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The rising costs of animal-source foods in Ethiopia: Evidence and implications

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ABSTRACT

In many developing countries in which staple foods dominate the composition of diets, higher consumption of animal-source foods (ASF) is associated with significant nutritional benefits. Given the importance of prices for consumption decisions in these settings, we analyze ASF price patterns in the last decade (2007-2016), relying on a large-scale price dataset collected in 116 urban retail markets in Ethiopia. We document important seasonal and spatial patterns and we find, worryingly, that real prices of ASF have been increasing in the last decade by between 32 to 36 percent for three major ASF – milk, eggs, and meat. Similar price increases are noted in rural and urban areas and for tradable and non-tradable ASFs. This price trend is in contrast with staple cereals for which real prices stayed at similar levels over the last decade. As we estimate that a price increase of this magnitude would reduce consumption of ASF by approximately 25 percent, holding other things constant, it seems that more investments and attention to the production of ASF and the livestock sector are needed to reduce ASF prices and increase their consumption in Ethiopia.

1. INTRODUCTION

There is a strong desire to improve nutritional outcomes in developing countries, given the often-high levels of undernutrition, consequent high prevalence of stunted children, and the resultant high human and economic costs (Hoddinott et al. 2013). To address this problem, a strong emphasis is generally put on increasing diet diversity, on top of other interventions, given the well-established link between, for example, improved dietary quality and reduced stunting rates (Arimond and Ruel 2004). Recent research shows that animal-source foods (ASF) play an important part in the beneficial impact of higher dietary diversity, as a direct link has been shown worldwide between higher consumption levels of ASF and improved nutritional outcomes (Randolph et al. 2007; Leroy and Frongillo 2007; Weaver 2014; Black et al. 2008; Jin and Iannotti 2014; Iannotti et al. 2014; Givens et al. 2014). As ASF have more accessible crucial vitamins and minerals relative to plant-based foods and contain bio-active factors, they have been shown to be beneficial for physical growth and for brain development of children (Dror and Allen 2011; 2014). There also is increasing evidence that bone development is strongly associated with increased ASF consumption (Givens 2010).

In Ethiopia, there is strong suggestive evidence on the link between the consumption of ASF – especially milk – and improved nutritional outcomes among children (Hoddinott et al. 2015; Sadler and Catley 2009). However, ASF consumption in Ethiopia is low (Tafere and Worku 2012). Increasing consumption levels of these products is therefore desirable to improve nutritional indicators for the country's population. Previous research has shown that factors associated with low ASF consumption levels in Ethiopia are high prices (e.g., Gordon et al. 2007; Tefera et al. 2010; Iannotti et al. 2012), shortage of ASF, particularly milk in urban areas (e.g., Gordon et al. 2007; Tegene et al. 2013), fasting habits (FVI-Idele 2016), and lack of awareness regarding dietary diversity or the nutritional benefits of ASF (e.g., Gordon et al. 2007; Tefera et al. 2010; Warren and Frongillo 2017). This work investigates the first issue in particular, examining price formation of ASF and livestock in Ethiopia.

Price formation of ASF is not well researched and, therefore, not well understood in Ethiopia. This is an important knowledge gap because the diversity and quantity of food consumed, and, thereby, the resultant nutritional outcomes, are strongly impacted by food and agricultural prices (e.g., Brinkman et al. 2010). This is specifically so for ASF, which are often prohibitively priced for poor and vulnerable households to afford (e.g., Iannotti et al. 2012). While we are not aware of recent studies of ASF pricing in Ethiopia, a number of

researchers have looked at the associated livestock markets in Ethiopia.[1] Livestock prices are linked to many factors, including the type of livestock (Ayele et al. 2006; Teklewold et al. 2009), market institutions and transaction costs (Jabbar et al. 2008; Bellemare and Barrett 2006), weather and rainfall patterns (de Waal 1988), the need for food purchase and cash (Little et al. 2014), rising feed costs that are linked with increasing land scarcity (Mekash et al. 2014; Negassa et al. 2012), and international trade (Tadesse et al. 2014).

This paper is aimed at filling this knowledge gap with respect to ASF prices, while also adding to existing knowledge on livestock price formation. Relying on a large-scale nationally representative price dataset that has been consistently collected in 116 urban retail markets in the country (CSA 2017b), we study patterns of ASF prices in Ethiopia over the last decade. We find that ASF products are expensive compared to basic staples. Costs of ASF per calorie and per kg are on average almost ten times higher than those of cereals. This is important given high poverty levels and the relatively high share of food expenditures in the overall budget of an average Ethiopian (Worku et al. 2016). For example, Warren and Frongillo (2017) show that households do not consume ASF – even when they are aware of their nutritional benefits – because of high prices. As seen in other developing countries, this seemingly explains why only the relatively richer part of the population regularly consumes ASF. We also see significant seasonality in both prices and consumption of ASF. This is associated with large swings in demand, due to the timing of religious celebrations and the fasting periods that precede these religious events. We further find that there are significant spatial variations in ASF prices, with relatively higher prices in cities and in more commercially-oriented livestock areas.

Most worryingly, we find that there have been significant increases in real prices of ASF in the last decade, on the order of 33, 36, and 32 percent increases for beef, milk, and eggs respectively. Similar price increases are noted in rural and urban areas and for internationally traded (meat) and non-traded (milk and eggs) ASF. This is in contrast with cereal prices that did not show such increases. While increases in ASF prices are good news for livestock producers, as their terms of trade improved, such price increases hamper the affordability of ASF, especially so for the poorer and more vulnerable populations in the country. As price elasticities are high for ASF products – Tafere and Worku (2012) estimate an elasticity of -0.73 and -0.67 for beef and dairy products, respectively – this implies that such price increases will have resulted in decreases in per capita consumption of beef and dairy products by almost 25 percent, holding other things constant, when we compare the end to the beginning of the decade.[2]

The results of these findings have important implications for agriculture and nutrition policy in Ethiopia. The Ethiopian government has a good track record with respect to improvement of cereal production in the country in the last decade. This improvement has been driven by a focus on a modernization of the cereal sector and on the increased adoption of modern technologies (Bachewe et al. 2015). It has been shown that changes in the cereal sector have brought about considerable improvements in poverty alleviation and calorie intake (World Bank 2014). However, in the further transformation process, ASF and 'high-value' crops will have a more important role to play, given food preferences of consumers, but also because of

[1] Several researchers have looked at price formation in food and agricultural markets in Ethiopia. Strong seasonality and spatial patterns have been shown to exist in these markets (Minten et al. 2014). While a number of factors that constrain the well-functioning of the markets persisted in the past (Rashid and Minot 2010; Rashid and Negassa 2011), these markets are growing and their efficiency is improving over time, seemingly driven by improved road and communication infrastructure, rapid urbanization, and the increasing demands from urban residents, based on their income growth and consequently increases in their willingness-to-pay for food (e.g., Minten et al. 2014).

[2] The increasing incomes in the country, however, might have compensated for these increases in prices, since these products also have high income elasticities (Tafere and Worku 2012).

their nutritional benefits.[3] To increase diet diversity and improve nutritional outcomes in the country, ASF and 'high-value' crops need to be made available at more affordable prices. This, in turn, points to the needs for more investments to increase livestock, ASF, and high-value crop production as well as to achieve a livestock production system that can accommodate the growing demand in ASF. This is important since most recent efforts to achieve nutritional improvements in Ethiopia have focused on behavioral change communication (BCC) and improvements in other sectors, such as health, water and sanitation. While important and successful (e.g., Kim et al. 2016), improving access to and achieving low prices for these nutritious ASFs also have an important role to play in multidimensional efforts to improve nutritional outcomes.

The paper is organized as follows. Section 2 gives background information on livestock and ASF consumption in Ethiopia. In section 3, we discuss data and descriptive statistics. We present findings on seasonal and spatial patterns in ASF and livestock prices in section 4. In section 5, we look at changes over time in real prices and in terms of trade. We finish with the conclusions and implications of the findings in section 6.

2. BACKGROUND ON LIVESTOCK AND ANIMAL SOURCE FOODS IN ETHIOPIA

2.1. Production and consumption

While numbers on livestock and livestock holdings in Ethiopia are uncertain and subject to debate, it is generally acknowledged that Ethiopia has the largest livestock population in Africa (Negassa et al. 2017). The Ethiopian Central Statistical Agency (CSA) estimated that in 2014/15 there were 56 million cattle, 29 million sheep, 29 million goats, and 57 million poultry (CSA 2015a).[4] Figure 2.1 illustrates the spatial distribution of the cattle population and the goats and sheep population in the country based on CSA livestock population data. These livestock species are shown to be densely concentrated in the central highlands of Ethiopia. However, the reported estimates do not account for the significant number of pastoralists – mostly in the eastern parts of the country – as CSA's regular data collection operations only cover sedentary parts of the country.[5] Negassa et al. (2012) estimated that 20 percent of the cattle population and 40 percent of sheep and goats are held in these pastoralist areas.

On the consumption side, based on the nationally representative Household Consumption Expenditures Survey (HCES) conducted by CSA, it was estimated in 2011 that 13.4 percent of consumption expenditures of an average Ethiopian consumer was devoted to ASF. Out of this expenditure, 42 percent was used for dairy products, 40 percent for beef, and 12 percent for sheep and goat meat. Expenditures on other ASF products (including poultry) are relatively minor.[6] As seen in several other countries, ASF are shown to be economically superior products that are mostly consumed by relatively better-off households (Tafere and Worku 2012). Worku et al. (2016) estimate that consumers in the richest quintile used 17.6 percent of their food budget for ASF. This compares to only 6.6 percent by the poorest quintile, about one-third the budget share level of the rich. Moreover, expenditure shares of ASF are significantly higher in urban areas (14.3 percent) relative to rural areas (9.8 percent). Within urban areas, differences are further noted with higher

[3] As has been noted in other growing economies, the relative importance of cereals in total food expenditures is decreasing in Ethiopia. We are beginning to see a shift toward more preferred, but also more expensive foods, including animal-source foods (Worku et al. 2016).

