REAP Research for Ethiopia's Agriculture Policy

ANALYTICAL SUPPORT for the ATA Led by IFPRI

The Barley Value Chain in Ethiopia

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RESEARCH FOR ETHIOPIA'S AGRICULTURE POLICY (REAP): ANALYTICAL SUPPORT FOR THE AGRICULTURAL TRANSFORMATION AGENCY (ATA)

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DISCLAIMER

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1. Introduction

1.1 Background

Ethiopia is the second largest barley producer in Africa, next to Morocco, accounting for about 25 percent of the total barley production in the continent (FAO, 2014). Ethiopia is also recognized as a center of diversity, as its barley germplasms have global significance because of improved traits, including disease resistance (Vavilov, 1951, Qualset, 1975, and Bonman et al., 2005). Unlike in industrialized countries where barley is mainly used for animal feed and malting, it is one of the staple food crops in Ethiopia, accounting for 6 percent of the per capita calorie consumption. It is also important in terms of the lives and livelihood of small farmers. In the 2013/14 *meher* season, about 4.5 million smallholder farmers allocated more than 1 million hectares of land (12 percent of total cereal area) to barley cultivation. Corresponding barley production was about 2 million tons, equivalent to 10 percent of the total cereal production in the country (CSA, 2014).

Although barley is not among the top cereal crops in Ethiopia, its importance is rapidly growing in terms of production, potential for poverty reduction, as well as for the country's coffers and the current balance of payment situation. Between 2003/04 and 2013/14, the number of smallholders growing barley increased from 3.5 million to 4.5 million; yields increased from 1.17 metric tons per hectare to 1.87 metric tons per hectare; and total production grew from 1.0 million tons in 2005 to about 1.9 million tons in 2014 (CSA, 2005; CSA, 2014). However, Ethiopia produces mostly food barley, with its share estimated to be 90 percent (Alemu et al., 2014), and remains significantly deficient in malt barley. As a result, while the country has generated a surplus of food barley and has consistently exported a small amount, the net import bill for malt barley jumped from US$240 thousand in 1997 to US$40 million in 2014. If this trend continues, Ethiopia's barley import bill could be as high as US$420 million by 2025. Given the country's balance of payment situation in recent years, this is an alarming trend. On the other hand, if farmers can cost effectively grow malt barley to meet the rapid growth in domestic demand, their livelihoods could be significantly improved.

There are several reasons to be optimistic about the potential gains from an increase in production of malt barley. **On the demand side, historical evidence suggests that consumption patterns change when incomes increase.** Dietary patterns become diversified, and one element of this diet diversity is an increased consumption of alcoholic beverages. Producing such beverages has historically been part of Ethiopian tradition. The level of consumption, however, has remained significantly lower than the neighboring countries. For instance, per capita beer consumption in Ethiopia is about 4.0 liters, which compares with 11.0 liters in Kenya, 9.5 liters in Uganda, and 55 liters in South Africa (FAO, 2011). This has started to change over the last decade as the economy has begun to grow. Ethiopia has experienced one of the fastest increases of beer consumption in the recent years, with consumption growing by as much as 90 percent between 2002 and 2011 (FAO, 2014).

This growth in demand is evident in two ways. First, the industry has responded to growing demand by expanding their scale of operation. The government invited two of the world's largest breweries (i.e., Heineken and Diageo) to set up operation, and more pilots are underway to

promote production of malt barely.[1] For instance, the Dashen Brewery, one of the holding companies in the country, is quadrupling its production capacity (from 1 million hectoliter to 4 million hectoliter) and exploring options for domestic sourcing. Similarly, other breweries are also trying to develop their own value chain. Second, there is now growing evidence that, with an increase in income, households are switching from domestically brewed beverages (e.g., Tella and Areki) to bottled beer. Since traditional beer is sorghum and other grain based, and the bottled beers are barley based, this has further accelerated the demand for malt barley.

On the supply side, there is a high potential for increasing productivity through improved farm practices and the application of modern inputs. In the 2013/14 meher season, Ethiopian farmers applied almost a million tons of fertilizers on cereal crops with of which only 44,465 tons (44 kgs/ha) applied to barley, compared to 219,596 tons (73 kgs/ha) for wheat and 162,295 tons (101 kgs/ha) for *tef*. Second, barley has received far less attention from both national and international research organizations. The CGIAR began working on barley in the 1980s when the International Center for Agricultural Research in Dry Areas (ICARDA) was mandated to include the crop into its research portfolio. Despite funding constraints, the Ethiopian Institute of Agricultural Research (EIAR) and ICARDA worked together to develop a number of varieties for different agro-climatic conditions.[2] Most of these new varieties, however, have remained on the shelf or have been limited to a few trials (Mulatu and Lakew, 2011). Despite the development of a number of varieties "arguably" suitable for various agro-climatic conditions, more than 80 percent of barley production has been confined to only two regions, Amhara and Oromia. Finally, despite a 5 percent average yield growth per year; the gap between the potential and actual yield in barley remains vast, reaching more than 200 percent for some varieties.[3]

Therefore, **the gains from promoting barley in general and malt barley, in particular can be high in terms of its demand and supply prospects**. Productivity can be enhanced by promoting on-the-shelf technologies with minor tweaks or adaptation; and given the current trend domestic demand is unlikely to slow. Therefore, there is a unique opportunity to promote domestic value addition, agro-industry development, and nonfarm income generation—all of which are important elements of a successful economic transformation (Haggblade, et al., 2009). The government recognized this fact and requested that the Ethiopian Agricultural Transformation Agency (ATA) develop a strategy to support higher production in the barley subsector. As input for that strategy, ATA requested IFPRI to undertake a study on the barley value chain in the summer of 2014. This report is the outcome of that request.

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[1] For instance, malt and brewing factories are closely working with producers, cooperatives, traders, and bureau of agriculture on promotion of malt barley varieties in North Shewa, Arsi, and North Gondar.

[2] Since the inauguration of Holetta Research Center, a center that focus on barley research, the national research system released 50 new varieties of which only 8 were malt varieties, but the rest are food barley (Mulatu and Lakew, 2011).

[3] In one of the EIAR experiment in 2005/06 season, gross yield were more than 4 tons/ha for four major malt varieties (i.e., Beka, Holker, HB51, and HB120). IBON 174/03, EH1847, Bekoji-1, and Misccal-21 are among the barley varieties under production with a yield potential of up to 5 tons/ha (National Varity Registers, Various Years).

1.2 Objectives

The broad goal of the study is to identify policy options to address the bottlenecks in the barley value chain. We analyzed the value chain from input supply and production to the terminal market and consumption across the four main regions of Ethiopia. The following sub-objectives were articulated in the ATA's original TOR:

- Understand the production, area, and yield growth of barley compared to other major cereals. This includes examining the extent of modern input use and access to extension services by smallholder barley producers.
- Map the major market routes of barley from local to terminal markets, while also exploring the market infrastructure in terms of aggregation and storage, access to markets, processing and value-addition, and distribution (i.e., wholesaling and retailing).
- Examine the proportion of production marketed by smallholder barley producers and the main challenges that deter the growth of marketable surpluses (i.e., the main challenges to increasing marketable surpluses as well as expanding the market infrastructure to handle and promote a significantly higher volume and value of barley flow to the market), if any.
- Identify the major actors in the barley value chain and their respective market requirements in terms of quantity and quality. Examine the margins of smallholder barley producers and other value chain actors.
- Identify the obstacles that have prevented a competitive barley sector relative to imports (i.e., an analysis of comparative advantage).

The research presented is complemented by a synthesis that prioritizes the enablers, incentives and other interventions required to address the main challenges across the barley value chain in the short-term and beyond.

1.3 Organization of the report

The rest of the report is organized as follows. Section 2 provides a brief description of the data and methods, and is followed by Section 3, an overview of the policy evolution and changes in the barley value chain. The results of the study are presented in Section 4, and the paper concludes with a summary of the key results and their policy implications.

2. Data and Methods

2.1 Data

The study relies on various sources of data: three survey data sets from the Central Statistical Agency (CSA), the ATA baseline survey, and a large amount of secondary data. Also, we conducted a rapid reconnaissance survey with Focus Group Interviews to triangulate the results from the available data and to understand the value chain better.

The three CSA data sets that were used in the study are (i) two rounds of the Ethiopian Agricultural Sample Survey (AgSS); (ii) Ethiopian Rural Socioeconomic Survey (ERSS), (iii) the

Household Income, Consumption and Expenditure (HICE) survey. The AgSS survey, which has a sample size of more than 40,000 households and is administered by the CSA annually, is the largest dataset on private peasant holdings in Ethiopia. This study uses the dataset to examine various indicators in barley production such as trends in land use, modern inputs (seeds and fertilizer) use and to understand crop use patterns over several years. The second survey is the ERSS conducted jointly by the CSA and the World Bank as part of the Living Standard Monitoring Survey (LSMS). This data set is used to generate information on post-planting and post-harvest activities including market surplus and the pattern of market participation. The information generated from ERSS survey data were also used to triangulate the figures on the extent of use of different inputs and farm management practices and crop use from the AgSS. Finally, HICE is another large data set that is nationally representative, conducted every fifth year, with a sample of 28,000 households in both urban and rural areas. In this report, HICE data are used to analyze the consumption pattern of barley and various barley products by location and types of households.

