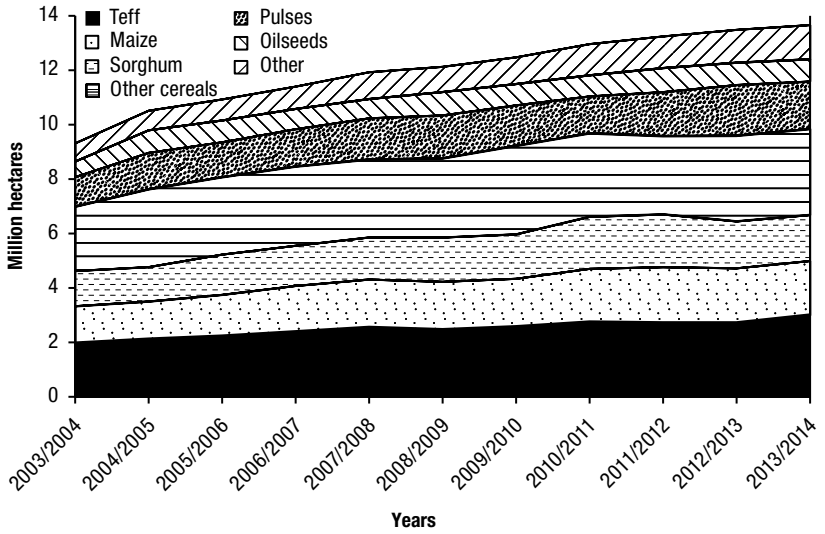
Figure 2.1 shows how the area allocated to teff and other major crops has evolved over time. While the teff area has grown by 50 percent over 10 years—from 2 million hectares in 2003/2004 to 3 million hectares in 2013/2014—the share of teff in total area cultivated has stayed relatively stable over time. It was as high as 21.3 percent in 2003/2004, and it even slightly increased to 22.1 percent in 2013/2014. The share of other crops also remained surprisingly stable over time, with seemingly no important diversification in Ethiopia's agricultural economy during the meher season to date. For example, the share of cereals in total area cultivated during the meher season was as high as 75 percent in 2003/2004. Although it declined over time, it remained as high as 72.1 percent in 2013/2014.

Although teff is the most important single crop by total cultivated area in Ethiopia, its importance in agricultural production is far less. This is due to the relatively low yields of teff compared with most other crops, especially other cereals. The total national production of teff in 2013/2014 (4.4 million metric tons) was lower than maize (6.5 million metric tons) but higher than wheat (3.9 million metric tons) and sorghum (3.8 million metric tons) (Ethiopia, CSA 2014b). The average yield of teff that year was 1.46 metric tons per hectare, less than half the yield of maize (3.25 metric tons per hectare).

However, prices paid per kilogram of teff are considerably higher (Table 2.1). When considering the production value of teff in 2013/2014 and comparing it to other cereals, teff production is found to be valued at

2 Taffesse, Dorosh, and Gemessa (2012) show that smallholders generate 95 percent of the total production of the main crops in Ethiopia, and that 97 percent of the total crop production is in the meher season. The second season (belg) is therefore relatively less important.

FIGURE 2.1 Share of different crops in total cultivated area (private peasant holdings; meher season)



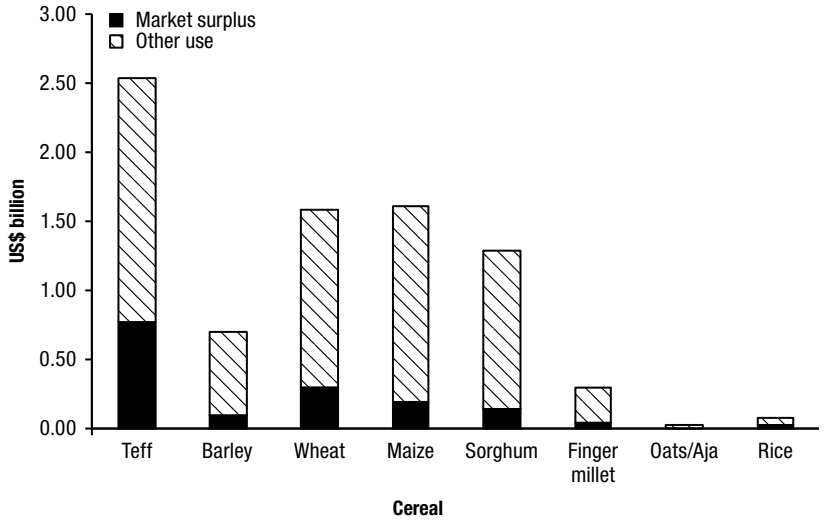
Source: Authors' calculations, CSA Agricultural Sample Surveys, 2003/2004–2013/2014.
Note: This includes private peasant holdings during the meher season.

US$2.5 billion, Ethiopia's crop of highest value.[3] Figure 2.2 shows the value of other cereals. Maize and wheat are each valued above US$1.5 billion (US$1.59 billion for maize and US$1.57 billion for wheat), while sorghum at US$1.27 billion and barley at US$0.69 billion are significantly lower. Overall, teff makes up 32 percent of the total value of the cereal sector.

If the commercial surplus (that part of production that is sold) is considered, its value for teff in 2013/2014 was estimated to be US$750 million. Within the cereal sector, teff is the most commercialized crop, with an estimated 30 percent of the production sold (Ethiopia, CSA 2014a). The value of the commercial surplus of teff makes up half of the value of total commercial surplus of the cereal sector and therefore equals the commercial surplus of all other cereals combined in the country, as shown in Figure 2.2 and in

3 To value production, the following methodology was used: The median retail price collected by CSA in all the surveyed markets in the country over the period July 2013–June 2014 was calculated. The prices of the following types in the CSA's dataset were used as an approximation of the price of the product: mixed teff, white wheat, white barley, white maize, white sorghum, millet, oats, and imported rice. The exchange rate of January 2014 of 19.33 Br (Ethiopian birr) per US$ to convert birr is used. For calculations of commercial surplus, the number published for the year 2013/2014 (Ethiopia, CSA 2014a) is relied upon.

FIGURE 2.2 Production value and use of cereals, 2013/2014



Source: Authors' calculations, CSA Agricultural Sample Surveys, 2013/2014.