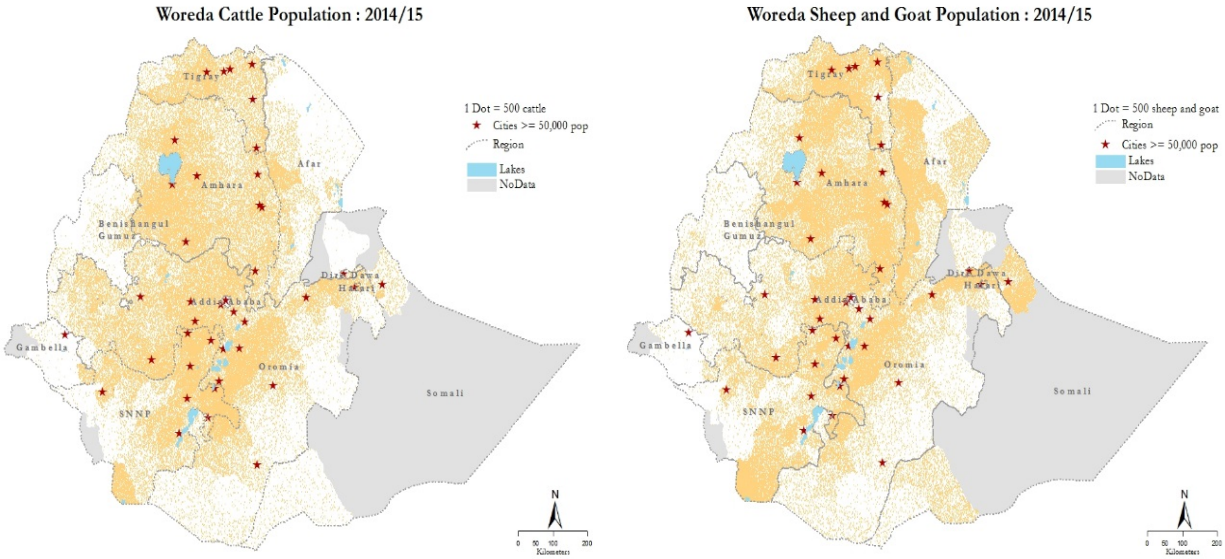
[4] It is to be noted that the Ethiopian Orthodox Christian Church and Islam – the two dominant religions in the country – do not permit pork consumption. Pig production, therefore, is rare in Ethiopia.

[5] Livestock ownership per household in the Somali region is considerably higher and that in Afar is somewhat higher relative to average ownership in the central highlands. However, the map would likely still show a dense livestock population in the central highlands even if data were available for the eastern parts, because the central highlands are significantly more densely populated.

[6] Average consumption levels of meat were around 5 kg per year per adult equivalent, based on these HCES data from 2011. This is relatively low, but not out of line for a country with GDP levels of Ethiopia (Msangi 2016).

consumption in bigger cities (16.2 and 16.1 percent in Addis Ababa and secondary towns, respectively) compared to smaller ones (13.2 percent).

Figure 2.1: Estimated cattle and sheep and goat population per woreda



Source: Authors' calculations based on CSA data, following the method of Tilahun and Schmidt (2012) [7]

The high consumption of ASF in cities as well as rapid urbanization in Ethiopia is leading to rapid increases in the size of rural-urban livestock and ASF value chains. This is illustrated by the rapid increase in the number of animals slaughtered in Addis Ababa, where an estimated one-quarter of the meat consumption in the country occurs (FVI-Idele 2016).[8] The number of sheep and goats and number of cattle slaughtered in Addis Ababa, respectively, increased from 75,015 and 151,977 head in 2007 to 175,818 and 232,822 head in 2015, or an annual increase of 12.9 percent and 6.3 percent, respectively (based on data reported by FVI-Idele 2016).

2.2. International trade

Ethiopia has increasingly become more integrated to international trading systems.[9] This trend is also seen in the livestock sector, as can be observed in increases in formal exports of livestock as well as in imports of ASF. On the import side, Ethiopia is increasingly importing dairy products, most importantly milk powder. The value of dairy products Ethiopia imported tripled from 6 million USD in 2005 to 18 million USD in 2015 (Figure 2.2). Meat imports are also growing but are much lower in value (1.5 million USD in 2015). On the other hand, exports from the livestock sector are relatively much more important and have grown impressively over the last decade. The value of exports of live animals increased more than ten-fold from 24 million USD in 2005 to 332 million USD in 2015; those of meat products increased from 18 million USD in 2005 to 107 million USD in 2015; and raw hides and skins increased by just below 50 percent, from 67 to 98 million USD over the same period. Part of the increases in exports has been achieved through closer

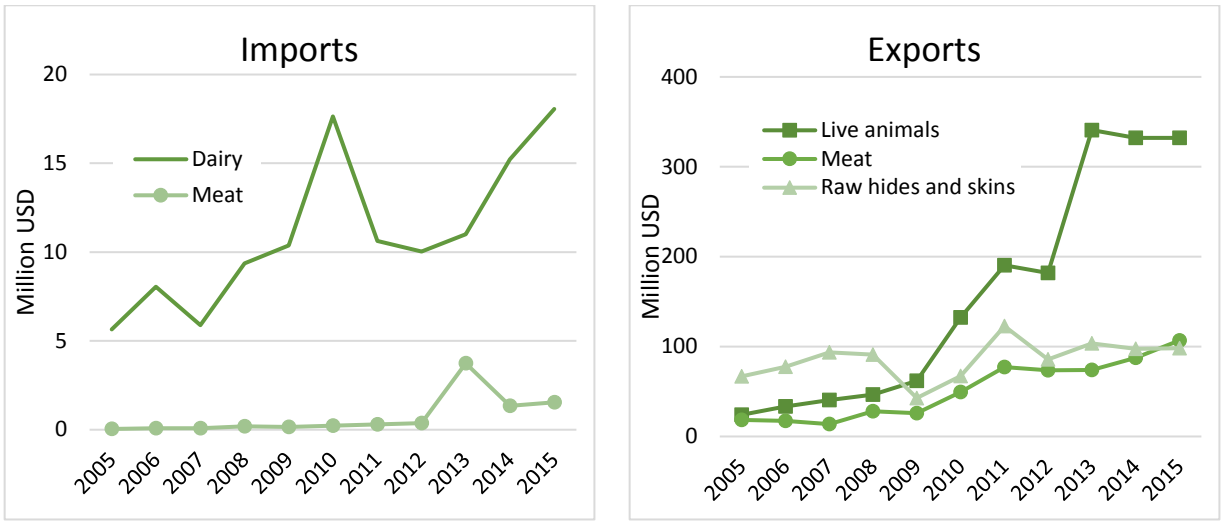
[7] The authors thank Helina Tilahun for this analysis.

[8] While slaughtering of sheep and goats is mostly done informally, this is not the case with cattle since beef is mostly sold through butcheries, which are required by law to buy from certified slaughterhouses. Sheep and goat meat is most often directly bought by consumers, so the animals are slaughtered informally in backyard settings. It is estimated that one-third of cattle slaughtering is informal or illegal in Addis Ababa (FVI-Idele 2016). Data on the number of cattle slaughtered in slaughterhouses (formal slaughter) might therefore provide a good indication of underlying trends in urban consumption.

[9] The National Bank of Ethiopia reports that, measured as a share of GDP, real value of both exports and imports on average declined during 2004/05-2014/15. However, in absolute terms, exports and imports were 70 and 134 percent higher in 2014/15 than in 2004/05, growing at average annual rates of about 7 percent and 9 percent, respectively.

oversight by the government, leading to a shift from informal to formal markets (Farmer 2010). However, there are still significant informal exports of live animals (Negassa et al. 2012). Farmer (2010) estimated informal exports to be seven times the volume of formal exports in 2005/06 (Farmer 2010), while USAID (2013) estimated more recently that informal exports made up 80 percent of total exports.

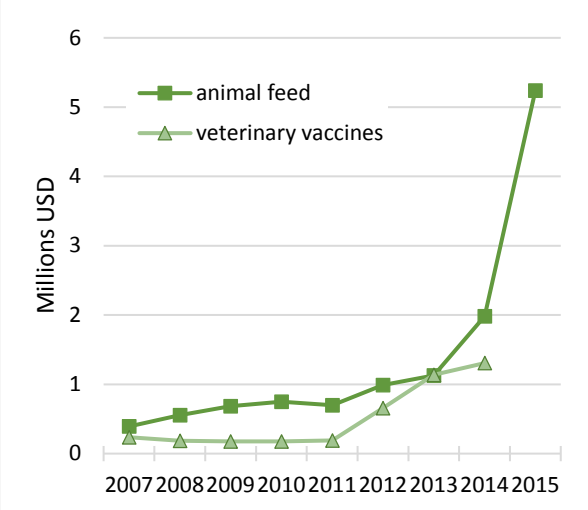
Figure 2.2: Ethiopia's import and export of livestock and animal-source foods, 2005 to 2105



Source: Authors' calculations based on Comtrade data (UN Comtrade 2017)

We also document to what extent the livestock sector is relying on international trade to obtain some of its modern inputs. The evolution of imports of feed and vaccines is illustrated in Figure 2.3. There have been significant increases, possibly showing important recent transformation and the increasing commercial orientation for some parts of the livestock sub-sector. For example, inputs of pre-mixed feeds have increased ten-fold over the last ten years, with their value standing at more than 5 million USD in 2015. The value of veterinary inputs also increased five-fold over the period considered. However, while increasing rapidly, the levels are still low. To put these imports in perspective, imports of chemical fertilizer used for crop agriculture amounted to more than 500 million USD in 2016 (UN Comtrade 2017).