In addition, the research team conducted a rapid reconnaissance survey in October 2014 to collect primary information on research and extension, input distribution, production, storage, marketing, and processing of barley. The reconnaissance survey covers five major food and malt barley-producing zones in Oromia and Amhara regions (Arsi, Bale, North Shew in Oromia; and North Gondar and West Gojjam in Amhara). The zonal level estimates by the CSA indicate that these survey sites represent about 32 percent of the total barley production in 2013/14 meher season. During fieldwork, the research team conducted focus group discussions and key informant interviews with actors at different levels in the barley value chain (inputs suppliers and farmers in the upstream, the assembler and whole seller in the midstream and processors in the downstream). The fieldwork included 6 focus group discussions (10 barley producers in each discussion), 10 barley traders (8 at district level and 2 at terminal markets), 2 primary grain marketing cooperatives, 2 cooperative unions, 2 malt factories, 2 breweries, 1 regional seed enterprise, and 2 regional agricultural research institutes.

2.2 Methods

We employed different methods to address the stated objectives. For characterization and a general overview, we used survey data to generate descriptive statistics, which were further triangulated with focus group interviews. We also used Geographic Information System (GIS) analysis to demonstrate the spatial patterns and market surplus. Regression analyses were used to identify determinates of marketable surplus.

The comparative advantage of malt barley was assessed by using a policy analysis matrix (PAM) proposed in Monke and Pearson (1989). The construction of PAM is based on detailed information collected through in-depth surveys in two major barley growing regions in Ethiopia (i.e., Arsi and North Gondar). By using PAM, we were able to generate several comparative advantage indicators including Domestic Resources Costs, Effective Protection Coefficient (EPC), as Social Costs Benefits Ratios (SCBR). More information on the methods and interpretation are provided in the relevant sections of the report.

3. Overview of the Subsector

There have been considerable changes in the production and marketing of barley worldwide. Despite growth in barley productivity by about 20 percent worldwide over the last decade, the world barely production grew, on average, by one percent during the same period, due to competition for agricultural land with other high-value crops. The total area of cultivated land for barley contracted by about 10 percent over the last decade. In terms of geography, five regions produce about 75 percent of the world's barley production – the European Union, Russia, Ukraine, Australia, and Canada accounting for 43, 14, 7, 6, and 5 percent of the global barley production, respectively (USDA, 2014; McFarland, 2014).

Demand for barley has been steady and is estimated to increase significantly in the next few years. For instance, estimates by USDA (2014) indicate a 14 percent, on average, export growth per year during the last decade. The world industrial and feed use of barley, which accounts for close to 90 percent of the total consumption[4], is also projected to rise by 1.9 percent per year (IGC, 2014). In particular, demand for malt from brewing industries dominates the industrial consumption and has shown strong growth in developing economies.

In terms of marketing, major malt producers are becoming more and more integrated with the grain trading businesses and producer organizations (FAO, 2009). Contract production and farming is another development that offers malting industries a secure source of supply of high quality barley with specific varieties and a price premium over high yielding food and feed barley for producers (Boland and Brester, 2006; Brester, 2012). Another striking phenomena at the malting industry level has been the international consolidation of firms (in the form of merger and acquisition), which enable processors to take advantage of synergies, economies of scale, and market share (Buschena and Gray, 1999; Ascher, 2012; FAO, 2009).

Africa, too, shows a promising trend: despite a decline in acreage, there has been significant growth in barley production due to impressive growth in yields, averaging about 4.08 percent per year in the past ten years (FAO, 2014; USDA 2014). Similar to the global scenario, market shares of barley in Africa are concentrated in three countries—Morocco, Ethiopia, and Algeria—accounting for 87 percent of the total barley production in the continent. Nonetheless, the region still heavily relies on imports to satisfy its growing domestic demand, especially for malt barley[5]. Analysis of FAO database suggests that Africa's barley and malt import grew by about 5 percent and 9 percent per year, respectively, between 2002 and 2011. Despite being one of the top three barely producing countries, Ethiopia's barley value chain appears to have substantial potential for improvements and, given growing local demand, harnessing this potential will have a lasting impact on improving the well-being of smallholder farmers.

4. Results

The results section covers the analysis of the barley value chain at upstream, midstream, and downstream levels. At the upstream level, we describe the trends in barley production, including

[4] In 2012/2013 barely used for feed, industries, and food accounts 65, 22, and 5 percent of the total production, respectively (IGC, 2014).

[5] The production share of the continent was limited to 5 percent in2013 (FAOSTAT, 2014).

area occupied and yield. At midstream we: (i) assess the extent of barley marketable surplus in the country and map and describe marketing channels and outlets; (ii) examine the development of market infrastructure; and (iii) estimate the margin of the main value chain actors for malt barley from production to processing. At the downstream level we analyze the current and upcoming processing capacities of malt factories and breweries. We also describe the consumption patterns of barley and barley products. Lastly, we examine the comparative advantages and distortions of malt barley production incentives in Ethiopia.

4.1 Barley production and productivity

Area and production

As indicated above, Ethiopia is the second largest producer of barley in Africa next to Morocco, accounting for about 26 percent of the total barley production in the continent. In 2013/14, about 4.5 million smallholder farmers grew barley on more than 1 million meher hectares of land. The total production has been increasing steadily over the past decade— it has increased from 1.1 million metric tons in 2003/4 to 1.9 million tons in 2013/14, which is equivalent to an annualized growth rate of 6 percent per year. The growth in production appears to have been driven largely by yield growth, as yield growth (about 5 percent) is far larger than the area growth of 1 percent during the same period (Table 1 and Table 2).

However, the barley sub-sector continually falls far behind other major cereals. The average annual production of barley over the last decade is estimated at 1.5 million tons, which is less than half of other major cereals (Table 1). In terms of volume, the share of barley in total cereal production has dropped from 12 percent in 2003/4 to only 9 percent in 2013/14. Similarly, of the total land allocated to major cereals, the share of barley has declined from 13 percent in 2003/04 to only 10 percent in 2013/14. Furthermore, barley has experienced the least yield growth during the same time. These numbers point to the fact the barley has received far less attention compared to the other major cereals, especially *tef*, maize, and wheat.

Table 1 Average cereal production, areas covered and yield, by crop, (2003/04 - 2013/14)

Crops	Production (million tons)				Area cultivated (million hectares)				Yield (tons)			
	2003/04	2013/14	Average (2003/04 - 2013/14	AGR (%)	2003/04	2013/14	Average (2003/04 - 2013/14	AGR (%)	2003/04	2013/14	Average (2003/04 -2013/14	AGR (%)
Cereals	9.006	21.584	15.009	9.1	7.0	9.85	8.79	3.5	1.29	2.19	1.68	5.4
Tef	1.677	4.419	2.971	10.2	1.99	3.02	2.51	4.3	0.8	1.47	1.16	6.3
Barley	**1.08**	**1.908**	**1.512**	**5.9**	**0.92**	**1.02**	**1.01**	**1.0**	**1.17**	**1.87**	**1.49**	**4.8**
Wheat	1.614	3.925	2.685	9.3	1.11	1.61	1.47	3.8	1.45	2.45	1.80	5.4
Maize	2.543	6.492	4.303	9.8	1.37	1.99	1.76	3.8	1.86	3.25	2.40	5.7
Sorghum	1.742	3.829	2.884	8.2	1.28	1.68	1.59	2.8	1.36	2.28	1.78	5.3

Source: Authors' compilation based on CSA-AgSS reports (2003/04 – 2013/14).
Note: AGR=Annual Growth Rate.

Moreover, there is a significant annual fluctuation in barley area and production. According to one measure of variability, the coefficient of variation, barley area and production over the last decade is 25 percent and 40 percent, respectively. The estimates of production become lower if we use Cuddy-Della-Valle (CDV) method of variability, which accounts for unusual fluctuation to smooth the estimate.[6] However, even by this measure, the variability of barley production and the area is substantially high. Across regions, SNNP faces a relatively higher variability in both barley area coverage and production compared to the other three main regions (Table 2).

Table 2 Variability in barley production, areas covered and yield, by region (2003 -2013)

		Measure of Variability (2003-2013)		
	Mean	Annual Compound Growth Rate CGR (%)	Coefficient of Variation (CV)	Cuddly La Valle Index (CDV)
Area cultivated ('000 Ha)				
Tigray	96	2.81	0.35	0.34
Amhara	349	0.93	0.29	0.29
Oromia	483	0.70	0.29	0.29
SNNPR	83	1.96	0.38	0.37
National	1,014	1.14	0.25	0.25
Production ('000 Mt)				
Tigray	130	7.61	0.52	0.32
Amhara	451	5.42	0.38	0.32
Oromia	769	5.61	0.42	0.31
SNNPR	113	6.25	0.55	0.46
National	1,473	5.72	0.40	0.21
Yield (Mt/Ha)				
Tigray	1.35	4.67	0.48	0.30
Amhara	1.29	4.45	0.34	0.22
Oromia	1.59	4.88	0.40	0.15
SNNPR	1.34	4.20	0.41	0.26
National	1.45	4.53	0.38	0.08

Source: Authors' compilation based on CSA-AgSS reports (2003-2013).

As shown in Table 2 and Figure 1, there are also spatial variations in barley production and area coverage. Most of the barley productions take place in the highlands of the Oromia and Amhara regions. From 2003-2013, these two regions accounted for about 83 percent of the total barley production (52 percent in Oromia and 31 percent in Amhara). While Tigray and SNNP region represent only 9 and 8 percent of the total barley production, respectively, these regions are experiencing relatively higher growth rates (Table 2). Higher growth rates of production in Tigray and SNNP region are mainly associated with expansion of barley areas over the past ten years—

[6] The coefficient of variation (CV) is calculated by dividing standard deviation of a variable by its mean. However, variability measure this way is biased upward if there is a trend. The Cuddy-Della-Valle index measures the coefficient of variation around the trend. It can be calculated as $CV*(1-R^2)^{0.5}$, where R^2 is the correlation coefficient between the variable and a time trend. The CDV index is a better measure of variability in variables with a trend.

the growth rate of area occupied by barley in these two regions are 2.81 percent and 1.96 percent per year, respectively. These are far higher than the growth rates of 0.7 percent in Oromia and 0.93 percent in Amhara (Table 2).