TABLE 2.1 Production and commercial surplus of cereals, coffee, and sesame, 2013/2014

	Quantities (million metric tons)		Price (birr per kilogram)	Values (US$ billions)	
Food item	Production	Market surplus		Production	Market surplus
Teff	4.42	1.31	11.03	2.52	0.75
Barley	1.91	0.24	6.95	0.69	0.09
Wheat	3.93	0.72	7.71	1.57	0.29
Maize	6.49	0.72	4.75	1.59	0.18
Sorghum	3.83	0.39	6.42	1.27	0.13
Finger millet	0.85	0.10	6.57	0.29	0.03
Oats	0.06	0.01	7.03	0.02	0.00
Rice	0.09	0.02	9.70	0.05	0.01
Total cereals	**21.58**	**3.52**	**n.a.**	**8.00**	**1.48**
Coffee	0.39	0.20	55.03	1.12	0.56
Sesame	0.22	0.15	32.41	0.37	0.26

Source: Authors' calculations, CSA Agricultural Sample Surveys, 2013/2014.
Note: n.a. = not applicable.

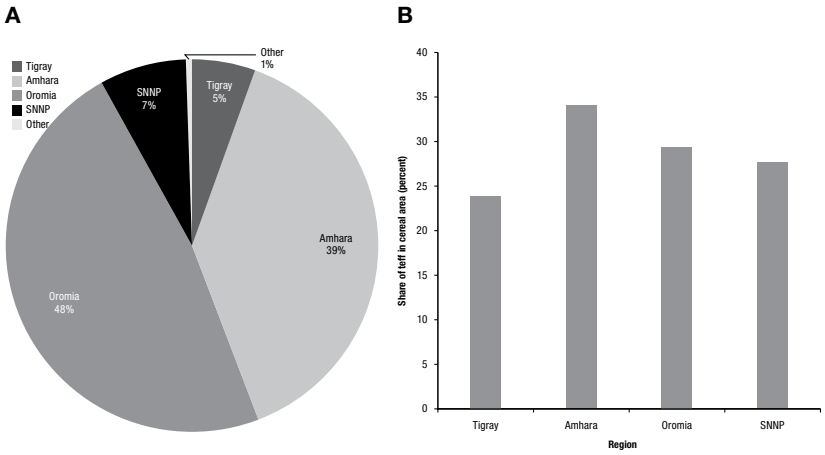
Table 2.1. The value of the commercial surplus of teff is also approximately equal to the value of coffee exports from Ethiopia during the same period (which amounted to US$714 million from July 2013 to June 2014). However, when the cash value accrued by farmers from the sales of teff is compared with the income gained through the sale of the two other major export crops from the country, income from teff is 34 percent higher than income from coffee, and almost triple the income that farmers make from the sales of sesame. Teff is thus by far Ethiopia's most important cash crop.

The role of teff in agricultural production between regions exhibits significant differences, partly driven by climatic suitability but also due to producer and consumer preferences. Figure 2.3A shows the share of different regions in total teff production in Ethiopia in 2013/2014. Oromia is the most important teff-producing area in the country, and its share in total national production is estimated to be as high as 48 percent. The second highest is Amhara with 39 percent. The other regions are relatively less important, with Southern Nations, Nationalities, and Peoples' (SNNP) region at 7 percent, Tigray at 5 percent, and the other regions combined at less than 1 percent. When the share of teff is examined as a proportion of total cereal area in each of the four major regions, relatively few differences are noted (Figure 2.3B). The share of teff in cereal area is highest in Amhara, where it reaches almost 35 percent. However, it drops to less than 25 percent in Tigray.

To understand the associates of growth in teff production since 2003, the level of production, area allocated, and yield is equated to 100 for the agricultural year 2003/2004. As Figure 2.4 illustrates, teff production has increased by 163 percent since 2003/2004, a combination of both area and yield increases of 50 percent and 73 percent respectively. Yield growth has thus been the main contributor to production growth. During the first half of the decade, yield and area growth were at similar levels (for the period 2003–2007). The gap between the two growth rates has, however, become wider since. Figure 2.4 also shows that the number of teff farmers has increased significantly since 2003/2004: an increase of 44 percent. As the area increase was of similar magnitude as the number of teff farmers, there has been no significant change in the area of teff cultivated per farmer over this period.

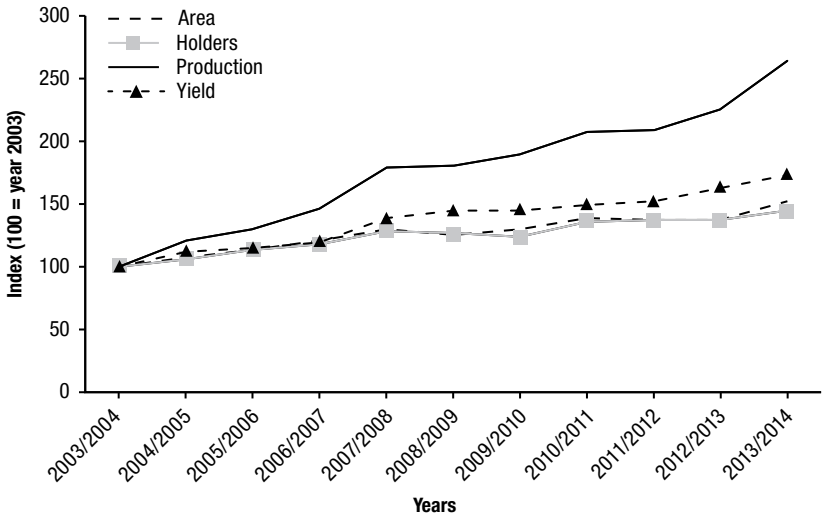
Table 2.2 further shows the relation of farm size and area allocation of all land, as well as teff land over the past decade. Based on the CSA data, 22 percent of total area in 2013/2014 was cultivated by farms that are 1 hectare or smaller. This compares to 32 percent for farm sizes between 1 and 2 hectares. In this same period (2013/2014), 46 percent of cultivated land was in the hands of farmers with farms larger than 2 hectares. The share of farmers

FIGURE 2.3 Share of the different regions in national teff production, 2013/2014



Source: Authors' calculations, CSA Agricultural Sample Surveys, 2013/2014.