Figure 2.3: Imports of inputs used in livestock production in Ethiopia, 2007 to 2015



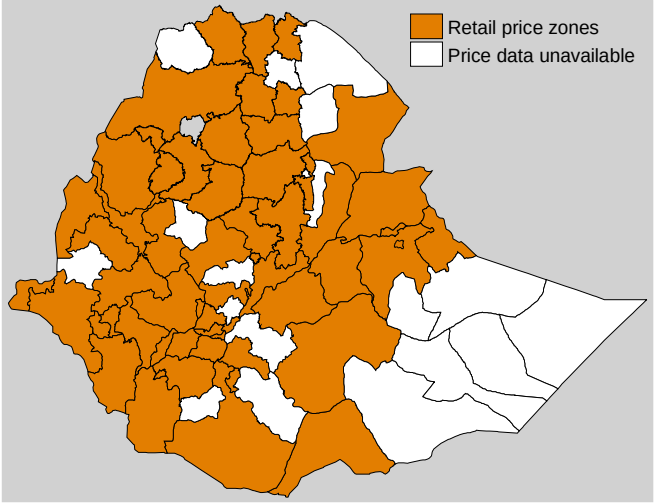
Source: Authors' calculations based on Comtrade data (UN Comtrade 2017)

3. DATA AND DESCRIPTIVE STATISTICS

3.1. Data

The price data used in this study are collected as part of the CSA's Consumer Price Survey (CSA 2017b). These data were collected in 116 urban retail markets in all regions of Ethiopia between January 2007 and December 2016. The number of markets in each region is approximately proportional to the region's share of the total urban population to ensure a sufficient degree of national representativeness (Figure 3.1). Thirty-two markets are surveyed in Southern Nations, Nationalities, and Peoples (SNNP) region, 24 in Oromia, and 20 in Amhara (the three biggest regions), while 12 markets are surveyed in Addis Ababa (by far the largest urban center with officially more than 3 million residents). The smaller regions include only a handful of markets.

Figure 3.1: Administrative zones covered by Central Statistical Agency retail price data



Source: Authors' mapping using CSA retail price data (CSA 2017b)

CSA enumerators, who reside permanently in these markets, collect price and weight/volume data from traders, retailers, and consumers. For each item, a maximum of three price quotations are collected from three different retailers in the first 15 days of each month in the European Calendar, though enumerators are encouraged to survey the same retailers across months if possible. In the case of livestock, prices are collected on cattle (heifer, cow, bull, and oxen), small ruminants (goats, sheep), and poultry (hen, cock). Prices of 11 types of ASF are collected: beef, camel meat, milk (processed and unprocessed cow milk, goat milk, camel milk, and milk powder), eggs, and processed dairy products (yoghurt, cheese, and butter). Most of our descriptive analyses rely on price data of eight of the 11 ASF items since data on camel meat, camel milk, and goat milk is unavailable in most months for most markets. We also study trends in real prices of cattle and ASF using CSA's Producer Survey Data (CSA 2017c). The producer price surveys are also conducted monthly and mostly in the same manner as the retail price surveys, but they differ in that they include only primary crop and livestock outputs.[10]

We deflate prices using the regional general consumer price Index (CPI) calculated by CSA. This is done to express all prices in December 2011 Birr (CSA 2017a). As the weight of individual products in the Consumer

[10] As a result, four of the eight ASF items are excluded from the dataset: beef, pasteurized cow milk, powdered milk, and yoghurt. Although the producer price data leaves out one-quarter of the items considered in this study, its use, albeit briefly, is justified as most rural residents purchase ASF and livestock, particularly oxen for use in crop production, from these markets. For instance, the HCES (2011) data indicates that 78 percent of the dairy consumed in rural areas in 2010/11 was own-produced while 20.3 percent was purchased. Similarly, 35 percent of the eggs and about 77 percent of the meat consumed was purchased.

Price Index (CPI) is relatively low and given the lack of any reasonable alternative, we rely on the regional CPI to deflate the retail prices. We use a de-seasonalized index, since one of our interests is studying seasonal patterns of prices that typically characterize the agricultural and food sectors.[11]

3.2. Descriptive statistics

Table 3.1 provides summary statistics of the real prices of livestock and ASF over the period 2007 to 2016. The dataset used in our analyses comprises a large number of observations for livestock, ranging from 10,898 observations for cows and 11,479 for oxen to 12,260 for sheep and 12,676 for cocks. The high number of observations indicate the wide presence of this type of livestock in these retail markets. In the case of ASF, we see wide availability of prices for beef, unpasteurized milk, butter, and eggs. Yoghurt, cheese, powdered milk, and pasteurized milk are less available. The price data least available are for goat milk, camel milk, and camel meat, which are mostly consumed in pastoralist areas (Afar and Somali regions) and in Dire Dawa, Harari, and parts of Oromia regions.

As might be expected, we see large price differences across livestock categories. Poultry are the cheapest livestock category with median prices for a hen of about 43 Birr (2.5 USD). Prices for a hen are about 10 percent the price of a sheep, which had a median price of 438 Birr (25 USD). The price of a bull is more than five times the price of a sheep. While there are obvious differences in the quantity of meat that can be obtained from different livestock categories, the price of beef is the most expensive at 71 Birr per kg, on average, while the average price of meat coming from sheep and goats is estimated at 45 Birr per kg, while that of poultry ranged from 52 to 78 Birr per kg.

In the case of ASF, beef is sold at slightly higher prices than camel meat. However, it is to be noted that camel meat is mostly found in eastern pastoralist areas, close to production areas and away from major urban centers, such as Addis Ababa and its lower price might possibly be explained by this. Unpasteurized cow milk is the cheapest of all milk types. The median prices of camel and goat milk are on average 22 and 26 percent higher than the median price of cow milk. Using medians, pasteurized cow milk is almost twice as expensive as non-pasteurized milk, implying that likely relatively richer households consume this type of milk. Looking at processed dairy products, butter has the highest price with a median price more than ten-fold that of milk. The price of cheese is more than twice that of milk, and the price of yoghurt is 65 percent higher than that of milk.

[11] To construct such an index, we first calculate a twelve-month moving average of the real price for each item. Then we deflate/normalize the price series so constructed by dividing it to its January 2007 values. Accordingly, the price index has a value of one in January 2007 and it is greater/less than one in months with de-seasonalized prices greater/less than January 2007 prices.

Table 3.1: Prices, descriptive statistics, 2007-2016

	Unit	Observa-tions	Mean	Median	Standard Deviation	Coefficient of Variation
Livestock						
Heifer (2 to 4 years)	piece	10,905	2,074.3	1,973.7	703.7	0.34
Cow (4 years and above)	piece	10,898	3,117.4	2,953.0	993.0	0.32
Bull (2 to 4 years)	piece	11,142	2,607.4	2,403.8	992.3	0.38
Ox (4 years and above)	piece	11,479	5,029.1	4,750.4	1,629.4	0.32
Sheep (10 to 15 kg)	piece	12,260	460.9	438.5	165.7	0.36
Goat (10 to 15 kg)	piece	12,158	425.0	393.3	161.1	0.38
Hen (indigenous)	piece	12,593	44.7	43.1	15.3	0.34
Cock (indigenous)	piece	12,676	66.7	64.5	21.0	0.31
Animal source foods						
Beef	kg	11,697	71.0	70.2	16.6	0.23
Camel meat	kg	1,018	63.1	65.1	19.6	0.31
Cow milk unpasteurized	liter	11,102	9.5	9.1	2.5	0.27
Cow milk pasteurized	liter	2,392	18.8	17.1	6.0	0.32
Camel milk	liter	1,438	11.8	11.1	4.1	0.35
Goat milk	liter	469	11.7	11.5	3.4	0.29
Powdered milk	450 g	7,853	99.8	99.4	14.6	0.15
Yoghurt	liter	8,884	15.8	15.0	5.2	0.33
Cheese	kg	5,997	23.8	21.1	11.4	0.48
Butter	kg	11,694	98.1	96.3	22.0	0.22
Egg	dozen	12,837	20.3	20.1	4.7	0.23
Cereals						
Teff (mixed)	kg	12,592	10.5	10.2	2.3	0.22
Wheat (white)	kg	12,416	7.6	7.3	2.0	0.26
Barley (mixed)	kg	12,512	7.5	7.2	2.0	0.27
Maize (white)	kg	11,823	4.7	4.4	1.6	0.35
Sorghum (white)	kg	11,040	6.0	5.8	2.3	0.38

Source: Authors' computations using CSA price data.

Finally, we present at the bottom of Table 3.1 prices per kg of the staple cereals in the country. When these prices are compared to prices of ASF, we note that the latter have much higher prices. Compared to the prices of maize, the most important cereal in calorie terms in the country, median beef prices are 16 times more expensive over the period considered. Relative to the price of maize, unpasteurized cow milk prices are more than double and a dozen of eggs was five times higher. On the other hand, milk is less expensive than teff. Based on the national household survey of 2011, Worku et al. (2016) compare the calorie prices of different food groups in average consumption baskets in Ethiopia and find that ASF calorie prices are on average 9.5 times more expensive than those of cereals. While the consumption of ASF obviously has other benefits than providing access to calories, these price differences indicate the challenge of assuring affordability of those products in settings where assuring food security remains a policy priority.

4. SEASONAL AND SPATIAL PATTERNS

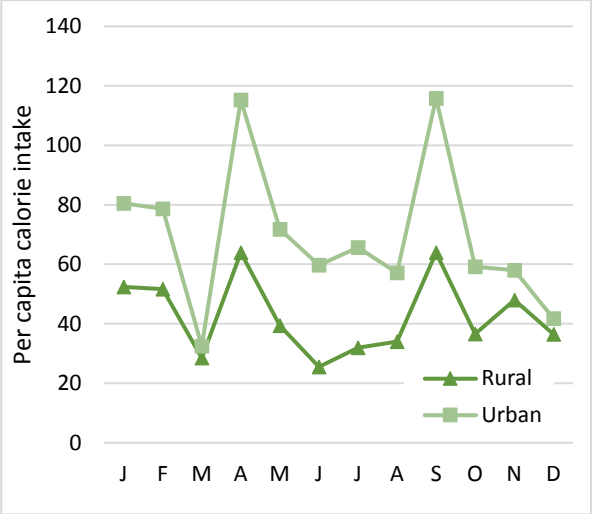
4.1. Seasonality

Seasonal patterns are a defining characteristic of agriculture all over the world (e.g., Sahn 1989). These seasonal movements are often linked to inherent constraints to consistent year-round supplies due to climatic and, most importantly, rainfall patterns. This is also the case in Ethiopia. Rainfall is unimodal in the west and north of the country with rainfall mostly falling between June and September and one main crop harvest (Meher), while it is bi-modal in the east and southeast of the country, giving rise to a second season (Belg) in those areas. Moreover, rainfall is more reliable in the west and south of the country compared to

other parts. As the production of feed for livestock is linked to this rainfall pattern, it induces seasonal patterns in the sector. Farmer (2010) shows that seasonality is an important factor for pastoralist households as rangelands can support fewer animals during the dry season, leading owners to sell livestock during the dry season or migrate to areas with better feed availability, while holding on to livestock during the wet season. For farmers in the highlands, fewer sales of livestock occur during the rainy period as feed is more easily available and cattle are needed for crop cultivation.