The regional-level estimates mask much of the heterogeneity of the production system across space. To explore this dimension, we used the Agricultural Sample Survey of the Central Statistical Agency (CSA) to estimate barley production at smaller geographic locations and carried out some GIS analysis. Figure 1 presents the results. The method of constructing Figure 1 is simple and was implemented in two steps. First, *woreda*-level barley productions are estimated using AgSS data. These estimates are then used to generate the map: for every 800 tons of barley production, one dot is placed in the woreda. Although the position of the dots within the woreda is random, the densities of dots are an accurate representation of the concentration of barley production in the country. For further illustration, the top 24 barley producing woredas are shown with black borders and listed on the map.

Figure 1 conveys some important messages. First, the woreda-level production estimates that have been mapped indicate that barley production is concentrated in a handful of woredas in the highlands of Oromia and Amhara regions. Twenty-three out of the top 24 top woredas are located in these two regions. More importantly, most of the woredas are from Arsi-Bale and West Shewa zones of Oromia region and North Shewa and North Gondar zones of Amhara region. While Tigray has one woreda among the top 24 (in Southeast Tigray), there are no woredas in the top 24 from SNNP. Second, roughly 33 percent of the total barley production, and perhaps the bulk of the marketable surpluses, are generated in these 24 locations. Finally, the landscape portrayed in Figure 1 begs a serious policy and strategy question: should efforts to promote barley be concentrated in the high potential areas or should they be expanded to less favored areas? According to existing literature, there is support for both arguments. Arguments that favor investment in high-production zones cite several advantages: higher rates of returns in crop production, lower food prices, and higher economic growth, which all come at a lower cost than in less-favored areas. Faster economic growth, in turn, leads to more employment and higher wages nationally. This argument forms the basis of agricultural development led industrialization.

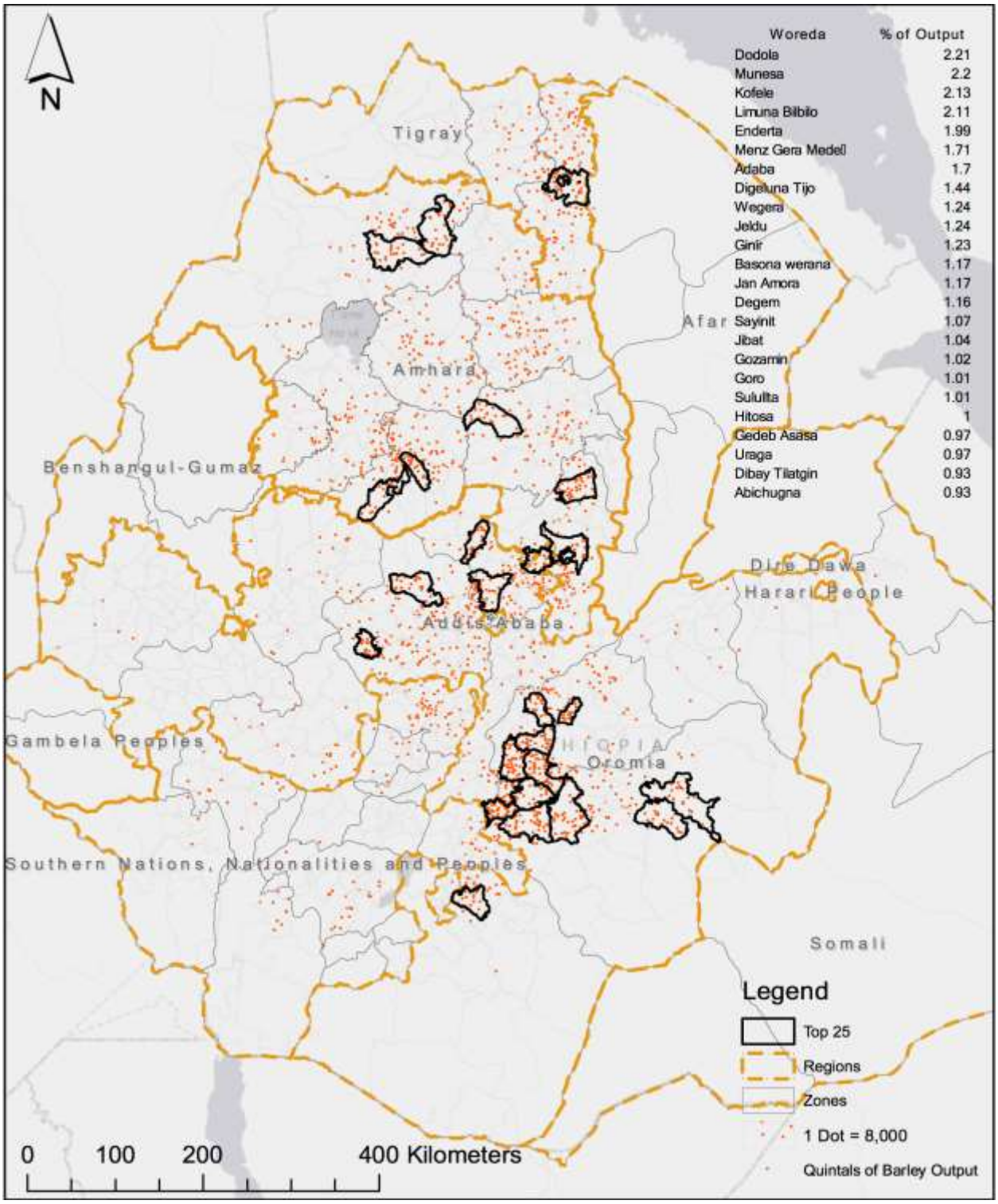
However, recent studies from India and China suggest that marginal returns to public investments in less-favored areas are in fact higher than the high potential areas. To be specific, results reported in Fan and Hazell (2001) suggest that the marginal impact of High Yielding Varieties (HYVs) on production is much larger in high— and low—potential rain-fed areas (Rs. 243 and 688 per hectare of HYVs adopted, respectively) than in irrigated areas (Rs. 63 per hectare). Investments in roads in the less-favored areas also have a high payoff in terms of poverty reduction. For example, marginal impacts of public investment in roads in less-favored areas of India can lift 9.5 persons out of poverty—much higher than the marginal effects in the high potential areas where the marginal impact is only 1.53 people (Fan and Hazell, 2001, table 2). The example from China shows similar results, although the magnitudes are much different. The study concluded that

> "… results reported here for India and China suggest that investments in rural infrastructure, agricultural technology, and human capital are now at least as productive in many rain fed areas as in irrigated areas, and they have a much larger impact on

> poverty. These results raise the tantalizing possibility that greater public investment in some low-potential areas could actually offer a win-win strategy for addressing productivity and poverty problems…"

Clearly, the Ethiopian context varies considerably from that of India and China. However, given this study and the implications of Figure 1, ATA should pay attention to these considerations in adopting new strategies, especially if food security and poverty reduction are core pillars of its strategy.

Figure 1 Spatial distribution of barley production and the top barley producing woredas



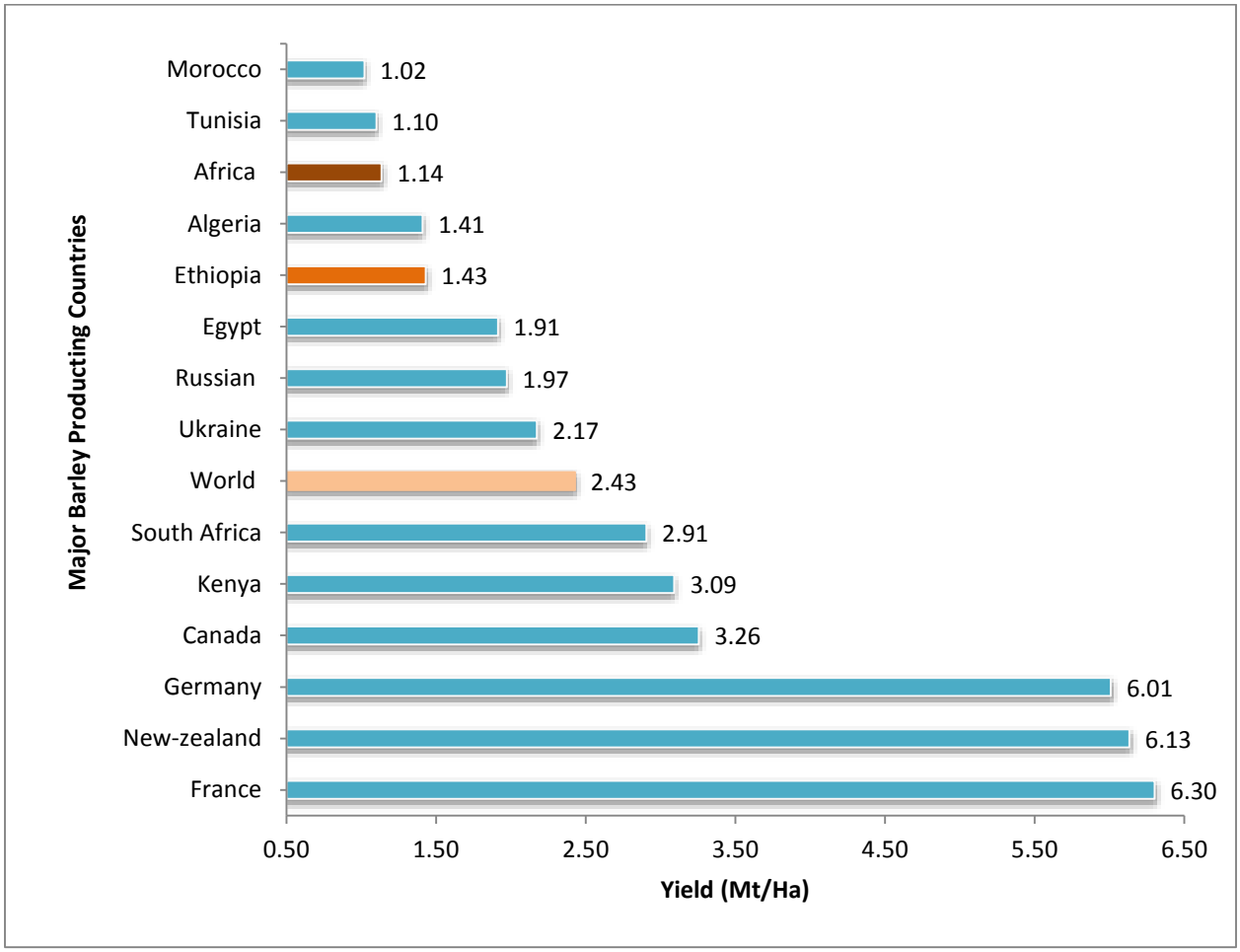
Source: Authors' analysis based on data from the 2012/13 Agricultural Sample Survey.