FIGURE 2.4 Changes in teff production, area, yield, and number of producers, 2003/2004–2013/2014 (private peasant holders, meher season)



Source: Authors' calculations, CSA Agricultural Sample Surveys, 2003/2004–2013/2014.

TABLE 2.2 Size of holdings and teff area, 2003/2004 and 2013/2014

Farm size (in hectares)	Total area (millions of hectares)	Share (%)	Teff area (millions of hectares)	Share (%)	Number of teff producers (millions)	Share (%)
2003/2004						
0–0.5	0.89	8	0.09	5	0.65	14
0.5–1.0	1.91	17	0.28	14	1.12	25
1.0–1.5	2.13	18	0.38	19	1.01	22
1.5–2.0	1.82	16	0.34	17	0.68	15
2.0–3.0	2.38	21	0.47	24	0.69	15
3.0–4.0	1.20	10	0.23	11	0.24	5
> 4.0	1.25	11	0.19	10	0.14	3
Total	**11.58**	**100**	**1.98**	**100**	**4.53**	**100**
2013/2014						
0–0.5	1.30	7	0.12	4	0.88	13
0.5–1.0	2.72	15	0.40	13	1.61	24
1.0–1.5	2.98	17	0.52	17	1.40	21
1.5–2.0	2.68	15	0.51	17	1.00	15
2.0–3.0	3.62	20	0.70	23	1.03	16
3.0–4.0	1.94	11	0.35	12	0.39	6
> 4.0	2.69	15	0.42	14	0.31	5
Total	**17.93**	**100**	**3.02**	**100**	**6.61**	**100**

Source: Authors' calculations, CSA Agricultural Sample Surveys, 2003/2004 and 2013/2014.

with farms larger than 2 hectares in total land area has stayed relatively stable over the years but increased slightly in 2013/2014 compared to 2003/2004. In the latter period, cultivated land of 2 hectares or larger was held by 42 percent of farmers. In the case of teff, almost half of all teff land (49 percent) was held by farmers with farms of 2 hectares or larger. This compares to 27 percent of teff farmers that actually have farms that are larger than 2 hectares. On the flip side, 73 percent of the teff farmers (the ones with farms smaller than 2 hectares) therefore cultivate half of the teff land. This ratio changed very little over the decade. The magnitudes of these shares illustrate the small size of the farms in Ethiopia overall but also the relatively equitable distribution of land.

Teff in Ethiopia's Food Economy

This section considers consumption patterns and their changes over time using four rounds of HICES datasets, covering the period from 1996 through

2011. To ensure comparability over time in this analysis, expenditures are deflated using the national Consumption Price Index (CPI) and values are expressed in constant 1996 birr, implying a lowering of nominal prices from later HICES rounds through a division by this CPI. Quantities consumed per capita were calculated as well.[4] The results of this exercise, presented in Table 2.3, illustrate a number of interesting findings. First, the share of nonfood items in the total consumption basket increased significantly over time, especially since 2000. In 2000 the share of nonfood consumption expenditures accounted for 36.4 percent of the total. Over the following decade, this type of expenditure grew rapidly, and its share in total household expenditures surged to 52.8 percent in 2011. Such increases of nonfood expenditures in total consumption aggregates are typical of transforming and improving economies, implying significant improvements in welfare in the country (World Bank 2014; Ethiopia, MoFED 2012). As a consequence of greater income, people's expenditures shift from food to nonfood products.

Second, an important increase of the total quantity of food consumed per capita is seen (at the bottom of Table 2.3). Consumption increased from 229 kilograms per capita per year in 1996 to 353 kilograms, an increase of 54 percent. The quantities of cereals consumed have shown much less growth, especially in the last 10 years. Here, consumption of cereals grew from 132 kilograms per capita in 2000 to 143 kilograms per capita in 2011, an increase of 8 percent. Moreover, expenditures on food have grown in real terms in the last two surveys conducted compared to 2000. Per capita food expenditures in 2011 were 19 percent higher than in 2000.

Third, some important patterns and shifts are noted within the food basket. Overall, the share of cereals in total food expenditures is declining. While the share made up 43.4 percent of expenditures in 2000, it had declined to 35.5 percent 10 years later. Most growth in the noncereal food categories was recorded in the "other food" category that grew from 9.7 percent to 15.4 percent from 2000 to 2011. There is also an increasing importance of animal products over time. Although the share of animal products is still relatively low, it has grown from 9.9 percent of the food basket in 1996 to 12.9 percent in 2010. These patterns are a reflection of Bennett's law that describes a relative decline in starchy staples and an increase in animal proteins with income (Bennett 1941). Ethiopia is generally characterized by a lack of diverse diets (Headey 2014), but over time this seems to be slowly changing.

4 To convert injera to kilograms of teff, it was multiplied by a conversion factor of 0.325.

TABLE 2.3 Food consumption and real per capita expenditures, by category, 1996–2011