We also note significant seasonality in demand. One important characteristic of ASF consumption, particularly in Ethiopia, is its link with religion. An estimated 43 percent of the population in Ethiopia are Orthodox Christians (CSA 2009) and their religion is characterized by important constraints on food intake, especially related to ASF. Figure 4.1, based on the Household Consumption and Expenditures Survey (HCES) of 2011, below shows how quantities of ASF consumed vary over the course of the year for rural and urban residents. We see peaks in the beginning of the year (for the festivities of Ethiopian Christmas and Timket), in April (for Easter), and in September (for the New Year and Meskel). We see similar patterns in rural as well as urban areas, although levels are lower in the former areas as discussed above. The major consumption peaks associated with the major religious events are preceded by troughs, which are linked with fasting periods that come before and culminate during these major celebrations. This is especially so for Christmas and Easter. During the fasting periods of Orthodox Christians – the Lent leading-up to Easter during which the fasting period lasts up to 56 days and the one before Christmas which lasts for about 40 days – no ASF are consumed. While there are other fasting periods during the year, they are much shorter.[12] This reduction in consumption of ASF also shows up in slaughterhouse data in Addis Ababa. The number of head of cattle and of sheep and goats slaughtered in the "Christian hall" of the slaughterhouse in the month before Easter typically drops to one-quarter the level of other months (FVI-Idele 2016). No such seasonality is seen for the "Muslim hall" during the Muslim major fasting season of Ramadan, and there is no evidence of higher activity at the end of Ramadan or for the Eid festivities.

Figure 4.1: Consumption of animal-source foods in Ethiopia, by month (2011)



Source: Adjusted from Hirvonen et al. (2016)

[12] On top of these long fasting periods, Orthodox Christians also do not eat ASF on Wednesday and Friday. It has been estimated that the total number of days that clergy (i.e. priest, nuns, monks) are not allowed to eat ASF amounts to 250 per year (Ayenew et al. 2009). For non-clergy practicing Orthodox Christians, the number of fasting days amounts to between 166 and 180.

Seasonal changes in demand seemingly drive changes in prices of livestock and ASF. A summary of the monthly price indices is reported in Table 4.1 for different livestock categories.[13] The results show that all seasonal indices for all livestock categories are higher than 1.0 in January/February, in April/May and in September[14], illustrating to what extent these religious events are associated with higher prices. Slightly higher indices for the prices of oxen/bulls/cows during June/July are also noted, possibly because of demand for cultivation during the meher season. The lowest prices are noted during the month of August, when fodder is easily available, as well as in November/December. It should be noted that seasonal amplitudes are not that large and vary between 5 percent and 10 percent for cattle and for sheep and goats. It is highest for poultry for which prices vary 19 percent over the year in the case of hens. Ayele and Rich (2010) also link the low prices of poultry with regular outbreaks of Newcastle Disease that typically occur in the late spring.

Table 4.1: Seasonal price indices of livestock in Ethiopia, 2007 to 2016

	Livestock					
	Sheep	**Goat**	**Cow**	**Bull**	**Ox**	**Hen**
January	1.03	1.02	0.99	1.01	1.01	1.11
February	0.98	0.98	0.98	0.98	0.97	1.02
March	0.96	0.97	0.97	0.99	0.96	0.99
April	1.02	1.03	1.01	1.01	1.01	1.07
May	1.02	1.03	1.02	1.03	1.04	1.01
June	0.99	0.99	1.02	1.01	1.02	0.94
July	0.99	0.99	1.01	1.00	1.02	0.92
August	0.99	0.99	1.01	1.00	1.00	0.93
September	1.06	1.05	1.03	1.01	1.04	1.08
October	1.00	0.99	0.99	0.99	0.99	0.98
November	0.98	0.97	0.98	0.98	0.97	0.97
December	0.97	0.97	0.98	0.98	0.96	0.98
Amplitude	0.10	0.08	0.06	0.05	0.08	0.19

Note: Seasonal price indices were calculated over the period January 2007 to December 2016 using the percentage moving average method. In this method, the original data values in the time-series are expressed as percentages of twelve-month moving averages.

In Table 4.2, seasonal indices are reported for several ASF. A similar pattern emerges as in the case of livestock. We see increases of prices at the time of major religious celebrations and a decrease during the July-August periods when livestock feed is easily available, products are more plentiful, and when milk yields are higher. Prices are also lower at the end of the year during or just after crops are harvested and when the stock of crop-residue, which is used as livestock feed, is at its maximum. It is to be noted that the September peak for ASF is much less pronounced than in the case of livestock.

[13] On top of these long fasting periods, Orthodox Christians also do not eat ASF on Wednesday and Friday. It has been estimated that the total number of days that clergy (i.e. priest, nuns, monks) are not allowed to eat ASF amounts to 250 per year (Ayenew et al. 2009). For non-clergy practicing Orthodox Christians, the number of fasting days amounts to between 166 and 180.

[14] Except for bulls in January.

Table 4.2: Seasonal price indices of animal-source food in Ethiopia, 2007 to 2016

	Animal Source Food						
	Beef	Cow milk	Goat milk	Yoghurt	Cheese	Butter	Eggs
January	0.98	1.00	1.04	1.00	1.02	0.97	1.02
February	0.95	1.00	1.02	1.00	1.02	0.96	1.00
March	0.96	1.00	1.00	1.00	0.97	0.99	0.94
April	0.97	1.00	1.01	0.99	1.00	1.11	0.94
May	1.00	1.00	1.00	1.00	1.05	1.11	1.01
June	1.02	1.00	0.98	1.00	1.03	1.05	1.00
July	1.02	1.00	0.98	1.00	0.98	0.99	0.99
August	1.03	1.00	0.99	1.00	0.98	0.98	0.99
September	1.03	1.00	1.03	1.00	1.02	1.01	1.06
October	1.02	1.00	1.01	1.00	0.99	0.95	1.04
November	1.01	1.00	0.98	0.99	0.98	0.93	1.00
December	0.99	0.99	0.96	1.00	0.95	0.93	0.98
Amplitude	0.07	0.01	0.08	0.01	0.09	0.18	0.12

Note: Seasonal price indices were calculated over the period January 2007 to December 2016 using the percentage moving average method. In this method, the original data values in the time-series are expressed as percentages of twelve-month moving averages.

4.2. Spatial patterns

We next look at livestock and ASF price variation by region, using average prices over the period 2007 to 2016 (Table 4.3). We note significant variation by region. For example, the price of oxen is more than 50 percent higher in Addis Ababa compared to the Afar region. Similar variations are noted for other types of livestock. Overall, prices for Addis Ababa are consistently above the national median. The difference varies from 23 percent for cocks to 98 percent for goats. Prices are also higher than the national median for the cities of Dire Dawa and Harar, except for poultry. Prices for livestock are also relatively higher in the western region of Benishangul-Gumuz (B.G.), seemingly linked with the hostile environment there for livestock production due to warm and humid conditions and the presence of tsetse fly (Ababa 2010).

Table 4.3: Prices of livestock by region, 2007 to 2016

		Region											
Livestock type	Unit	Tigray	Afar	Am-hara	Oro-miya	So-mali	B.G.	SNNP	Gam-bella	Harari	Addis Ababa	Dire Dawa	Total
Median prices (Birr)													
Heifer (2 to 4 yrs)	piece	2,074	2,050	2,162	1,925	2,039	2,323	1,677	1,889	2,683	2,915	2,767	1,976
Cow (4 years or more)	piece	3,334	3,338	3,130	2,786	3,417	3,396	2,633	2,942	4,660	4,142	3,156	2,983
Bull (2 to 4 years)	piece	2,661	2,411	2,624	2,425	2,466	2,516	2,098	2,077	4,167	3,384	3,100	2,406
Ox (4 years or more)	piece	4,511	4,520	4,642	4,919	5,926	4,614	4,484	4,222	7,562	7,506	7,089	4,779
Sheep (10 to 15 kg)	piece	548	412	452	419	369	441	371	584	697	713	415	437
Goat (10 to 15 kg)	piece	502	454	377	368	378	374	361	542	646	784	440	396
Hen (indigenous)	piece	56	56	46	41	31	51	37	48	26	58	30	43
Cock (indigenous)	piece	72	70	56	63	47	75	64	83	49	79	52	64
Comparison with national median (%)													
Heifer (2 to 4 years)	%	105	104	109	97	103	118	85	96	136	148	140	100
Cow (4 years or more)	%	112	112	105	93	115	114	88	99	156	139	106	100
Bull (2 to 4 years)	%	111	100	109	101	103	105	87	86	173	141	129	100
Ox (4 years or more)	%	94	95	97	103	124	97	94	88	158	157	148	100
Sheep (10 to 15 kg)	%	125	94	104	96	84	101	85	134	160	163	95	100
Goat (10 to 15 kg)	%	127	114	95	93	95	94	91	137	163	198	111	100
Hen (indigenous)	%	131	131	107	95	73	118	87	113	62	135	70	100
Cock (indigenous)	%	111	109	88	98	73	117	99	129	76	123	81	100

Source: Authors' computations using CSA price data.

Prices in the SNNP region, on the other hand, are consistently and significantly lower for all types of livestock.[15] Prices for most livestock are also low in the lowland and pastoralist areas of Somali. However, this is not the case for all types of livestock, as cattle prices are higher than the median. The breed sold in Afar markets is almost exclusively Danakil, which is among the lowest valued, while the breed sold in Harari region, the Harari breed, has the highest value. All sorts of breeds are sold in Addis Ababa markets, which is why cattle prices in Harari region are generally higher than those in Addis Ababa, but lower for other livestock.

The price of sheep is lowest in the Somali region, a major supply region for export markets. Despite the large herd of livestock and its remoteness, the Afar region shows surprisingly high prices for cattle overall. However, there are significant variations in breeds over the country with different quality premiums attached to it (Teklewold et al. 2009). Sheep and goats from lowland areas have a higher fat content and their meat is perceived not to "darken" when prepared. Consequently, such meat is preferred in export markets. Sheep and goats from lowlands are therefore more destined to export markets compared to those of the highlands which are more used by domestic consumers. Comparing livestock prices, without quality considerations, is therefore not straightforward. Doing this more detailed analysis is left for future research.