Yield and yield constraining factors

Discussion in this section is divided into two broad themes: (i) potential for yield growth and (ii) constraints to yield growth.

The analysis of cross-country historical data clearly shows **that there is a high potential for enhancing barley productivity in Ethiopia**. At the very aggregate level, while barley yields in Ethiopia are greater than that of the continent-wide average, its average yields are significantly behind Kenya and South Africa and far behind much of the developed world (Figure 2). During the past decade, barley yields in Ethiopia have averaged 1.43 tons, which is less than half of barley yields in both Kenya (3.26 tons /ha) and South Africa (2.93 tons/ ha). In high-performing countries of the developed world—such as France, Germany and the Netherlands—average barley yield is over 6 tons per hectare. Thus, despite recent growth in the sub-sector, barley yields in Ethiopia remain significantly lower than global and regional averages.

Figure 2 Average barley yield in Ethiopia, compared other countries averages



Source: FAOSTAT (http://faostat3.fao.org/download/Q/QC/E).

The current productivity level presents both opportunities and challenges. There are reasons to be optimistic because the average yield in 2014 (1.87 tons /ha) was far below the yield achieved (4 ton/ ha)[7] in research station trials. Increasing yield to 3 tons per hectare (Kenya has achieved higher rates) can result in a host of benefits to the country. Such an increase in yield can potentially make the country a net exporter, improve farmers' income, generate local employment, and reduce pressure (over mining of soil nutrients) on the land. The second reason to be optimistic is that Ethiopia exhibits large spatial variations in barley yields. For instance, in the 2013/14 meher season, average barley yields in Oromia were 2.17 t/ha, which is 16 percent higher than the national average and much higher than the yields in other regions in the country. This result is particularly strange because such large variations have not been observed in research stations across the country. Therefore, understanding the underlying causes of such variations and taking appropriate measures could boost barley production in the country.

Why is there such a large yield gap? There are several reasons. First, **barley farmers in Ethiopia have not fully adopted modern inputs like fertilizer and modern seeds that help boost production** (CSA, 2014; Mulatu and Lakew, 2011). This is evident in Table 3, which shows that from 2003 to 2013 on average, two third of the barley growers did not apply any fertilizer to their plots. Even though more barley farmers have started to use fertilizer in recent years (42 percent in 2014), the rate is far below all other cereals except sorghum. Second, a similar trend is observed in fertilizer application rates (dosage). On average, barley growers applied only about 30 kilograms of fertilizer, which again is far lower than all other cereals except sorghum. Finally, even when only fertilized areas are considered, average fertilizer application rates remain far below the recommended dosage, which also contributes to lower yields. For example, two studies argued that proper application of fertilizer can double barley yields in most of the barley producing regions in Ethiopia (Agegnehu et al., 2011; Abera et al., 2011).

[7] For detail on yield estimate, see CSA, 2014; Alemu et al., 2014; MOA, 2012, 2011, 2010 Animal and Plant Health Regulatory Directorate.

Table 3 Fertilizer application by crop (2003/04 – 2013/14)

Crops	Fertilizer application area (share of total area cultivated, %)				Fertilizer application rate (total kilograms/total hectares)				Fertilizer application rate (total kilograms/total fertilized area, kg/ha)			
	2003/04	2013/14	Average (2003/04 -2013/14	AGR (%)	2003/04	2013/14	Average (2003/04 -2013/14	AGR (%)	2003/04	2013/14	Average (2003/04 -2013/14	AGR (%)
Cereals	33.4	53.1	41.2	4.7	33	64.6	44	6.9	98.9	121.8	107	2.1
Tef	45.9	68.7	56.7	4.1	38.4	72.8	51.3	6.6	83.7	106	90.8	2.4
Barley	**26.7**	**42.3**	**32.7**	**4.7**	**22.9**	**43.6**	**30.5**	**6.7**	**85.8**	**103.1**	**93.4**	**1.9**
Wheat	53.6	73.4	61.9	3.2	57.7	101.1	74.2	5.8	107.7	137.8	121.6	2.5
Maize	30.5	50.8	36.6	5.2	42.2	83.4	54.4	7.0	138.5	164	150.8	1.7
Sorghum	3.3	14.7	6.7	16.1	4.1	12.1	5.9	11.4	124.1	82.8	101.6	-4.0

Source: Authors' compilation based on CSA-AgSS reports (2003/04 – 2013/14).
Note: AGR=Annual Growth Rate.

The **statistics on farmers using modern seed for growing barley is worse than fertilizer use**. Using CSA data, our estimates suggest less than 1 percent (0.6 percent) of barley growers use modern seed varieties—far less than the other cereals except sorghum (Table 4). The shortage of improved barley varieties is associated with both the research system, which is required to generate primary or early generation seeds and the seed enterprises that produce and distribute seeds. For instance, in Amhara region, it was apparent that there is a coordination issue between the regional research institute and the seed enterprise. The research institute indicated that only 1 out of 12 improved varieties were under production. On the other hand, the seed enterprise indicated that there is a severe shortage of basic barley seeds and that they tend to distribute third-generation seeds as improved seed at a small scale. This is reflected by the fact that of the total seed marketed by the regional seed enterprises (RSE); only 4 percent is barley, which compares with 18, 63, and 13 percent for *tef*, wheat, and maize, respectively.

Even though the rates of modern seed use for wheat and maize is higher than barley, the rates remain low relative to other countries in Africa. Recent studies suggest that adoption of modern maize varieties is approaching 100 percent in Nigeria and averages around 67 percent in the Western and Central Africa region (Alene et al., 2009). According to CSA estimates of Ethiopia, presented in Table 4, only about 40 percent of the maize growers and 6 percent of wheat growers used modern seed varieties. However, these estimates may not reflect reality. In Ethiopia, according to official statistics published by the country's statistical agency, only about 4.7 percent of the cropped area was cultivated by improved seeds in 2008, which is also supported by other household survey data (Spielman et al. 2011). However, the study points out that these numbers can be grossly underestimated depending on the how the survey questions are framed. For example, questions in a household survey may ask farmers whether they had purchased improved seeds. However, for improved open-pollinated varieties like wheat, farmers do not necessarily have to purchase seed each season as they would in case of hybrid maize. Other studies on the seed sector in Ethiopia confirm this contention. For instance, Lantican et al. (2005) reported that 71 percent of the wheat area in Ethiopia was cultivated with an improved variety; and 43 percent of the area cultivated under the improved wheat variety used seed released in the past 10 years. Unfortunately, however, we have not come across similar studies on Barley.

Other modern inputs—such as pesticides, extension packages, and irrigation—are also limited in barley production. For instance, from 2003-2013, pesticide and extension package use represented only about 18 and 15 percent of the barley growers, respectively. Given that modern input use heavily depends on access to extension services and information, it is likely that the low use of fertilizer, modern seed varieties, and other inputs can be attributed in large part to the limited reach of the extension services to barley growers. Notice in Table 4 that barley has received less attention than the three major cereals—maize, *tef*, and wheat—that received far higher attention from the agricultural extension services.

Table 4 Cropland area under improved farm management by practice and crop (2003/04 – 2013/14)

Crops	Share of crop area (%)															
	Improved seed applied				Pesticide applied				Irrigated				Extension package covered			
	2003/04	2013/14	Average (2003/04 -2013/14	AGR (%)	2003/04	2013/14	Average (2003/04 -2013/14	AGR (%)	2003/04	2013/14	Average (2003/04 -2013/14	AGR (%)	2003/04	2013/14	Average (2003/04 -2013/14	AGR (%)
Cereals	4.9	10.1	5.9	7.5	12.4	26.1	20	7.7	0.9	0.7	0.9	-2.5	14.1	35.4	20.4	9.6
Tef	0.6	3.1	1.3	17.8	19.8	39.5	30.1	7.2	0.4	0.4	0.4	0.0	15.4	36.4	21	9.0
Barley	**0.4**	**0.6**	**0.6**	**4.1**	**8.4**	**23**	**17.7**	**10.6**	**0.6**	**0.4**	**0.6**	**-4.0**	**11.7**	**21.8**	**14.7**	**6.4**
Wheat	4.1	5.6	4.6	3.2	30.4	47.2	41.1	4.5	0.3	0.4	0.4	2.9	18.4	42.7	27.5	8.8
Maize	20.1	40	23.2	7.1	1.4	5.7	3.5	15.1	2.4	1.4	2.0	-5.2	21.9	52.1	29.1	9.1
Sorghum	0.5	0.2	0.3	-8.8	1.2	9.2	5.7	22.6	0.9	1.0	1.1	1.1	5.5	12.8	5.7	8.8

Source: authors' compilation based on CSA-AgSS reports (2003/04 – 2013/14).
Note: AGR=Annual Growth Rate.