	1996		2000		2005		2011	
Food item	**Birr**	**Share (%)**	**Birr**	**Share (%)**	**Birr**	**Share (%)**	**Birr**	**Share (%)**
Real per capita expenditures (birr per capita per year)								
Food								
White teff	16	2.6	18	3.0	17	2.6	18	2.5
Mixed teff	22	3.6	28	4.6	18	2.8	19	2.6
Red teff	31	5.0	32	5.2	22	3.4	19	2.6
Injera	5	0.8	5	0.8	9	1.4	34	4.7
Total teff	73	11.9	82	13.4	67	10.3	90	12.4
Wheat	44	7.2	53	8.7	57	8.8	56	7.7
Barley	28	4.6	23	3.8	41	6.3	18	2.5
Maize	63	10.2	70	11.5	40	6.2	57	7.8
Sorghum	43	7.0	37	6.1	52	8.0	37	5.1
Five major cereals	251	40.8	265	43.4	257	39.7	258	35.5
Other cereals, pulses, and oilseed	87	14.1	89	14.6	85	13.1	121	16.6
Vegetables, fruits, roots, and tubers	100	16.3	132	21.6	96	14.8	143	19.7
Animal products	61	9.9	63	10.3	73	11.3	94	12.9
Other foods	115	18.7	59	9.7	136	21.0	112	15.4
Total food	**615**	**100.0**	**610**	**100.0**	**648**	**100.0**	**727**	**100.0**
Food versus nonfood								
Food	615	51.5	610	63.6	648	54.3	727	47.2
Nonfood	579	48.5	349	36.4	546	45.7	812	52.8
Total	**1,194**	**100.0**	**959**	**100.0**	**1,194**	**100.0**	**1,539**	**100.0**
Food Item	**Kg**	**Share (%)**	**Kg**	**Share (%)**	**Kg**	**Share (%)**	**Kg**	**Share (%)**
Consumption (kilograms per capita per year)								
White teff	5	2.2	6	2.0	7	2.2	8	2.3
Mixed teff	8	3.5	11	3.7	8	2.5	9	2.5
Red teff	11	4.8	13	4.3	10	3.1	10	2.8
Injera	2	0.9	3	1.0	3	0.9	7	2.0
Total teff	25	10.9	31	10.3	27	8.3	29	8.2
Wheat	21	9.2	25	8.3	30	9.3	25	7.1
Barley	14	6.1	10	3.3	24	7.4	10	2.8
Maize	34	14.8	43	14.3	25	7.7	51	14.4
Sorghum	17	7.4	23	7.7	32	9.9	28	7.9
Five major cereals	111	48.5	132	44.0	138	42.6	143	40.5
Other cereals, pulses, and oilseed	30	13.1	28	9.3	27	8.3	29	8.2

	1996		2000		2005		2011	
	Kg	Share (%)	Kg	Share (%)	Kg	Share (%)	Kg	Share (%)
Vegetables, fruits, roots, and tubers	54	23.6	114	38.0	105	32.4	114	32.3
Animal products	15	6.6	14	4.7	17	5.2	17	4.8
Other foods	20	8.7	12	4.0	37	11.4	49	13.9
Total food	**229**	**100.0**	**300**	**100.0**	**324**	**100.0**	**353**	**100.0**

Source: Authors' calculations based on HICES and CSA.
Note: Kg = kilograms.

While still low, there were on average more diverse consumption expenditures in 2011 than 10 years earlier.

Fourth, cereal expenditures make up 35.5 percent of the total consumption basket, but they make up 40.5 percent of the quantity consumed. This indicates that the relative cost of cereals is lower. In contrast, animal products constitute 12.9 percent of expenditures and 4.8 percent of the quantities consumed. These animal products are the most expensive in the consumption basket. On the opposite side of the price spectrum, the category "vegetables, fruits, roots, and tubers" is considered a relatively cheap food category in the consumption basket.

Fifth, the most important crop within the cereal expenditures of the food basket is teff, which accounted for 12.4 percent of food expenditures in 2011. This compares to 7.8 percent for maize, 7.7 percent for wheat, and 5.1 percent for sorghum. Over time some minor shifts within the consumption of cereals are observed. For example, the share of expenditures on sorghum in cereal expenditures was 6.1 percent in 2000 and 8.0 percent in 2005, but it declined to 5.1 percent in 2011. Compared to 2000, the share of maize in cereal expenditures has decreased as well. Sorghum and maize are both characterized by low income elasticities, and it seems that the growing average incomes in Ethiopia might lead consumers to retreat from consuming these crops (Berhane et al. 2012).

Sixth, some important changes are noted within the teff category. While red teff made up 5.0 percent and 5.2 percent of food expenditures in 1996 and 2000 respectively, this share declined to half that level in 2011.[5] Expenditures on red teff in 2011 were only 2.6 percent of all food expenditures. 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

5 Red teff is also referred to as "black teff."

most important change within the teff expenditures is, however, the quick emergence of injera as an important food item in the food basket. It represented 4.7 percent of expenditures in 2011—a significant increase compared to 0.8 percent of total food expenditures in 1996 and 2000. 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 readily part of the consumption basket (Kennedy and Reardon 1994; Dibley, Boughton, and Reardon 1995).[6]

Seventh, total teff consumption over the years has remained at similar levels. It was as high as 31 kilograms per capita in 2000, dropped to 27 kilograms in 2005, and then increased again to 29 kilograms in 2011. Within the teff categories the same trends are seen in teff expenditures. The quantities consumed of white teff and injera are on the rise. On the one hand, white teff consumption increased from 5 kilograms in 1996 to 8 kilograms in 2011, and injera consumption increased in the same period from 2 kilograms to 7 kilograms. On the other hand, red teff consumption (from 13 kilograms in 2000 to 10 kilograms in 2011) and mixed teff consumption (from 11 kilograms in 2000 to 9 kilograms in 2010) decreased over time.

Table 2.4 further illustrates the differences in consumption patterns between rural and urban areas. It shows that the average per capita expenditures are significantly higher in urban areas than in rural areas, and the share of nonfood expenditures is also significantly higher in urban areas (62.3 percent) than in rural areas (48.8 percent). Compared to the rural areas, urban food expenditures are also relatively higher: rural food consumption expenditures are only two-thirds of the urban food expenditures (669 birr versus 1,017 birr respectively). Although the food expenditures are significantly higher in urban areas, the actual quantities consumed are slightly lower (366 kilograms in rural areas versus 319 kilograms in urban areas), likely because of the higher prices paid in urban areas for food but also possibly because of lower calorie requirements in these urban settings (Deaton and Drèze 2009).

Interestingly, there are almost no differences in the share of cereals in the food consumption basket, and the quantities consumed of cereals are also at similar levels. However, consumption of animal products is significantly higher in urban areas. Within the cereal category, though, consumption patterns differ significantly. Rural consumers consume significantly more sorghum (32 kilograms versus 12 kilograms) and maize (58 kilograms versus

6 However, some caution in the interpretation of injera consumption might be required given that rural consumption seems low and that injera can be made from different cereals.