Median prices of ASF are presented by region in Table 4.4. We note again significant variation in prices across regions. Prices of beef and milk are relatively low in the northern part of the country, i.e., Tigray and Amhara. Beef and milk prices in Tigray are 7 and 3 percent lower than the national median, respectively. This compares to 5 and 9 percent, respectively, in the Amhara region. Prices are also low for these products in the western regions of Benishangul-Gumuz and Gambella. On the other hand, prices for beef and cow milk are high in the lowlands of Somali and Afar. Processed dairy product prices are also high in Somali and Afar, seemingly as there is little habit of processing milk in those settings. FAO (2017) notes that pastoralists and agro-pastoralists mostly consume milk fresh and as yoghurt and ghee.

ASF prices are also high in cities, particularly in the eastern cities of Harar and Dire Dawa compared to the capital, Addis Ababa. Unlike livestock prices, prices of not all ASF are the highest in Addis Ababa. Prices for cow milk (pasteurized) are among the lowest in Addis Ababa. This might possibly be explained by the considerable development of the dairy sector around Addis Ababa.[16] Improved dairy processing plants combined with high demand allows for economies of scale, which seems to have contributed to relatively low prices in the capital compared to other cities.

Egg prices are also high in cities. They are lower than the median in the three major agricultural regions of the country (Tigray, Amhara, and SNNPR) and at par with the median in the Oromiya region. Prices are also very high in pastoralist areas, seemingly as chicken are not well adapted to these hot areas.

[15] The only exception is "cock".

[16] Two-thirds of the current dairy processing plants in Ethiopia are based in Addis Ababa or its surrounding areas.

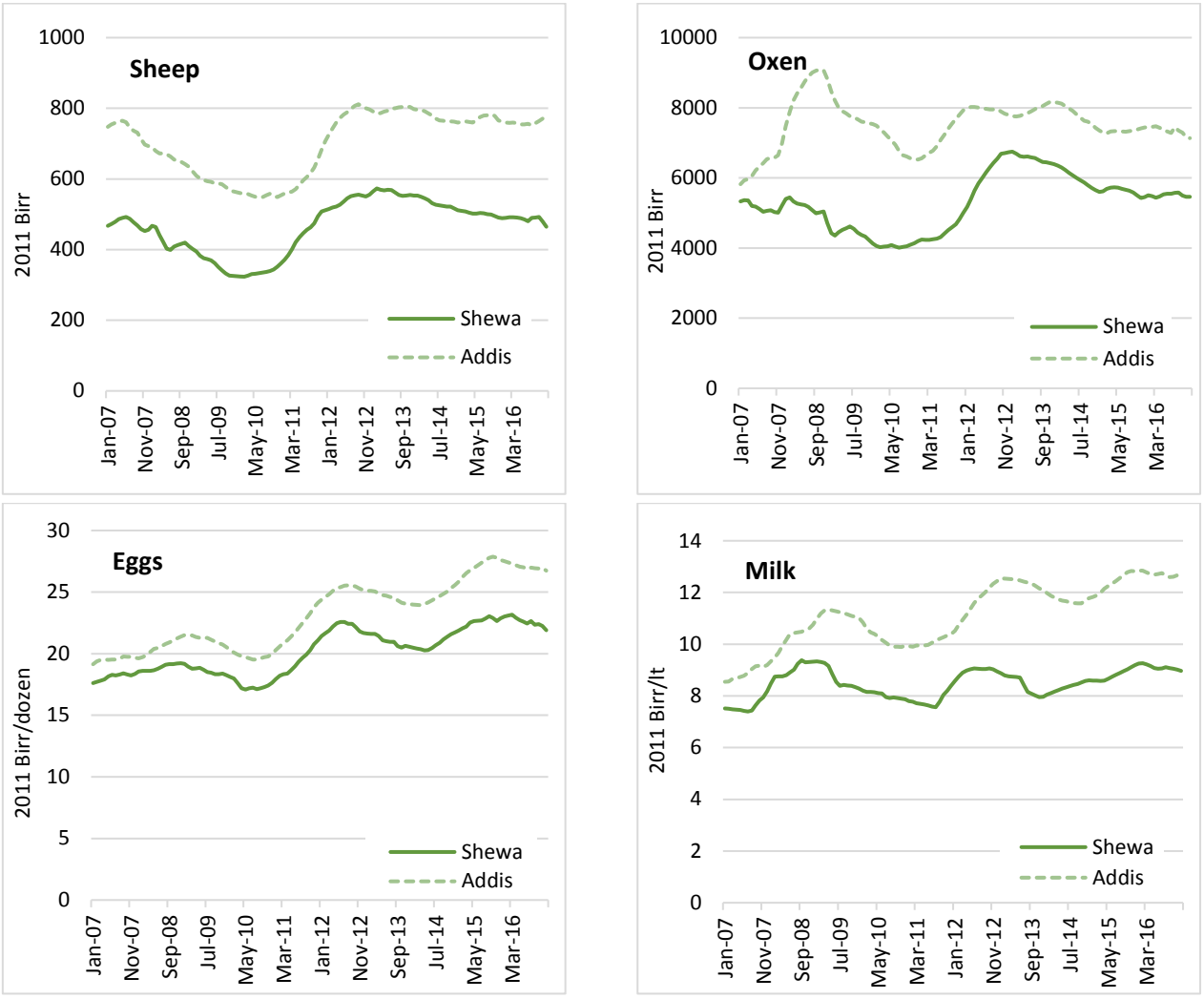
Table 4.4: Prices of animal-source foods by region, 2007 to 2016

Animal-source food type	Unit	Region											
		Tigray	Afar	Am-hara	Oro-miya	So-mali	B.G.	SNNP	Gam-bella	Harari	Addis Ababa	Dire Dawa	Total
Median real prices (Birr)													
Beef	kg	65	77	66	73	89	57	71	63	84	76	84	70
Cow milk unpasteurized	liter	9	11	8	9	11	8	9	8	12	11	12	9
Cow milk pasteurized	liter	21	25	15	18	25	15	18	17	24	16	23	18
Powdered milk	450 gr	94	98	102	97	107	102	100	112	111	94	100	100
Yoghurt	liter	22	15	13	16	18	15	15	19	18	13	15	15
Cheese	kg	24	32	21	19	23	6	19	21	47	39	50	21
Butter	kg	105	109	90	96	109	74	96	98	116	113	107	97
Egg	dozen	20	25	18	20	26	23	19	26	23	24	22	20
Comparison with national median (%)													
Beef	%	93	110	95	104	126	82	101	90	120	109	120	100
Cow milk unpasteurized	%	97	119	91	103	123	88	99	93	131	124	135	100
Cow milk pasteurized	%	118	142	84	103	143	83	102	98	139	88	133	100
Powdered milk	%	95	98	102	97	108	103	101	112	111	94	101	100
Yoghurt	%	145	102	83	106	117	100	97	127	118	85	99	100
Cheese	%	116	156	102	93	113	28	93	100	228	188	240	100
Butter	%	109	113	93	100	112	77	99	102	120	117	110	100
Egg	%	98	123	88	100	128	114	93	128	115	117	110	100

Source: Authors' computations using CSA price data.

Semi-urban and rural areas around cities are often suppliers of food to these cities and, therefore, are usually well integrated with the end markets in the cities (Minten et al. 2014). As a result, one would expect that prices in these areas to be lower than in the cities, with the differences in prices reflecting marketing costs. We present supplying areas and urban prices in the case of eggs, milk, sheep and oxen, comparing the median prices of Addis Ababa and the surrounding Shewa zones (east, west, and north Shewa in Oromiya, and north Shewa in Amhara) over the period 2007 to 2016 (Figure 4.2). We indeed note that prices in Addis Ababa are all above the prices in the surrounding areas. More importantly, these prices have a close relationship during the whole period, except for oxen prices, which appeared to move in different directions and were wider apart during mid-2007 to December 2008. Despite the wide differences in oxen prices in the beginning of the period, the differences are rather stable at the end of the period. We also note that price differences are rather stable for sheep but increasing towards the end. Differences in milk and egg prices also appear to be slowly but consistently increasing. More in-depth research would be needed to explain these trends in seemingly increasing marketing costs between rural and urban areas.

Figure 4.2: Real prices of sheep, oxen, eggs, and milk in Addis Ababa and surrounding Shewa zones, 2007 to 2016



Source: Authors' calculations based on CSA price data

5. PRICE EVOLUTION OVER TIME

5.1. Real animal-source foods and livestock prices

We next look at the extent that livestock and ASF prices have changed over the last decade. Retail prices of cows, bulls, and oxen are presented for the years 2007, 2011, and 2016 in Table 5.1. Real prices in 2011 were at similar (or even lower) levels than in 2007. However, there has been a significant increase since – by 2016, real prices of cattle had risen between 10 and 13 percent relative to 2007 prices. Sheep and goats show similar upwards trends, with prices 22 and 26 percent higher in 2016, respectively, while they also were higher in 2011. Finally, chicken prices increased the highest of all – prices of cocks were 46 percent higher in 2016 than a decade earlier. In the case of ASF, we see similar increases in retail prices over time (Table 5.2). Beef prices increased by 33 percent between 2007 and 2016. Cow milk and egg prices increased by 36 and 32 percent, respectively. Important increases are also seen for processed dairy products and for imported powdered milk.