Some studies suggest that there are other factors that limit barley productivity. **Biotic stresses like disease, insect pests, and weed infestations contribute to lower rates of yields in Ethiopia.** Diseases (such as scald, net blotch, spot blotch, and rusts) and insect pests (such as aphds and barley shoot fly) reportedly can cause yield losses of up to 67 and 79 percent, respectively (Negassa et al., 1997; Lakew et al., 1996; Yirga et al., 1998; Sinebo and Yirga, 2002). Yield gains from weed control, on the other hand, ranges from 14-60 percent depending on the location and type of weed (Negewo et al., 2011; Negewo et al., 2006). Nevertheless, the application of pesticides and fungicides is remarkably low (Table 4 and Table 5).

Table 5 Existence of crop damage during planting and post-harvest and causes and preventive actions

Attributes	Tigray	Amhara	Oromiya	SNNP	National
Damage during planting					
Was damage on the field during planting? (Yes, %)	34	43	38	38	40
Percentage share of damage	32	39	19	24	29
Did you take precaution measure to prevent damage (Yes, %)	10	5	47	13	21
Did you use any? (%)					
Pesticide	13	22	7	7	9
Herbicide	69	32	70	99	70
Fungicide	13	14	4	3	5
Damage during harvest and post-harvest					
Was any damage during harvest? (Yes, %)	23	37	36	52	38
Percent share of damage	7	9	9	22	11
Reasons for the damage					
Too much rain	15	8	0	24	10
Too little rain	25	39	48	22	36
Crop disease	0	10	4	4	6
Depletion of soil fertility	20	3	19	8	11
Other*	40	40	29	43	37

Source: authors' computation based on CSA's 2013 Post Harvesting Survey.
Note: * includes reasons contributed to the post-harvest losses as such weeds, floods, animals.

Finally, **abiotic or non-biological stresses like poor distribution of rainfalls in lowland areas and low soil fertility due to soil erosion and poor soil drainage are named as causes of significant yield losses in barley production** (Yirga et al., 1998; Abera et al., 2011). The results reported in Table 5 also indicate that low rainfall and depilation of soil fertility are two of the major causes of yield losses. Crop damage during planting, harvesting, and post-harvest handling is another major abiotic factor that causes significant barley yield losses in Ethiopia (Table 5). In particular, about 40 percent of the barley farmers in the country face crop damage both during planting and post-harvest handling, which causes a yield loss between 11-29 percent. The estimates on post-

harvest losses are found to be consistent with the prediction by the African Post-harvest Losses Information System (APHLIS).[8]

4.2 Storage, marketing, and processing

4.2.1 Storage

Storage plays a central role in improving the value chain of an agricultural commodity. Proper storage with appropriate institutions—such as Warehouse Receipts System—can alleviate farmers' liquidity constraints, reduce price volatility, and improve the well-being of both consumers and producers. In Ethiopia, commodity storage is primitive and similar to most other developing countries, except in the case of cash crops, mainly coffee and exportable pulses. In this section, we present evidence on farm households' storage behaviors using CSA's 2013 Post Harvest Survey data.

Table 6 shows the regionally aggregate results for storage-related variables. Three distinct messages emerge from the analysis. First, while an overwhelming majority of barley growers store their barley, the primary reason for storage is for future consumption, which implies limited commercialization. For example, consider the case of Oromia, where 89 percent of the farmers store their barley immediately after harvest. However, 93 percent of the households reported that the primary reason for storage was for consumption, and the secondary reason was seed (82 percent). Only 14 percent of the farmers reported having stored their barley to sell at a later time for a higher price. At the national level, 92 percent of the farmers reported that the primary reason for storage was for consumption; and the main secondary reason was for seed (81 percent) and future sale (14 percent), respectively.

[8] APHLIS estimate yield losses during harvesting, drying, handling operations, farm storage, transportation at 10 percent (http://www.aphlis.net/?form=losses_estimates&c_id=333#).

Table 6 Ownership of storage facilities and reasons for storage

	Tigray	Amhara	Oromiya	SNNP	National
Did you have the recent harvest in storage (Yes, %)	90	84	89	84	86
Method of Storage					
Unprotected pile	0	0	0	26	6
Heaped in house	6	15	3	5	7
Bags in house	77	28	78	60	58
Metallic in house	0	0	0	0	0
Other in house	17	57	19	9	29
Primary reason for storage					
Household Consumption	98	91	93	88	92
Secondary reason for storage					
Sell at higher price	0	10	14	27	14
Seed for planting	99	86	82	64	81

Source: authors' computation based on CSA's 2013 Post Harvest Survey.

Second, responses to the methods of storage indicate that farmers use very primitive storage facilities. At the national level, no farmers used metallic storage facilities for their cereals; 58 percent of the farmers store their barley in bags on the floor, with the proportion ranging from 78 percent in Oromya to 28 percent in Amhara; and 29 percent use other means of storage within their home. There are several implications for such primitive storage. First, commonly used storage methods expose grain to infestation, quality deterioration, and associated health risks. Second, post-harvest loss can increase significantly due to high storage losses. Finally, **since a large share of grains are stored as seed, seed quality can deteriorate, resulting in low yields in subsequent years**. This is an especially serious concern because only a small fraction of barley growers' purchase certified seeds.

Finally, unless the storage constraints are alleviated, commercialization will not take root and the country will continue to be dependent on barley imports. However, this does not mean that each farmer requires a storage facility of their own to address the liquidity constraints and to reduce market volatility. There can be an alternative institutional mechanism—such as community storage—that can address the farm level constraints. Our analysis of focus group interviews, as well as secondary data, suggest that storage is a pervasive and systemic problem at all levels of the value chain. In most of the kebeles and woredas, the largest storage facilities are owned by the cooperatives; and neither retailers nor wholesaler reported to have large storage facilities. Moreover, many traders reported that grain storage is discouraged by the government. Many studies across the developing world suggest that such interventions are counter-productive to value chain development.[9] While large-scale storage by big traders can theoretically increase market prices, these business practices are practically impossible given the size of the grain markets in the country.

To sum up, there are two policy messages worth mentioning from the discussion on storage:

[9]For further discussion on the topic, see Rashid et al., 2008 and Timmer, 1988.

- One, **storage is a serious constraint in Ethiopia's grain markets in general and malt barley in particular**. This constraint is unlikely to be alleviated through market forces, implying that deliberate policy action may be needed. There are some encouraging signs as new investors, such as Heineken and Diageo, are promoting contract farming for local sourcing, but this will only target barley growers, not the general problem in the cereal markets.
- Two, existing public attitudes towards private storage need to change. Instead **private investment in storage should be encouraged and bolstered by appropriate and transparent rules and regulations**.

4.2.2 Marketing

This section covers three aspects of barley marketing. It begins with a discussion of marketed surplus (including determinants of marketed surplus), which is followed by a discussion on actors and the marketing chain. We conclude with a discussion of marketing margins that were estimated by using data from the Focus Group Interviews.

Marketed surplus

We begin this section by presenting some basic estimates of marketable surplus of barley. Two points need to be clarified: (a) there is a difference between marketed and marketable surpluses: while marketable surplus refers to voluntary sales, marketed surplus generally include both voluntary and distress sales; and (b) the estimates presented in this section are marketed surplus, not marketable surpluses.

We present two broad sets of results: (i) an overall characterization of marketed surplus and (ii) spatial distribution of marketed surplus. With regards to overall characterization, we begin by presenting the regional estimates of marketed surplus (measured as the sales as a percentage of total production) in Table 7. Notice that, while there are regional variations, **a tiny fraction (12-13 percent nationally) of the total barley production is marketed**. Furthermore, the share of marketed proportion (not volume) has remained relatively constant over the past decade or so. There are two important apparent implications of these results.

- First, because there are only small amounts of marketed surplus (commercialization) this implies that the barley sub-sector is largely subsistence in nature. Statistics from the CSA reinforce this position showing that home consumption (≈ 64 percent) and seed use (≈ 20 percent) account for more than 80 percent of total barley production in the country (CSA, 2014).

- Second, nationally published statistics on barley are a bit puzzling. Despite steady 6 percent growth in barley production, the share of marketed surplus has remained the same over the last seven years (CSA, 2008; 2014). Since the population growth has been around 2.6 percent, an important question to answer is why has the rate of marketed surplus remained the same?

While there is little doubt about the first implication, the second implication (question) is often considered to be a puzzle by both statistical agencies and policy makers. **We argue that one should use caution when linking production growth and marketed surplus. From a theoretical perspective, an increase in total production does not necessarily have to lead to an increase in marketable surplus, especially given population and income growth factors**. Our estimates suggest, although overall production has grown by 6 percent per year, per capital production growth has only been 2.63 percent. Assuming a per capita income increase of 7 percent, this implies an income elasticity of about 0.4, which is a reasonable estimate in most developing countries (Timmer, 1983; Rashid et al., 2008). Therefore, one can argue that the population and

income growth, leaving the share of marketed surplus constant, subsume the growth in total production.[10]

Table 7 Barley producers' marketed surplus by region

Region	2008/09	2013/14	Average (2008/09-2013/14)
Tigray	10.0	7.3	9.2
Amhara	8.0	8.3	7.9
Oromia	12.5	13.2	12.5
SNNP	19.4	20.5	19.4
National	12.8	12.5	12.3

Source: Authors' compilation based on CSA-AgSS reports (2008/09 – 2013/14).