TABLE 2.4 Food consumption and per capita expenditures in 2011, urban versus rural

	Urban		Rural		Total	
Food item	**Birr**	**Share (%)**	**Birr**	**Share (%)**	**Birr**	**Share (%)**
Real per capita expenditures (birr per capita per year)						
Food						
White teff	45	4.4	13	2.0	18	2.5
Mixed teff	60	5.9	11	1.6	19	2.6
Red teff	25	2.5	17	2.6	19	2.6
Injera	93	9.1	23	3.4	34	4.7
Total teff	223	21.9	64	9.5	90	12.4
Wheat	98	9.6	48	7.1	56	7.7
Barley	9	0.8	20	3.0	18	2.5
Maize	24	2.4	63	9.4	57	7.8
Sorghum	16	1.5	41	6.2	37	5.1
Five major cereals	370	36.3	236	35.3	258	35.5
Other cereals, pulses, and oilseeds	176	17.3	109	16.4	121	16.6
Vegetables, fruits, roots, and tubers	191	18.8	133	19.9	143	19.7
Animal products	169	16.6	79	11.8	94	12.9
Other foods	111	10.9	112	16.8	112	15.4
Total food	**1,017**	**100.0**	**669**	**100.0**	**727**	**100.0**
Food versus nonfood						
Food	1017	37.7	669	51.2	727	47.2
Nonfood	1684	62.3	639	48.8	812	52.8
Total	**2,701**	**100.0**	**1,308**	**100.0**	**1,539**	**100.0**
Food Item	**Kg**	**Share (%)**	**Kg**	**Share (%)**	**Kg**	**Share (%)**
Consumption (kilograms per capita per year)						
White teff	19	5.8	6	1.6	8	2.2
Mixed teff	28	8.6	5	1.4	9	2.5
Red teff	13	3.9	9	2.5	10	2.7
Injera	23	7.1	4	1.1	7	2.0
Total teff	81	25.5	24	6.6	34	9.4
Wheat	35	11.1	23	6.3	25	7.0
Barley	4	1.1	11	3.0	10	2.7
Maize	18	5.7	58	15.7	51	14.3
Sorghum	12	3.6	32	8.7	28	7.9
Five major cereals	150	47.0	147	40.3	148	41.3
Other cereals, pulses, and oilseeds	30	9.5	29	7.9	29	8.2

(continued)

TABLE 2.4 Continued

	Urban		Rural		Total	
Food Item	**Kg**	**Share (%)**	**Kg**	**Share (%)**	**Kg**	**Share (%)**
Vegetables, fruits, roots, and tubers	83	26.1	121	33.0	114	32.0
Animal products	21	6.4	17	4.6	17	4.8
Other foods	35	10.9	52	14.2	49	13.7
Total food	**319**	**100.0**	**366**	**100.0**	**358**	**100.0**

Source: Authors' calculations based on HICES and CSA.
Note: Kg = kilograms.

18 kilograms). In contrast, the share of teff in the urban food consumption basket is significantly higher than in rural areas—more than twice as high. Moreover, urban consumers eat 81 kilograms of teff per person per year—more than three times the level in rural areas. Urban teff consumers consume mostly mixed teff (28 kilograms out of 81 kilograms), whereas with rural consumers, it is mostly red teff (9 kilograms out of 24 kilograms). While red teff makes up 11 percent of all teff consumption expenditures in urban settings, this contrasts to 27 percent in rural areas. The share of injera and mixed teff is higher in urban than in rural areas, and urban consumers spent 9.1 percent of all food expenditures in the form of injera.

If teff consumption is disaggregated by region (Table 2.5), distinctive patterns become apparent. As indicated, the highest teff consumption appears in Ethiopia's major cities, with Addis Ababa in the lead (101 kilograms per capita), followed by Harar (40 kilograms) and Dire Dawa (38 kilograms). The country's major production zones also show relatively higher per capita consumption levels, 36 kilograms in Amhara, 35 kilograms in Oromia, and 38 kilograms in Tigray. Consumption levels are relatively low in the southern (a region known for consumption of root crops) and western parts of the country (a region where maize is commonly consumed)—that is, 19 kilograms in SNNP, 17 kilograms in Gambela, and 3 kilograms in Somali. Injera is consumed more in urban areas both in relative and absolute terms. Except for Addis Ababa, the Amhara region is the only region where white teff consumption exceeds 10 kilograms per capita per year.

Quantities consumed were further converted to calories per adult equivalent using the standard conversion rates in vogue in Ethiopia (Table 2.6). A consistent increase in the per capita calorie consumption is seen over the years, reflecting the country's improving food security situation. Average calorie consumption was only 2,200 kcal per day per adult equivalent in 1996, but this measure reached 3,000 kcal in 2011. Cereals are the major contributors

TABLE 2.5 Teff consumption by region in kilograms per capita per year, 2011

	Type of teff				
Region	White	Mixed	Red	Injera	Total
Tigray	8	9	16	5	38
Afar	9	10	1	9	30
Amhara	11	8	10	8	36
Oromia	7	9	13	6	35
Somali	1	0	0	2	3
Benishangul-Gumuz	3	3	12	4	22
Southern Nations, Nationalities, and Peoples' (SNNP) region	6	5	2	6	19
Gambela	3	4	1	9	17
Harari	6	12	7	15	40
Addis Ababa	18	45	9	29	101
Dire Dawa	6	9	4	19	38
Total	**8**	**9**	**10**	**7**	**34**

Source: Authors' calculations based on HICES and CSA.

to total calorie consumption. They contributed 58.7 percent of all the calories in the food basket in 2011. Although their absolute level of consumption has increased over time, their share in total consumption has come down from 62.1 percent in 1996.

The total quantities of teff consumed have remained stable over the years. They were at a level of 402, 354, and 380 kcal per adult equivalent per day in 2000, 2005, and 2011 respectively. However, the share of teff in total calorie consumption has gone down. It contributed almost 15 percent of all calories in 1996, but that share declined to 12.7 percent in 2011. While the share of mixed teff and red teff are decreasing in total expenditures compared to white teff and injera, the former products still contribute significantly to calorie consumption, mostly because of their lower prices. Mixed teff and red teff contributed 3.7 percent and 3.9 percent respectively of calorie consumption in 2011.