Table 5.1: Price evolution for livestock in Ethiopia, 2007, 2011, and 2016

		Urban retail prices			Rural producer prices		
		2007	2011	2016	2007	2011	2016
Median real prices (2011 Birr)							
Heifer (2-4 years)	piece	1,866	1,811	2,059	1,636	1,407	1,713
Cow (4 years and above)	piece	2,732	2,788	3,105	2310	2127	2536
Bull (2 - 4 years)	piece	2,285	2,216	2,547	2,041	1,816	2,168
Ox (4 years and above)	piece	4,405	4,250	4,992	3,606	3,258	3,858
Sheep (10 - 15 kg)	piece	393	422	479	345	345	392
Goat (10 - 15 kg)	piece	349	376	440	292	319	363
Hen (indigenous)	piece	38	39	48	36	34	42
Cock (indigenous)	piece	54	58	78	50	50	65
Comparison with national median in 2007 (%)							
Heifer (2-4 years)	%	-	97	110	-	86	105
Cow (4 years and above)	%	-	102	114	-	92	110
Bull (2 - 4 years)	%	-	97	111	-	89	106
Ox (4 years and above)	%	-	96	113	-	90	107
Sheep (10 - 15 kg)	%	-	107	122	-	100	114
Goat (10 - 15 kg)	%	-	108	126	-	109	124
Hen (indigenous)	%	-	102	128	-	96	118
Cock (indigenous)	%	-	109	146	-	101	132

Source: Authors' calculations based on CSA price data

Table 5.2: Price evolution for animal-source foods in Ethiopia, 2007, 2011, and 2016

		Urban retail prices			Rural producer prices		
ASF type	**Unit**	**2007**	**2011**	**2016**	**2007**	**2011**	**2016**
Median real prices (2011 Birr)							
Beef	kg	62	56	82			
Cow milk unpasteurized	liter	7	9	10	6	7	8
Cow milk pasteurized	liter	14	17	17			
Powdered milk	450 gr	77	97	100			
Yoghurt	liter	13	15	16			
Cheese	kg	18	18	22	15	16	22
Butter	kg	83	101	100	71	82	85
Egg	dozen	17	20	22	12	15	18
Comparison with national median in 2007 (%)							
Beef	%	-	90	133			
Cow milk unpasteurized	%	-	118	136	-	130	141
Cow milk pasteurized	%	-	122	122			
Powdered milk	%	-	126	129			
Yoghurt	%	-	115	122			
Cheese	%	-	101	125	-	105	146
Butter	%	-	122	120	-	116	120
Egg	%	-	116	132	-	123	142

Source: Authors' calculations based on CSA price data

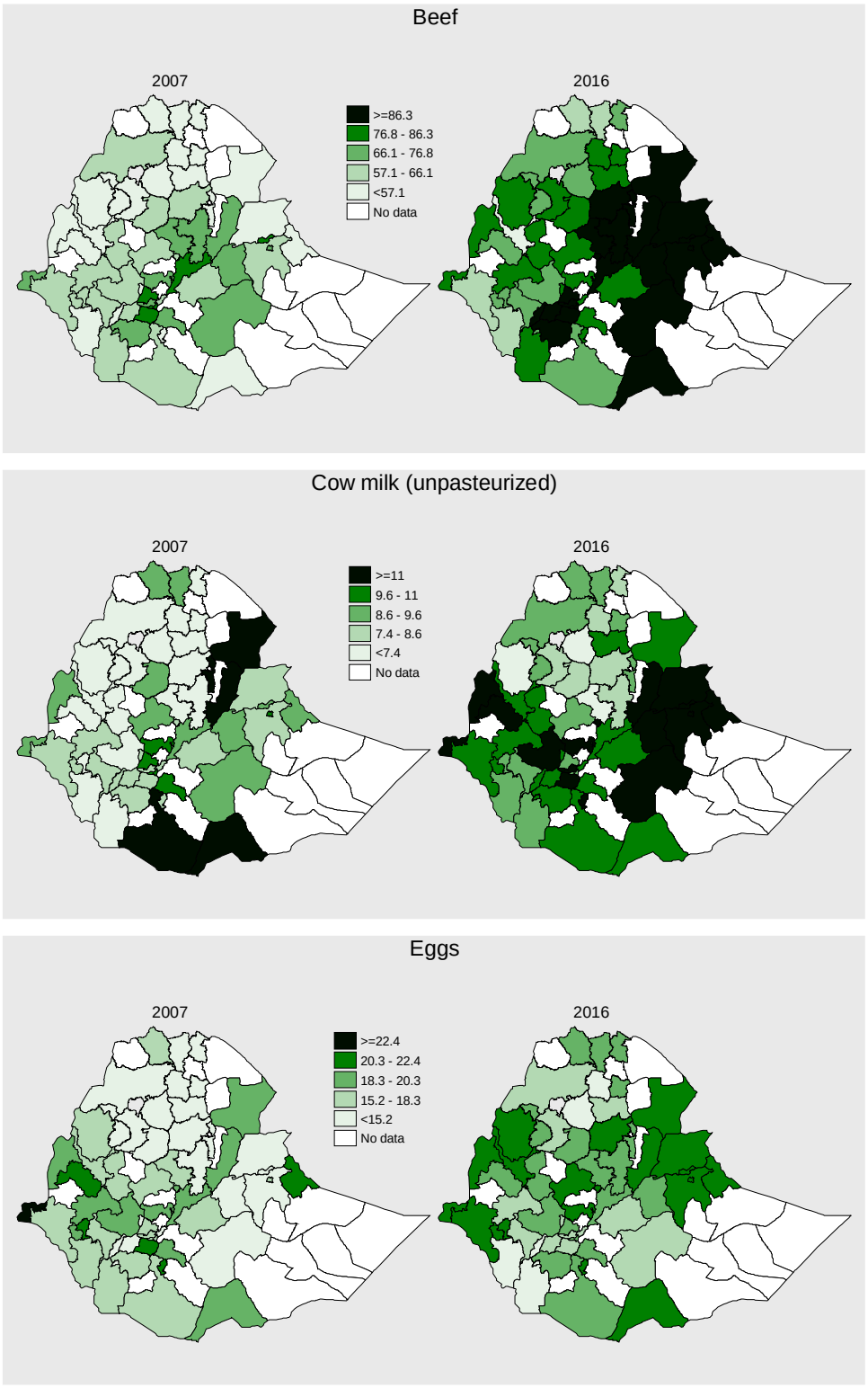
We also use CSA's producer price dataset (CSA 2017c) to study trends in prices of livestock and four of the eight ASF items included in the rural producer price dataset. In general, similar price increases are noted as in urban retail prices. Table 5.1 indicates that real producer cattle prices increased by 5 to 10 percent while the increase was 14 percent in sheep, 24 percent in goats, and by over 18 percent in poultry. Producer livestock prices in 2016 were lower than retail prices ranging from 14 percent (for hens) to 30 percent (for oxen). Moreover, growth in producer prices was lower relative to retail prices for all livestock types.

However, livestock types with rapidly/slowly growing retail prices generally showed rapid/slow growth in producer prices. Real producer prices of cheese were essentially the same as retail prices in 2016, while retail prices were at least 18 percent higher than producer prices for the remaining three items (Table 5.2). However, growth rates in producer prices of these ASF items was generally higher than growth in retail prices.

In Figure 5.1, we present zonal maps indicating real prices at the beginning and at the end of the last decade for the three most important ASF, beef, milk, and eggs. In this figure, an increase in price is indicated by a change of colors from light to darker green and vice versa. Accordingly, the overall darker colors on the right for these three ASF illustrate the increase in prices of the three ASF items over the last decade. In the case of beef, we note relatively lower prices and a relatively lower change in the north of the country. However, we note a considerable increase in the east, central, and southern parts of the country. The map suggests that relative beef prices have especially gone up in those areas that are well integrated in commercial livestock circuits.

Similarly, cow milk prices are relatively low and seem to have stayed the same or changed little over the last ten years in the northern part of the country. While milk prices were already higher in the south and east of the country in 2007, that difference seems to even have widened over the last ten years. It is to be noted that real milk prices around the capital Addis Ababa do not seem to have increased very much over time, possible driven by the development of this active peri-urban dairy value chain. Eggs also show similar patterns, a worsening over time overall, a relatively stable to slow increase in the north and around Amhara and Tigray, and worsening in the most southern, eastern, and western zones of the country.

Figure 5.1: Real prices of beef (Birr/kg), milk (Birr/liter) and eggs (Birr/dozen) in 2007 and 2016 by zone, 2011 Birr