From a policy standpoint, especially in the context of smallholders' market access, another important aspect is to understand the sources of marketed surplus and the conditions under which smallholders sell their produce. To this end, we analyzed the marketed surplus by farm sizes using results from the AgSS survey. Table 8 presents the calculations and shows that the share of marketed surpluses appears to remain fairly constant across different farm sizes. Our earlier point about the distinctions between marketed and marketable surpluses becomes relevant in this context. In particular, notice that there are small variations in marketed surplus across various farm sizes. The difference between marginal and the small to medium is only about 1.5-2 percent and the difference is marginally statistically significant only with small farmers.

Table 8 Marketed surplus by farm size

Barley plot size category	Proportion of barley growers, %	Average area cultivated, Ha	Share from total barley cultivated area, %	Share from total barley production, %	Percentage share of marketed surplus, %
Marginal (<=.5ha)	87.87	0.15	55.46	52.72	11.48
Small (>0.5 ha <=1ha)	9.34	0.68	27.10	28.61	13.08
Medium (>1 ha <=2ha)	2.50	1.30	13.84	14.86	13.54
Large (>2ha)	0.30	2.84	3.61	3.80	12.35

Source: Authors' computation based on CSA's AgSS data (2012/13). Bold refers that differences with marginal farmers is statistically significant at 10 percent level.

[10] Note that this is only one possible explanation. A fuller explanation would require further analysis. Furthermore, these estimates refers to both food and malt barley, with malt barley occupying a very small share. Since disaggregated marketed surpluses are not reported by the national statistical agency, it is difficult to assess how food and malt barley vary in terms of marketed surpluses. Nonetheless, our focus group interviews suggest that a much larger share of malt barley is marketed. In particular, our survey indicates that malt barley producers market 70-80 percent of their production.

Determinants of marketed surplus

Besides the disaggregated analysis of marketed surplus by farm size, we estimated a regression model to examine the effect of other household demographic and location variables on the proportion of marketed surplus. Table 9 summarizes the results from a fractional logit model on the determinants of the proportion of marketed surplus. Overall, the results indicate that the percentage of marketed surplus is more correlated with spatial variables (i.e., distance to road and region) and wealth of the household as measured by Tropical Livestock Unit (TLU) than household demographics. Farm households residing close to roads and with a relatively higher stock of livestock tend to market a higher fraction of their barley than their counterparts. For instance, ownership of one additional TLU can increase the proportion of marketed surplus by 0.4 percentage points. Much of the variation in the proportion of marketed surplus is explained by the regional dummies at the bottom of Table 9. The numbers indicate that the proportion of marketed surplus by farm households from Amhara, Oromia, and SNNP regions is higher than farmers from the Tigray region by about 4.3, 6.3, and 10.6 percentage points, respectively. Conversely, household and landholding sizes and distance to an agricultural cooperative are not correlated with the proportion of marketed surplus.

Table 9 Determinants of marketed surplus (fractional logit)

	Coefficient	Std. Err.	Marginal effect (dy/dx)	Std. Err.
Sex of HH head (Male=1)	-0.298	0.241	-0.030	0.024
Age of HH head	-0.056**	0.028	-0.003**	0.002
Age square	0.000	0.000	0.000	0.000
HH education				
Primary (<=6 grade)	-0.000	0.163	-0.000	0.016
Middle (<=8)	0.311	0.228	0.034	0.026
Marital status (Married=1)	0.067	0.241	0.006	0.024
HH size	0.004	0.039	0.000	0.003
Landholding size	0.019	0.040	0.001	0.004
TLU	0.042***	0.015	0.004***	0.001
Farm implements (Value)	-0.000	0.000	-0.001	0.000
Distance to road	-0.001**	0.000	-0.000**	0.000
Distance to coop	0.001	0.001	0.000	0.000
Region				
Amhara	0.611*	0.329	0.043*	0.021
Oromia	0.808***	0.314	0.063***	0.020
SNNP	1.172***	0.310	0.106***	0.023
Constant	-1.143	0.738		

Source: Authors' calculation based on ATA baseline data collected in 2012.
Note: High school and above (>=8) is a reference category for education; Tigray is a reference category for the region dummy, and TLU refers to Tropical Livestock Unit.

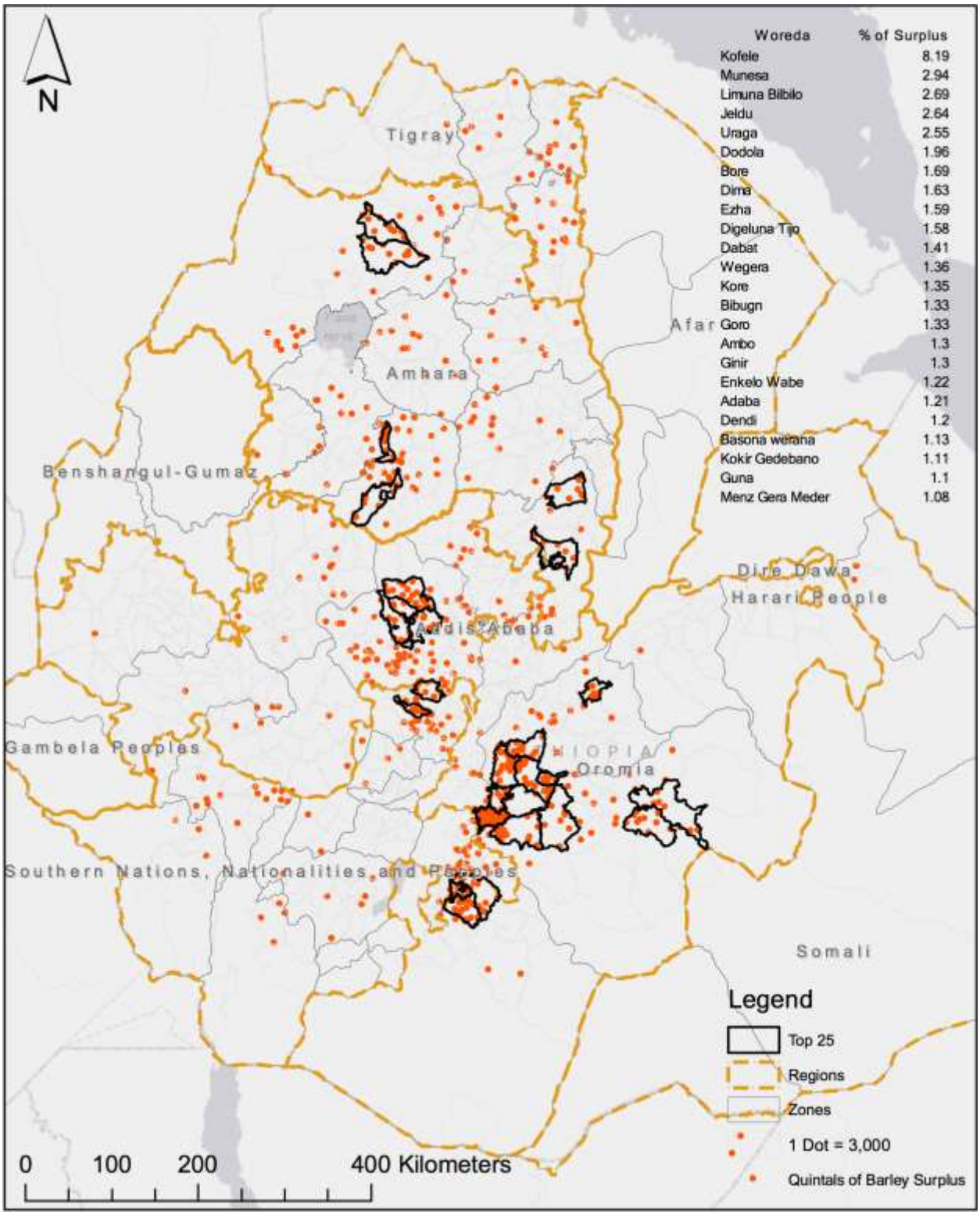
Spatial distribution of marketed surplus

Using aggregate numbers to provide a characterization of marketed surplus only reveals general patterns. For a better understanding of the sub-sector, and to be relevant to the ATA's cluster strategy, we conducted further spatial analysis of the marketed surplus. We adopted a three-step analytical approach with the AgSS data. First, we estimated production and marketed surplus of barley by woreda, and ranked them in ascending order to determine the top 50 woredas with marketed surplus. We then used GIS to map the top 24 woredas (see Figure 3[11]). Consistent with aggregate estimates, the calculations suggest that marketed surplus is concentrated in the Amhara and Oromya regions. However, notice that marketed surplus is only concentrated in a few zones in these two regions.

More specifically, **the woredas with a relatively higher marketed surplus of barley are from zones that are known for their malt barley production and potential**, which include: Arsi, Bale, and West Shewa zones of Ormia region and from North Gondar, East Gojiam and North Shewa zones of Amhara region. Another key point is that the high producing woredas, presented in Figure 2, are not necessarily the generators of high market surplus. Specifically, of the 24 top barley producing woredas mapped in Figure 2, only half belong to the top 24 woredas generating marketed surplus. For instance, while the high producing woredas from South Tigray and South Wollo zones are not equivalently high marketing surplus woredas, low producing woredas from Guji zone reportedly marketed a high proportion of their production.

[11] For every 300 tons of barley marketed, one dot is placed in the woreda. Although the position of the dots within the woreda is random, the density of dots across the country illustrates the areas of concentrated barley marketed surplus. The top 24 woredas in barley marketed surplus are shown with black borders and listed on the map.

Figure 3 Spatial distribution of marketable barley surplus and list of top supplier woredas



Source: Authors' analysis based on data from the 2012/13 Agricultural Sample Survey.