By comparing expenditures on food with consumption of calories, prices per calorie can be calculated. Table 2.7 shows that the price per calorie differs significantly between food groups. When the prices for 2011 are considered, prices of cereals are significantly lower than those of any other category. These other crops are therefore usually called "high-value" crops. Animal products

TABLE 2.6 Daily calorie consumption per adult equivalent, 1996–2011

	1996		2000		2005		2011	
Food item	Kcal	Share (%)	Kcal	Share (%)	Kcal	Share (%)	Kcal	Share (%)
White teff	66	3.0	73	2.7	84	2.9	97	3.2
Mixed teff	96	4.3	136	5.0	104	3.7	110	3.7
Red teff	141	6.4	163	6.0	129	4.5	116	3.9
Injera	22	1.0	30	1.1	38	1.3	57	1.9
Total teff	325	14.7	402	14.7	354	12.4	380	12.7
Wheat	260	11.8	316	11.6	364	12.8	304	10.1
Barley	129	5.8	85	3.1	219	7.7	121	4.0
Maize	440	19.9	555	20.3	330	11.6	605	20.2
Sorghum	217	9.8	289	10.6	363	12.7	353	11.8
Five major cereals	1,371	62.1	1,647	60.4	1,630	57.2	1,763	58.7
Other cereals, pulses, and oilseeds	369	16.7	351	12.9	339	11.9	424	14.1
Vegetables, fruits, roots, and tubers	199	9.0	536	19.6	466	16.4	549	18.3
Animal products	109	4.9	94	3.4	127	4.5	75	2.5
Other foods	159	7.2	101	3.7	287	10.1	189	6.3
Total food	**2,207**	**100.0**	**2,728**	**100.0**	**2,849**	**100.0**	**3,001**	**100.0**

Source: Authors' calculations based on HICES and CSA.

carry the highest price for calories, with a calorie price that is eight times as high as the average price paid for cereals. The price for other foods is also significantly higher than the average. Within the cereal category the lowest calorie prices are found for maize and sorghum. These prices are half the level that consumers pay per calorie for teff products. The prices for wheat and barley fall in between maize or sorghum and teff.

Notably, the shift that is seen over time in food preferences shows a 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 between 2000 and 2011. This is mostly driven by a shift to more expensive commodities. For example, Table 2.7 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 gone up, but especially so for the period between 2005 and 2011. Similar trends are seen within the teff category. Cheapest calories are obtained from red and mixed teff, while the highest prices are obtained for

TABLE 2.7 Real price per kcal paid, 1996–2011

Food item	1996	2000	2005	2011
White teff	0.66	0.68	0.55	0.51
Mixed teff	0.63	0.56	0.47	0.47
Red teff	0.60	0.54	0.47	0.45
Injera	0.62	0.46	0.65	1.63
Total teff	0.62	0.56	0.52	0.65
Wheat	0.46	0.46	0.43	0.50
Barley	0.59	0.74	0.51	0.41
Maize	0.39	0.35	0.33	0.26
Sorghum	0.54	0.35	0.39	0.29
Five major cereals	0.50	0.44	0.43	0.40
Other cereals, pulses, and oilseeds	0.65	0.69	0.69	0.78
Vegetables, fruits, roots, and tubers	1.38	0.67	0.56	0.71
Animal products	1.53	1.84	1.57	3.43
Other foods	1.98	1.60	1.30	1.62
Total food	**0.76**	**0.61**	**0.62**	**0.66**

Source: Authors' calculations based on HICES and CSA.

white teff and injera. As with cereals in general, however, there is a shift away from the cheap to the more expensive calories available within teff products.

Income and Its Link with Food and Teff Consumption

Significant research has been conducted in agricultural economics to understand the link between income and food consumption patterns. The parameters resulting from such research are important as they allow for economic modeling to assess impacts on consumption of food policy changes, as well as projecting food requirements in the future, given reasonable assumptions on income growth. There have been significant methodological advances. 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 is widely used to estimate parameters as part of complete food demand systems (Deaton and

Muellbauer 1980). Researchers have also tried to improve their understanding of transforming food systems in economic development and associates with changes in consumption (for example, 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 increase. Comparing the differences in consumption patterns of richer and poorer households is often indicative of how transformation of food systems will shape food economies in a particular country.

In an effort to understand these patterns in Ethiopia, all households in the HICES survey of 2011 were ranked by wealth quintile, from the poorest quintile 1 to the richest quintile 5. The shares of different consumption categories were then calculated. As expected (for example, Subramanian and Deaton 1996; Bouis 1994; Bouis and Haddad 1992; Pingali 2007), strong differences in the composition of consumption baskets are seen over poverty quintiles. While food expenditures make up 54.3 percent of total consumption expenditures for the poorest quintile, this declines to 38.0 percent for the richest one. The five major cereals make up 37.7 percent of the poorest quintile, and this surprisingly only declines minimally for the richest quintile to 32.2 percent (Table 2.8). 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. The food budget for animal foods for the richest households comprises 20.4 percent, yet this is only 7.9 percent for the poorest ones. As for cereals, the higher consumption of animal products is especially noted for the richest quintiles 4 and 5 (see also Tafere and Worku Hassen 2012).

The share of cereals in total food consumption is relatively stable over poverty quintiles, but there are large differences within this category by poverty quintile. Maize and sorghum are the two cereals that are typically consumed more by the poor than by the rich; 13.5 percent of all food expenditures of the poor goes toward maize. This compares to 2.5 percent for the rich. These numbers are 7.4 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 relatively little variation in wheat, based on the poverty level; however, it is consumed slightly more by the rich.

Teff consumption also shows a distinctive pattern by poverty level. It increases consistently over poverty quintiles, and teff only makes up 6.9 percent of the food expenditures of the poorest quintile. By contrast, teff