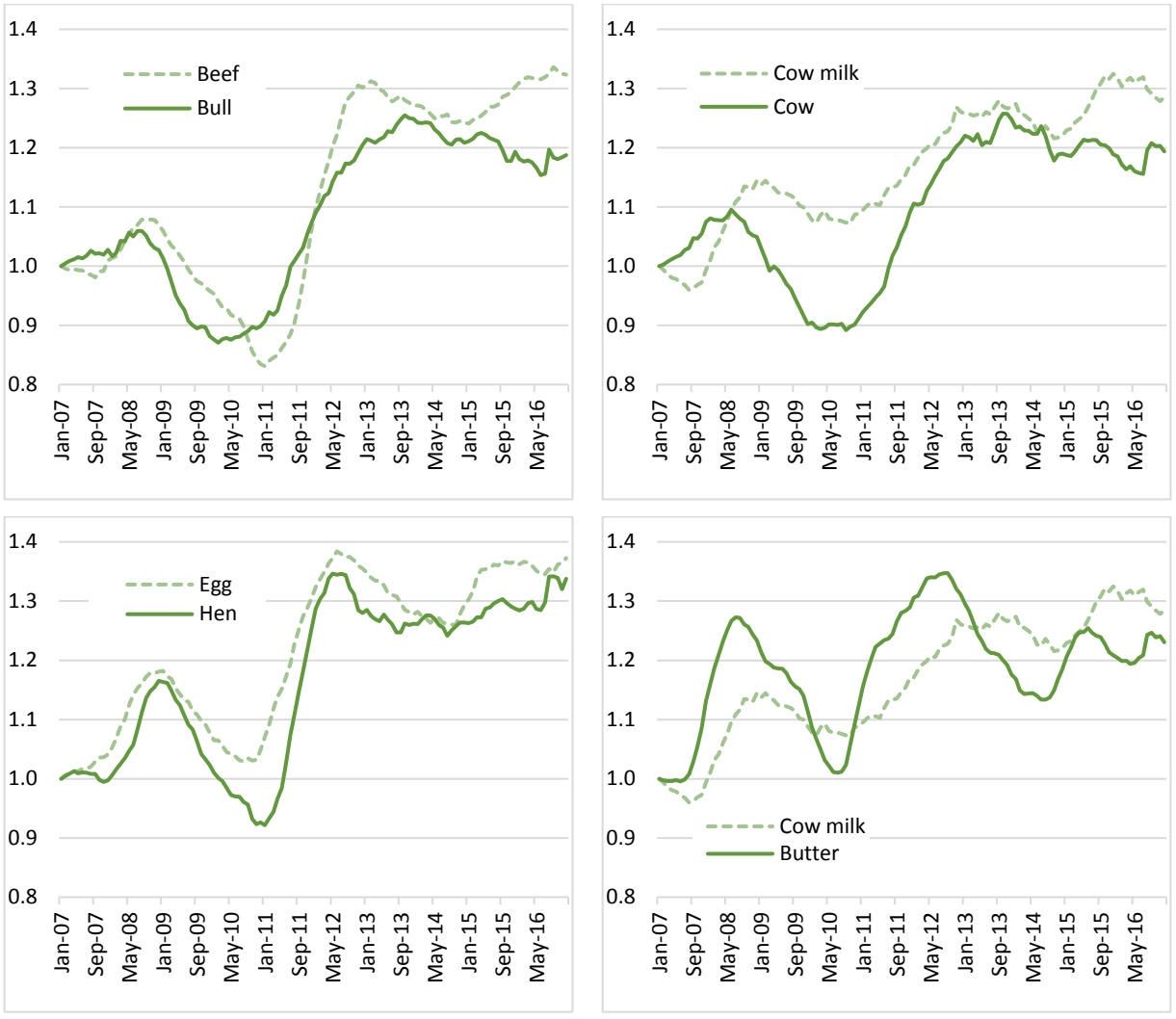


Source: Authors' calculations based on CSA price data

As ASF are obtained from livestock, we further assess to what extent price increases of ASF and livestock have been linked over the last decade. To do so, we plot different pairs of ASF and livestock prices (Figure 5.2) and compute simple correlation coefficients. As one would expect, we see strong correlations, indicating the close link of ASF and livestock sector performance. Beef prices seem more volatile than bull

prices - as prices of the latter went relatively lower and higher than bull prices over the period considered - but correlation coefficients are still high at 0.94. Beef prices in 2011 dropped significantly compared to bull prices, possibly because of price-fixing of beef by the government in the beginning of that year (Hassan 2011). The price fixing led to less meat being brought to the market and only those in need seemingly were willing to sell their oxen.[17] Cow milk and cows are less correlated with a correlation coefficient of 0.78. Eggs and hens on the other hand are characterized by a very high correlation coefficient of 0.96. We note in this case also the disruption of the price-fixing done in the beginning of 2011 as the prices of hens in that period were the lowest of the whole decade. Butter and milk are also less correlated (0.60). In any case, the graphs suggest overall that the strong increases in prices of ASF are associated with increases in livestock prices.

Figure 5.2: Correlations of animal-source foods and livestock price indices (January 2007 = 1.0)



Source: Authors' calculations based on CSA price data

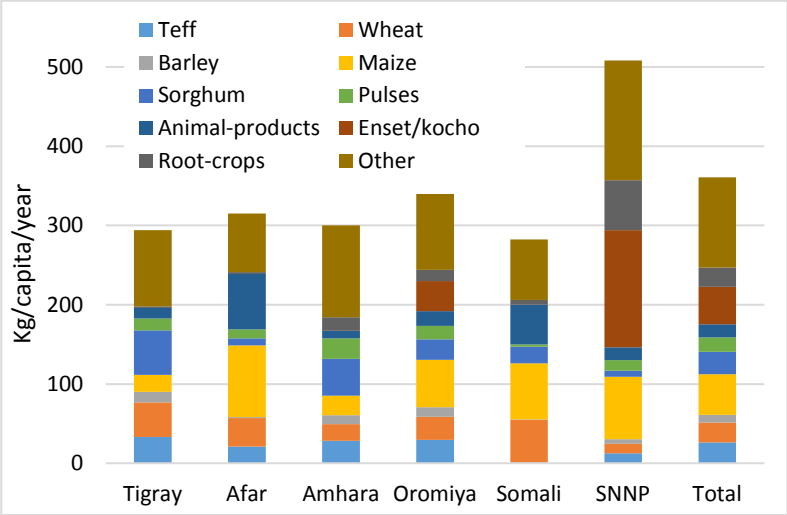
5.2. Animal-source foods and livestock versus other food prices

Since increasing the consumption of ASF would imply at least a partial trade from other major products in the consumption basket, we compare to what extent the real prices of cereals changed relative to real

[17] On 6 January 2011, the government announced a list of 18 products for which it fixed prices (Hassen 2011). However, as several products were becoming in short supply, most of the price caps were lifted in late May 2011.

prices of livestock and ASF products over the last decade.[18] To do so, we first examine the quantity of different crops and products consumed. Figure 5.3 shows these data for the four major crop producing regions, as well as for the Afar and Somali regions. We use the average consumption basket from the Household Consumption Expenditures Survey (HCES) in 2011. Figure 5.3 illustrates that cereals are, in quantity terms, very important in these regions. They comprise 60 percent of the average consumption basket in Tigray, decreasing to 53 percent in Afar and 56 percent in Somali, and still remain at 50 percent in the Amhara and Oromia regions. In contrast, they comprise only 24 percent of the quantity consumed in SNNP due to the high levels of consumption of enset and root crops there.

Figure 5.3: Annual per capita food consumption in 2011 in Ethiopia, by food type and region, kg/capita/year



Source: Authors' calculations from CSA, HICES 2011.

We use these consumption data, together with CSA's retail price series, to compute the terms of trade of each ASF/livestock type as a ratio of the real prices of ASF/livestock to per capita consumption weighted real cereal prices. The results of this exercise are provided in Tables 5.3 and 5.4.

[18] CSA data indicate that over 80 percent of the population in 2015 was engaged in crop production; nearly 86 percent of crop farmers produced one or more type of cereals; and consumed 66 percent of the cereals output (CSA 2013; 2015b; 2015c). In the same year, 73 percent of the total crop area was used to produce cereals (CSA 2015c).

Table 5.3: Terms of trade of livestock relative to cereals in Ethiopia, 2007, 2011, and 2016

Livestock type	Unit	Year 2007	2011	2016
Terms of trade (in terms of 100 kg of cereal)				
Heifer (2-4 years)	piece	3.3	2.9	3.8
Cow (4 years and above)	piece	5.0	4.4	5.6
Bull (2 - 4 years)	piece	4.0	3.6	4.8
Ox (4 years and above)	piece	8.0	7.0	9.2
Sheep (10 - 15 kg)	piece	0.7	0.7	0.9
Goat (10 - 15 kg)	piece	0.6	0.6	0.8
Hen (indigenous)	piece	6.5	6.1	8.9
Cock (indigenous)	piece	9.4	9.2	13.7
Comparison with national median in 2006 (%)				
Heifer (2-4 years)	%	-	88	116
Cow (4 years and above)	%	-	89	113
Bull (2 - 4 years)	%	-	90	120
Ox (4 years and above)	%	-	88	115
Sheep (10 - 15 kg)	%	-	94	120
Goat (10 - 15 kg)	%	-	97	127
Hen (indigenous)	%	-	94	138
Cock (indigenous)	%	-	98	146

Source: Authors' calculations based on CSA price data

Table 5.4: Terms of trade of animal-source foods relative to cereals in Ethiopia, 2007, 2011, and 2016

ASF type	Unit	Year 2007	2011	2016
Terms of trade (compared to 1 kg of cereal)				
Beef	kg	10.7	8.8	15.1
Cow milk unpasteurized	liter	1.3	1.4	1.9
Cow milk pasteurized	liter	2.4	2.9	3.5
Powdered milk	450 gr	14.1	15.5	18.1
Yoghurt	liter	2.4	2.4	3.2
Cheese	kg	3.1	3.1	4.0
Butter	kg	14.3	16.3	18.5
Egg	dozen	2.8	3.1	4.0
Comparison with national median in 2006 (%)				
Beef	%	-	82	140
Cow milk unpasteurized	%	-	103	141
Cow milk pasteurized	%	-	122	146
Powdered milk	%	-	111	129
Yoghurt	%	-	101	134
Cheese	%	-	98	129
Butter	%	-	114	130
Egg	%	-	107	139

Source: Authors' calculations based on CSA price data

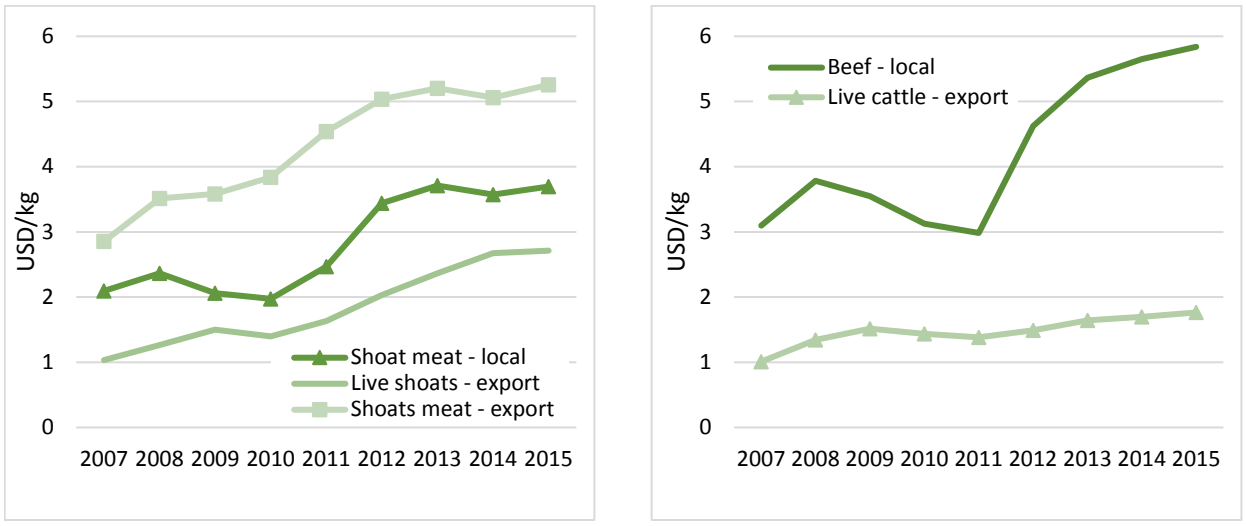
To buy one kg of beef in 2016, one would have needed 15 kg of cereals (Table 5.4). This compares to 10.7 kg in 2007. This change in terms-of-trade corresponds to a 40 percent higher price of beef relative to cereals – a cereal farmer wanting to buy a kg of beef would need 4.3 kg of more cereals in 2016 than in 2007 to do so. A similar deterioration is seen in the case of milk where prices expressed in kg of cereals deteriorated by 41 percent over the last decade. Egg prices also showed a deterioration of 39 percent. A similar exercise is done for livestock, indicating to what extent livestock producers can buy more cereals with the sales of their

livestock (Table 5.3) or how much more product cereal producers must sell to buy each type of livestock. The results show that cereal producers' terms-of-trade clearly deteriorated. The increase in the quantity of cereals needed to buy livestock ranged from 15 percent (1.2 quintals) in oxen to 46 percent in cocks, the latter of which sold for 9.4 and 13.7 kg of cereals in 2007 and 2016, respectively.