Next, we generated the descriptive statistics of the top 50 woredas by region, and present the results in Table 10. Two points are worth highlighting. First, at the national level, each of these woredas generated about 3,000 tons of surplus; that is, the **top 50 woredas generated roughly 150,000 tons of surplus.** Given that only 12.3 percent of the 1.87 million tons or the total production in 2014 was marketed, total national marketed surplus amounts to about 230,000 tons. In other words, **the marketed surplus generated by the top 50 woredas is equivalent to 65 percent of the total marketed surplus in the country**. Therefore, while there are little signs of commercialization when looking at the aggregate numbers, when we disaggregate the numbers this is not the case. Second, notice that while only 7 out of top 50 surplus generating woredas are in SNNP, these woredas market almost 42 percent of their production, which implies that these woredas are far more commercialized than aggregate public statistics suggest. Although beyond the scope of this paper, this observation raises and important question: what makes these woredas more commercialized than the others? Answering this question can directly fit into the ATA's Agricultural Commercialization Cluster (ACC) strategy.

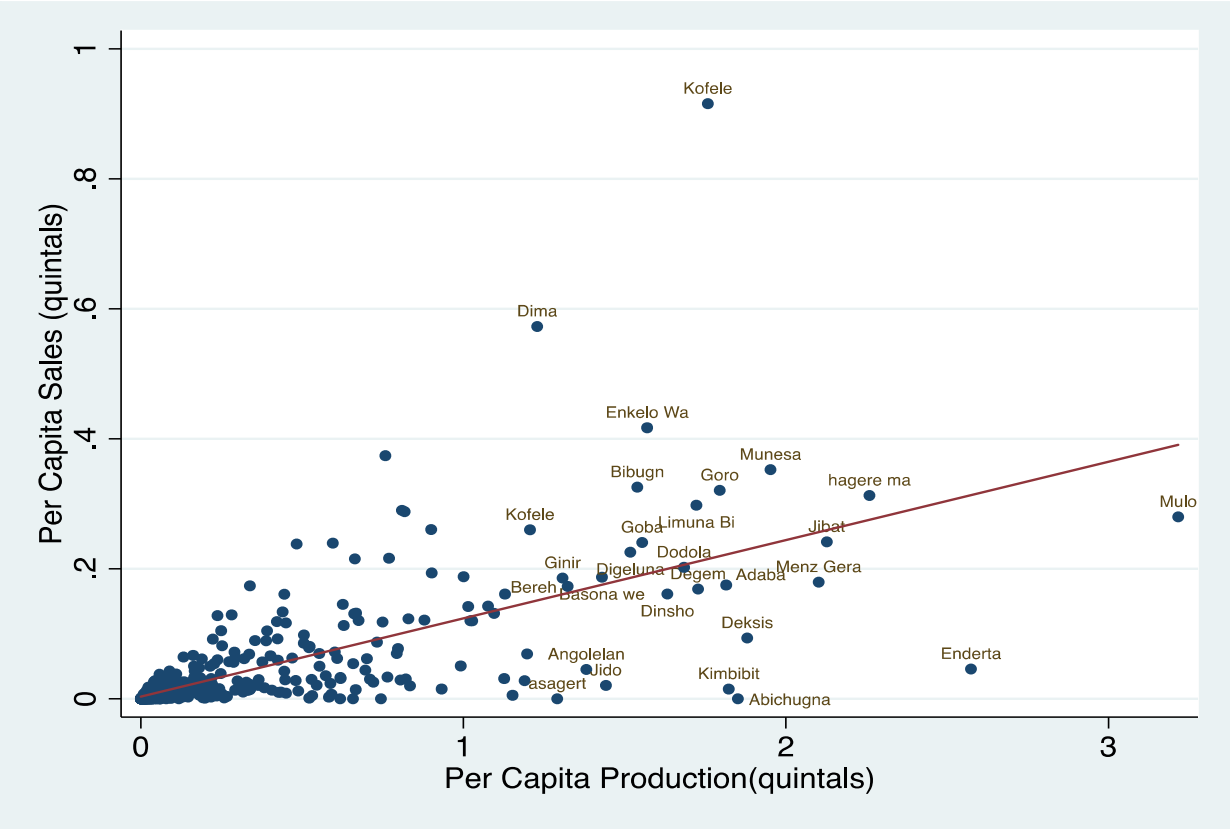
Table 10 Proportion of marketed surplus for the top 50 barley producing woredas

	% of Woredas (among top 50)	Production per woreda (1,000 Mt)	Marketed Surplus per woreda (1,000 Mt)	% Marketed per woreda
Tigray	6	11.7	1.9	16.8
Amhara	30	15.1	2.3	16.6
Oromia	50	17.2	3.8	24.2
SNNP	14	5.0	2.1	41.6
National (weighted)	100	14.6	3.0	23.9

Source: Authors' computation based on CSA 2012/13 AgSS data.

Finally, we plotted per capita production against the marketed surplus and fitted linear regression line (Figure 4). Overall, the figure shows that there is a positive relationship between per capita production and sales. However, there seems to be a wide variation across woredas: **some woredas appear to sell a disproportionately higher share of production, and there are woredas where marketed shares are disproportionately low**. For illustration, consider two woredas from the figure—say Dima and Kimbibit. While barley farmers in Dima sold almost 50 percccent of their production (0.6 out of 1.2 quintals), farmers in Kimbibit sold only small fraction, even though their per capita production is about 1.8 quintal—much higher than Dima. Also, notice that there are some small farmers who market a large share of their crops. However, in these cases, it is not clear whether a higher proportion of sales represents distress sales or actual marketable surplus.

Figure 4 Per capita sales of barley and production of barley by woreda



Source: Authors' analysis based on data from the 2012/13 Agricultural Sample Survey.

Market actors and the marketing chain

Market actors: In Structure, Conduct, Performance (SCP) framework, a principal task of assessing the value chain of a given commodity is identifying the key players and determining their margins. We used two sources of data to accomplish this task. First, we analyzed the 2012 ATA Baseline Survey, which contains detailed transaction information, to identify key actors in the barley value chain. Note that the survey, which was conducted by IFPRI, is only representative at the regional level, but given the richness of the data, we were able to generate some useful statistics. Table 11 displays our main findings. Unsurprisingly, there are wide variations across the regions when determining which farmers sell their barley. However, **at the national level, traders are the single largest actor in barley marketing, handling over 70 percent of the marketed surplus**. Next in line are consumers and farmers, accounting for 17.1 and 10.4 percent, respectively. Most of the sales to farmers consisted of seed, and the consumers are the deficit households in the community.

Table 11 Composition of barley farmers' market clients

	Tigray	Amhara	Oromia	SNNP	National
Farmers	22.7	11.3	4.1	14.3	10.4
Traders	31.8	75.5	81.8	64.9	70.9
Cooperative	0.0	0.0	1.0	0.0	0.4
Consumer	45.45	13.2	12.1	18.2	17.1
Other	0.00	0.0	1.0	2.6	1.2

Source: authors' computation based on the 2012 ATA Baseline Survey.

Note: Other includes local markets outside once kebele's and woreda/district markets.

We drew three key messages from these results. First, small traders (mainly local assemblers, because we used farm-level data) are the main actors in the barley value chain. As the value chain develops, the role of these actors will diminish, and the farmer will have more direct access to the terminal markets. **However, given the current state of the market fundamentals—that is, infrastructure, institutions, and information—these actors perform an important market function, namely product aggregation.** The majority of these traders are also smallholders who conduct commodity trade as a secondary business. Therefore, the surpluses generated through trading ultimately contribute to improving well-being and food security. Furthermore, as we discuss in the next section, these small traders operate very competitively with low margins.

Second, despite heavy public emphasis on farmers' organizations, we found that ***cooperatives appear to play a minimal role in the barley value chain.*** Less than half a percentage of marketed barley passes through cooperatives, which has little influence on the cooperatives revenues. In 2014, 230,000 tons of barley were marketed; and only 920 tons were marketed through a cooperative, the majority of which was malt barley. Assuming a margin of 10 percent and a unit price of 10,000 Birr per ton, cooperatives made about 920,000 Birr or US$46,000, which is miniscule given the size of the market. However, it should be noted that our estimates differ from other available studies. For instance, Bernard et al. (2008; 2010) reported that cooperatives accounted for 5-10 percent of all grain marketing. Another study that foucsed on malt barley found that cooperatives marketed 6 percent of the surplus (Alemu et al. 2014).

Finally, about 10 percent of the marketed barley, equivalent to 23,000 tons in 2014, changed hands through farmer-to-farmer transactions. Because we defined sales to consumers separately these transactions refer mainly to seed sales. This is consistent with our earlier discussion that modern seed use (and hence commercial purchases) is extremely low in the case of barley. Therefore, if the seed sector develops over time, which appears to be a policy focus now, **marketable surplus will further increase through two channels: (i) increased productivity and (ii) reduction in farmer-to-farmer seed sale.**

Marketing chain: Marketing chains vary depending on the infrastructure and other market fundamentals at the location of production. . Secondary data obtained from CSA and other households and market surveys were not sufficient for to provide a fuller depiction of the marketing chain. Therefore, we referred to rapid rural appraisals conducted in late 2014 to fill in