TABLE 2.8 Share of expenditures by poverty quintile, 2011

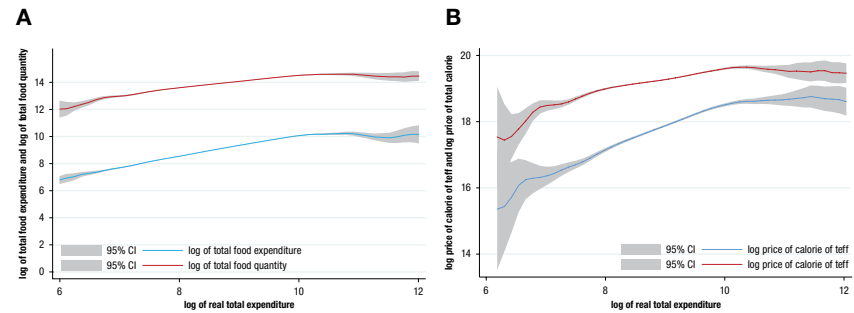
Food item	(Poorest) Q1	Q2	Q3	Q4	(Richest) Q5	Total
White teff	1.1	1.6	2.2	2.7	4.1	2.5
Mixed teff	1.3	1.9	2.5	3.0	3.6	2.6
Red teff	2.0	2.5	3.2	3.0	1.9	2.6
Injera	2.6	2.6	3.0	4.3	9.1	4.7
Total teff	6.9	8.6	10.8	13.0	18.8	12.4
Wheat	6.6	7.0	8.0	8.4	7.9	7.7
Barley	3.2	3.3	2.9	2.3	1.3	2.5
Maize	13.5	11.1	9.4	6.3	2.5	7.8
Sorghum	7.4	6.8	6.5	4.9	1.8	5.1
Five major cereals	37.7	36.8	37.6	35.0	32.2	35.5
Other cereals, pulses, and oilseeds	15.7	17.2	17.2	17.3	15.5	16.6
Vegetables, fruits, roots, and tubers	22.9	21.4	18.9	19.4	17.4	19.7
Animal products	7.9	9.0	10.0	13.2	20.4	12.9
Other foods	15.8	15.6	16.3	15.2	14.5	15.4
Total food	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**
Food versus nonfood						
Food	54.3	53.8	51.8	48.0	38.0	47.2
Nonfood	45.7	46.2	48.2	52.0	62.0	52.8
Total	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**

Source: Authors' calculations based on HICES and CSA.

comprises 18.8 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 further distinctive patterns. Red teff makes up 28 percent of the teff expenditures for the poorest households (quintile 1), but this decreases to 10 percent for the richest ones. Expenditures on injera drop from 48 percent for the richest quintile to 38 percent for the poorest one, likely driven by the significantly higher prices per kilogram or per calorie for injera as seen in Table 2.6.

Figure 2.5 shows to what extent total food consumption and total food expenditures vary by income. This figure illustrates an upward trend in both lines, indicating that the richer consumers become, the more they spend on food and the more food they consume. It also shows that the gradient of the expenditures is steeper than that of the quantity consumed, indicating a shift from lower-priced food to higher-priced food on becoming richer. Figure 2.5B

FIGURE 2.5 Food consumption and spending on food and price per calorie by income level, 2011



Source: Authors' calculations based on HICES and CSA.
Note: CI = confidence interval.

further shows the extent to which prices paid per calorie increase by income level. This trend exists for the food consumption basket overall as well as for teff in particular.

In a more complete quantitative approach, Tafere, Taffesse, and Tamru (2010) use an AIDS model to estimate income elasticities from the HICES data of 2004/2005. As predicted from the previous tables, animal products have the highest income elasticity of all the food product categories considered (Table 2.9). A doubling of income leads to a 172 percent increase in animal expenditures in urban areas and a 198 percent increase in rural areas. Animal products are therefore an economically superior product (for example, Berhane et al. 2012; Delgado et al. 1999; Delgado 2003). Teff also shows high income elasticities (1.2 in rural and 1.1 in urban areas), indicating that a doubling of income increases expenditures by 120 percent and 110 percent respectively. Other cereals show much lower elasticities. Sorghum even has a negative income elasticity in urban areas, indicating that it is an economically inferior commodity in this urban environment. When households become richer, the consumption of such goods is reduced. The importance of sorghum as a food is therefore likely to reduce, and the importance of teff is likely to increase with the rise in income over time, as Ethiopia becomes wealthier and more urbanized.

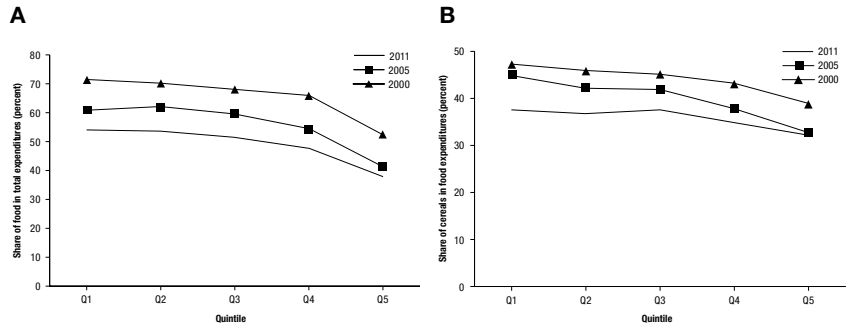
To further explore patterns of consistency between quintiles and changes in consumption behavior patterns, Figure 2.6A illustrates how the share of food in the total consumption basket has evolved over time by quintile. The figure illustrates that the reduction in the food share has been consistent over quintiles. Although food expenditures made up 71 percent of total

TABLE 2.9 Own price and income elasticity of demand for selected food items, 2004/2005

	Urban		Rural	
Food item	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 other root crops	–0.99	1.22	–1.01	1.18
Other foods	–0.92	0.66	–0.92	0.92

Source: Tafere, Taffesse, and Tamru 2010.

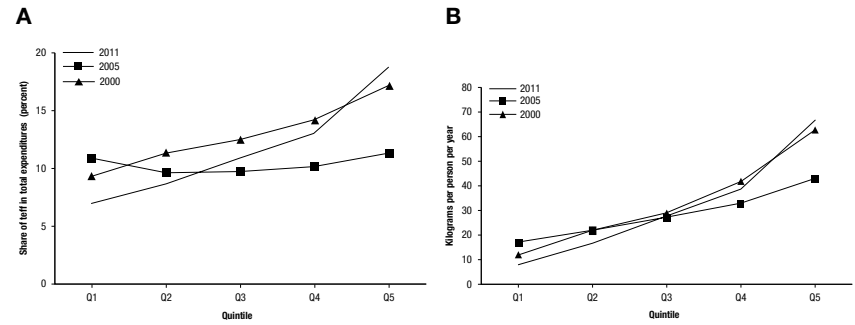
FIGURE 2.6 Share of food in total consumption expenditures and share of cereals in food expenditures, 2000–2011, by quintile



Source: Authors' calculations based on HICES and CSA.

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 2.6B 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 it declined to 38 percent in 2011. Again, there has been a consistent decrease of the share of cereals for all quintiles in the consumption basket, even though the average quantities consumed increased over time. Overall, these findings seemingly indicate that the growth in Ethiopia from 2000 to 2011 has been equitable and has benefited the majority of the population (World Bank 2014).