5.3. Local versus international prices

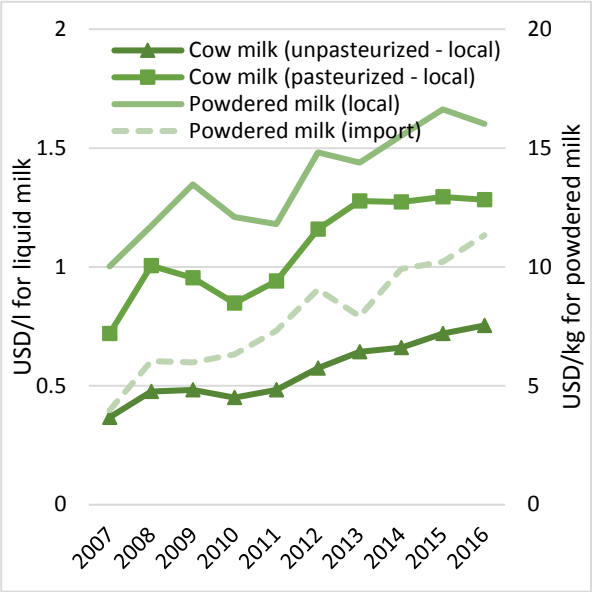
Part of the changes in the domestic livestock and ASF prices is likely explained by changes in export and import prices of livestock and ASF. Using export data from the Ethiopian Revenue and Customs Authority (ERCA) (2017), Figure 5.4 shows to what extent prices, expressed in USD/kg, have changed over the last 10 years for both locally sold and exported live animals and meats. The data show important increases for live cattle, sheep, and goats as well as meat both sold locally and exported. Figure 5.5 further shows how imported powdered milk prices have changed over the last decade and to what extent similar trends show up in local pasteurized and non-pasteurized milk prices. We find a strong correlation for these prices. These graphs suggest that price increases in local markets have at least in part been linked to price increases in international markets.

Figure 5.4: Export (from Ethiopia) border prices and local prices of live animals/meat, 2007 to 2015



Source: Authors' calculations based on custom data (ERCA 2017) and CSA price data. 'Shoat' combines sheep and goats into a single category.

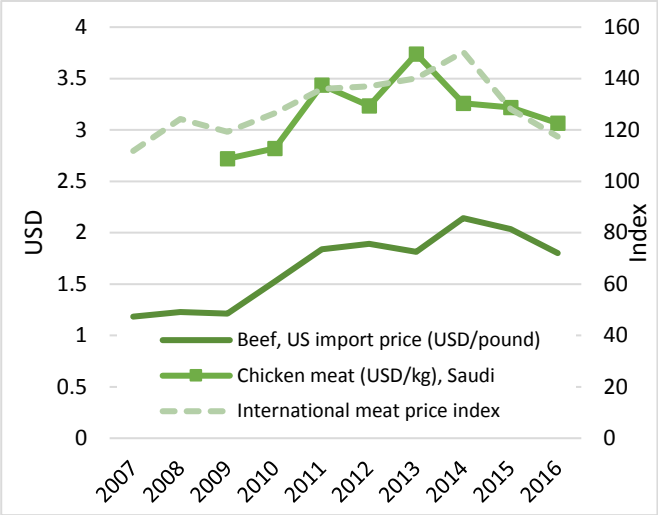
Figure 5.5: Import (to Ethiopia) border prices and local prices of milk, 2007-2016



Source: Authors' calculations based on custom data (ERCA 2017) and CSA price data.

We further present the evolution of prices in international meat markets to understand to what extent the border prices that are noted in Ethiopia are synchronized with international patterns. We look at meat prices in Saudi Arabia, a major export country for Ethiopia, the USA import prices, and the international meat price index (Figure 5.6). These graphs all show significant increases over the last decade. However, we also see that meat prices have been coming down in the two most recent years, partly explaining why growth in meat prices in Ethiopia in recent years has been slower.

Figure 5.6: International meat price trends, 2007-2016



Source: Authors' calculations

While it is likely that price increases of some of the livestock categories and ASF in the country have been influenced by international price increases, as Ethiopia is a major exporter of meat, such price increases were also seen for non-traded ASF, such as eggs and milk, and price increases in export destinations seemingly only explain part of these local price rises. In the case of milk, it is to be noted that prices of powdered milk in comparison will local milk are very high. There is likely limited substitution away from these local fresh milk products to imported sources, especially for poorer households, making local milk

mostly a non-tradable good.[19] For example, the OECD-FAO (2016) estimates that fresh dairy products, with less than one percent of production traded, are one of the least traded agricultural commodities.

6. CONCLUSIONS AND IMPLICATIONS

Increasing evidence shows that consumption of ASF have important beneficial nutritional impacts. However, only a minority of consumers in developing countries eat such foods, and poorer households especially forego ASF consumption seemingly as prices are perceived to be prohibitively high. Using a large national retail price dataset for Ethiopia that spans the last ten years, we look at patterns in ASF prices, assess changes over time of ASF and associated livestock prices, and compare these prices with other food products, such as staple cereals. Several typical patterns in ASF and livestock pricing can be highlighted. First, there is price seasonality mostly driven by changes in demand due to religious festivities and fasting periods in the country. Second, there are significant spatial patterns with higher prices in cities and in commercial livestock areas. Third, ASF are relatively expensive. Average prices of ASF per calorie and per kg are about ten times as high as for staple cereals, an important consideration in these settings and especially so for the poorer part of the population.

Moreover, we find that real prices of ASF have been increasing rapidly in the last decade, on the order of 33, 36, and 32 percent for beef, milk, and eggs respectively. Such ASF price increases are strongly related with increases in livestock prices. These price trends are in contrast with staple cereal prices that do not show such increases. These are important findings as low prices of food are important in consumption decisions in these environments as shown by consistently high empirical estimates of price elasticities. For example, Tafere et al. (2010) used variation in prices to estimate to what extent consumption patterns change with changing prices, based on the national consumption survey of 2005. They found that most price elasticities were close to -1.0 suggesting that a 10 percent increase in prices would lead to a 10 percent decrease in consumption. Tafere and Worku (2012) followed a similar methodology to estimate price elasticities for ASF products. They found that price elasticities for beef and dairy products as high as -0.73 and -0.67 respectively. These estimates imply that the price increases seen in the last decade in the country would have led to decreases in per capita consumption of beef and dairy products of almost 25 percent, holding other things constant, when we compare the end to the beginning of the decade.

The findings have important implications for policy. There is increasing emphasis on behavioral change communication to stimulate the adoption of more diverse diets in these settings. While these investments are important, households, however, also should be able to afford these more nutritious, but also more expensive, foods. While Ethiopia has done rather well in improving cereal production in the country and keeping prices of cereals stable, these higher priced foods that might be good for nutrition – as well as for farmers' income – have received relatively limited attention by government and development partners. Relative to the rapid growth in crop output and productivity recorded in the last decade, livestock and ASF output grew slower and productivity stagnated such that their share in agriculture production overall consistently declined (Negassa et al. 2017). This neglect should be addressed to stimulate further agricultural and nutritional transformation in the country.[20]

[19] Retail powdered milk prices in 2016 were around 16 USD per kg. Assuming a typical 6.5 liters of liquid milk out of a 1 kg of powdered milk, this would imply a price of 2.5 USD per liter, significantly above the local unpasteurized (at less than 1 USD/l) as well as pasteurized (at just over 1 USD/l) milk prices.

[20] Unlike development policies in the last two decades, the current Growth and Transformation Plan II (GTP-II) provides more focus on livestock production and also includes reduction of undernutrition as one of its targets. Under GTP II (2015/16-2019/20), the Ethiopian government targeted the reduction of stunting levels in young children from 40 percent in 2014/15 to 26 percent in 2019/20 (National Planning Commission 2016). Furthermore, improving dietary diversity is one of the focus areas of the Agricultural Growth Program-II (2015/16-2019/20) and is one of the four outcome indicators for the Program (Ministry of Agriculture and Rural Development 2015).

Exploring the exact reasons for the increases of livestock and ASF prices should be fertile ground for further research. Several hypotheses can be forwarded. First, adoption of modern practices is low. For example, yield levels of livestock are low because of the low adoption of artificial insemination, lack of improved breeds, and bad feeding practices. Production has not kept up with the increasing demand for ASF from an increasingly better-off population in some pockets of Ethiopia, leading to such price increases. Second, crop land cultivation has expanded rapidly in Ethiopia. The increasing land pressure might have led to less land being available for (cheaper) grazing and subsequently to the adoption of more expensive purchased feeds. These higher production costs are then reflected in higher livestock and ASF prices. Third, rural wages are rapidly increasing in rural Ethiopia. This, combined with the lower availability of youth that often tend the animals of a household – as they are increasingly enrolled in schools – might also have led to higher costs for keeping animals. Fourth, better road and information infrastructure as well as closer links with rewarding export markets might have contributed to general price rises in the livestock sector. International trade and price movements in destination markets should be looked at as they might have driven some ASF price increases in Ethiopia. However, it should be noted that non-traded ASF showed similar increases. Unraveling the contribution of each of these factors through further research will help better design of policies in this area with the purpose of making ASF more affordable – especially so for the poorer population.

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