FIGURE 2.7 Share of teff in food expenditures and teff consumption per person per year, 2000–2011, by quintile



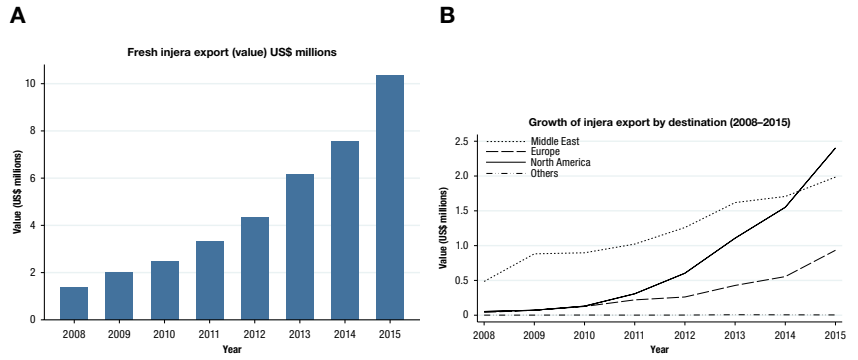
Source: Authors' calculations based on HICES and CSA.

Finally, when the share of teff in food expenditures in particular is investigated (Figure 2.7A), and when trends between 2000 and 2011 are compared, the poorest quintiles are seen to have reduced their consumption of teff while the richest quintiles display higher levels of consumption, if measured in shares of their food expenditures. Similar trends show up when quantities of teff consumed per capita are examined (Figure 2.7B).

Exports

Global interest in teff from Ethiopia is increasing. This is seemingly driven by two factors. First, teff is gluten-free and is therefore suitable to prepare food products for people who suffer from celiac disease (see Chapter 15). It is also rich in amino acids, and it has even been dubbed by some as the new superfood (Secorun 2016). The rapid international growth of the quinoa market—a gluten-free cereal mostly produced in Peru and Bolivia—has stimulated the Ethiopian government to revise its export ban of teff and open teff export markets to the increasing global demand. However, as the government is conscious of local price increases by opening these export markets, it has currently only allowed a limited number of commercial farmers to start producing teff to fulfill this export demand. Second, exports of injera are rapidly increasing. Figure 2.8 shows how the value of injera exports from Ethiopia has evolved over time. Official exports of injera in 2015 were valued at about US$10 million. While the Middle East was the traditional region to which injera was exported, North America received the largest share of injera exports in 2015. Injera exports to Europe are also on the rise. It seems that these

FIGURE 2.8 Injera exports from Ethiopia, by value, 2008–2015



Source: Authors' calculations based on data from the Ministry of Trade.

exports are especially driven by demand from immigrant Ethiopians in these areas who remain attached to the culinary culture of their homeland.

The rapid take-off of injera exports is seemingly linked with the increased number of direct flights from Addis Ababa to a number of international destinations. As injera is highly perishable, short travel times are required, which makes air travel the only option for international trade. As Ethiopian Airlines has been rapidly expanding its international flight destinations, injera exports have followed along the lines of these destinations. For example, in 2012/2013 Ethiopian Airlines served 76 international destinations, rising from 54 destinations five years earlier—an increase of 41 percent. Moreover, Ethiopian Airlines doubled the frequency of their flights to these destinations.

Conclusion

The analysis in this chapter illustrates the importance of teff in Ethiopia's agricultural and food economy. On the production side it is estimated that teff is Ethiopia's most important single crop, making up 22 percent of its cultivated area during the most important meher season. Teff is grown by 6.6 million farmers. The production value of the crop was estimated in 2013/2014 to be as high as US$2.5 billion. Moreover, it is shown that teff is the most important cash crop in the country. The value of income generated for farmers from teff is estimated to be more important than that from coffee, the most important export product of Ethiopia. The value of the commercial surplus of teff is as high as the commercial surplus of all the other cereals in the country combined. Since 2003, further significant increases have occurred in the

production of teff, driven by area expansion as well as yield improvements. However, teff yields are still significantly lower than yields of other cereals.

This chapter has reviewed important transformations that characterize Ethiopia's agricultural and food economy. Average quantities and calorie consumption per capita have consistently and significantly improved over the past 15 years. The past decade has seen a shift from the least preferred yet lower cost foods to more costly and more preferred food options. The consumption of high-value foods is therefore on the rise. While the quantities of cereals slightly increased over the past decade, the share of the lower-priced cereals in the total food consumption basket has declined, from 43 percent of the average consumer in 2000 to 35 percent in 2011. Important changes are seen within the cereal sector, with the shares of maize and sorghum relatively declining in importance, while the share of teff remains stable. Within the teff sector, 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.

Teff is consumed more by urban households than by rural households. Urban consumption per capita is as high as 81 kilograms per year based on national household consumption data. In comparison, this figure is only 24 kilograms per capita per year for rural areas. Teff is further characterized by high income elasticities, evaluated at 1.10 in urban areas and 1.20 in rural areas. These figures demonstrate that teff is an economically superior commodity, implying that an increase in income leads to a disproportional increase in teff consumption. Teff will continue to be a product that is consumed in greater quantities by the rich, in mostly urban areas, than by the poor. The lower consumption by the poor is partly explained by the high prices of teff, which are typically twice as high as the cheapest cereal—that is, maize.

Finally, we note an increasing interest for teff exports. While teff exports were banned in the past because of fears of price rises, this policy has recently been changed, with a number of commercial farmers being identified and permitted to export from Ethiopia. The increasing demand for teff globally is driven by its gluten-free characteristic, which makes it a suitable product for the increasing health-conscious consumers in Western countries. Exports of prepared injera is also on the rise, with large demands from Ethiopian diaspora living abroad. The rapid expansion of flight routes by Ethiopian Airlines, adding to the already good connections of Ethiopia with a number of these countries in which these diasporas reside, has facilitated the market. Given the fast economic growth that Ethiopia is experiencing and the rapid increase in urbanization, as well as export demand, the importance of teff in food systems

is expected to increase in the near future. Therefore, ensuring appropriate investments to deal with the increasing demand of teff products is a priority for agricultural and food policy in Ethiopia.

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