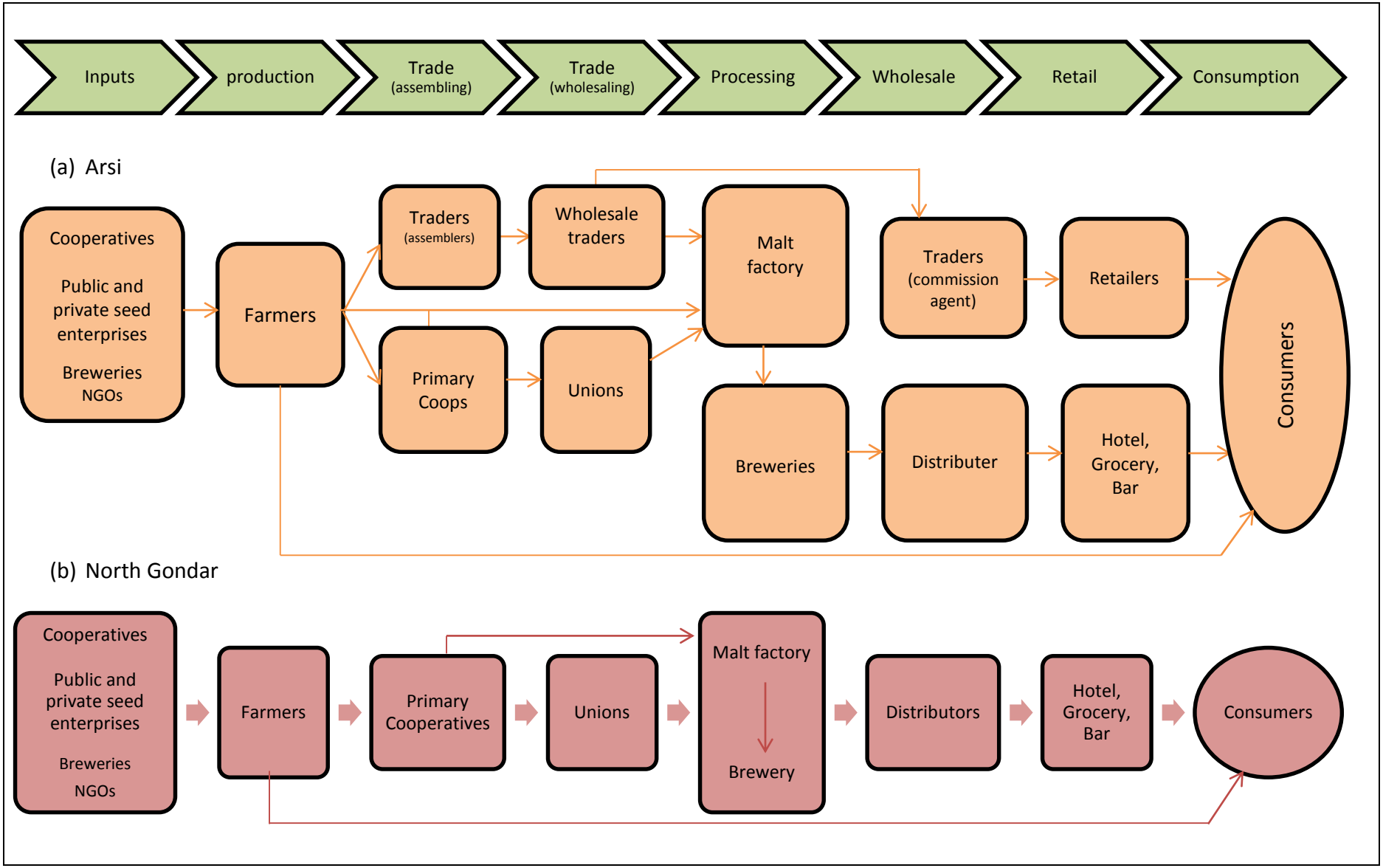
these information gaps. Two zones—Arsi and Gondar—selected for the rapid appraisal appear to vary significantly in terms of barley marketing. While farmers in Arsi produce both food and malt barley and market through cooperatives and traders, farmers in Gondar exclusively market their malt barley through cooperative (see Figure 5a and 5b).

Several insights can be gained by carefully examining the marketing chain depicted in figure 5a and 5b. First, note that a large number of actors are involved at the beginning of the marketing chain, that is, in providing input supplies. In both Arsi and Gondar, there are several government agencies (national research system, seed enterprises), cooperatives, holding companies, NGOs, and private seed companies that are involved in seed marketing. Therefore, it is very surprising that modern input use is so low. A**n obvious implication is that perhaps there is very little coordination among these actors to promote input supplies to the barley growers. Thus, enhancing coordination among actors and streamlining their mandates, if necessary, can contribute towards improving modern input supplies and ultimately enhancing barley productivity.**

Second, in the Arsi marketing chain (Figure 5a), both traders and cooperatives appear and compete in marketing both food and malt barley. This is a bit counter-intuitive given our earlier results that cooperative's share in total marketed volume is small (0.4 percent). Thus, if one relies on the national statistics, a cooperative's share in Arsi would be very small, even though in reality they do engage in trade. It is also not clear whether public support to cooperatives in this instance serve any social or economic objectives—such as, addressing market failures or linking smallholders to markets. There have been significant improvements in infrastructure in the Arsi-Bale area of the country, and the value chain for most commodities have lengthened, with many farmers marketing directly to the terminal markets, such as Addis Ababa. **Therefore, it may be time for the government to re-think the roles that cooperatives can legitimately play in addressing market failures or achieving social objectives.**

Finally, north Gondar is unique in that cooperatives market all of the malt barley (Figure 5b). The case of cooperatives' existence in this context is clear: there are fundamental weaknesses in the infrastructure and product aggregation. As a result, primary cooperatives along with their unions account for more than 90 percent of the malt barley market. Though the market share of cooperatives is relatively smaller in Arsi Zone, home of the oldest malt factory, cooperatives are reportedly preferred marketing channels by malt processors because of the volume and quality they process. Farmers also appreciate the role played by cooperatives in terms of their affect on price and service adjustments in the marketplace. However, as private infrastructure improves and the private sector evolves, the costs of marketing will go down, and the private sector will be able to aggregate, ensure quality, and market directly to the breweries. Therefore, cooperatives will have to improve their efficiency to compete and remain as legitimate market actors.

Figure 5 Value chain map for malt barley in Arsi and North Gondar, Ethiopia



Marketing margin

One of the main challenges in conducting any agricultural commodity value chain is the estimation of appropriate marketing margins. In this study, we attempted to generate these estimates in two zones (i.e., Arsi and North Gondar) using rapid rural appraisal. First we collected detailed farm budget, sales, and other transaction costs through a set of focus group interviews in selected villages in the respective zones. To triangulate this information, we then collected information from other market actors including assemblers, wholesalers, cooperatives, and processors. Subsequently, the results were aggregated at four levels: farmers, assemblers (primary coops.), wholesalers (coop unions), and processing/malt factories. Tables 12 and 13 illustrate the findings for Arsi and north Gondar, respectively.

The results are striking and go against the conventional wisdom that agricultural commodity value chains in developing countries are non-competitive, and that farmers are often exploited. Our estimates suggest that in both Arsi and Gondar, farmers retain the highest share of the final price. In Arsi, farmers net margin is estimated to be 35 percent, which compares with less than 10 percent for assemblers and wholesalers combined, and a little over 18 percent in case of malt factories.

In north Gondar, the estimated margin for farmers is over 36 percent, more than a full percentage point higher than that of Arsi. Also, the margin of the malt factories are lower at about 16 percent[12]. An interesting feature here is that cooperatives' margins (primary cooperatives and unions) are far lower than the margins estimated for the assemblers (primary cooperative) and whole sellers (cooperative union) in Arsi. A primary cooperative in north Gondar earns only 1.9 percent, which compares to over 8 percent in Arsi. By contrast, while a whole seller in Arsi makes only 1.5 percent, a cooperative union in north Gondar makes 2.5 percent. This variation is contrary to available studies on input marketing through cooperatives, where margins are pre-set by the government. For example, in the case of fertilizer marketing, a primary cooperative can earn only US$1.7 per metric tons of fertilizer distributed (see, Rashid et al., 2013 for details on fertilizer marketing). **Therefore, it is surprising that different margins are observed in different locations in case of barley.**

[12] Note that the estimate for Gondar malt factory does not account for the depreciation costs, which essentially overestimate the margins. If margins are adjusted for depreciation costs, the estimated margin is likely to go down further.

Table 12 Distribution of margin and value along the value chain of malt barley in Arsi, Ethiopia

Function	Main actors	Price received (birr/qt.)	Share of the final price (%)	Production or intermediate cost (birr/qt.)	Cost to price ratio (in %)	Net margin (in %)
Production	Farmers	870	54%	Labor: 104 Oxen: 64 Land: 267 Fertilizer: 51 Seed: 80 Total: 566	65.0%	35.0%
Trade (assembling)	Traders (assemblers)	1000	62%	Barley grain: 870 Transport: 35 Un/loading: 8 Sack: 2 Storage: 3 Total: 918	91.8%	8.2%
Trade (wholesaling)	Wholesalers	1035	64%	Barley grain: 1000 Transportation: 10 Un/loading: 5 Sack: 5 Total: 1020	98.5%	1.5%
Processing	Malt factory	1609	100%	Deprecation: 100.31 Barley grain: 1035 Processing cost: 180.52 Total: 1315.83	81.8%	18.2%

Source: Based on primary information collected by the authors 'during October 2014.
Note: the farmers production cost calculation assumes a 72 person days of labor per hectare from land preparation to harvest (40-50 birr per day), 24 oxen days for ploughing and threshing (80 birr per pair of oxen), and 30 quintal per hectare production of malt barley, on average. The price and cost calculation for malt factory is based on 78 percent extraction rate (i.e., a total of 22 percent cleaning and malting loss per quintal) and include depreciation cost.

Table 13 Distribution of margin and value along the value chain of malt barley in North Gondar, Ethiopia

Function	Main actor	Price received (birr/qt.)	Share of the final price (%)	Production or intermediate cost (birr/qt.)	Cost to price ratio (in %)	Margin (in %)
Production	Farmers	1000	65%	Labor: 184 Oxen: 100 Land: 136 Fertilizer: 110 Seed: 107 Total: 637	63.7%	36.3%
Trade (assembling)	Primary Cooperatives	1032	67%	Barley grain: 1000 Storage: 5 Scale: 2 Un/loading: 5 Total: 1012	98.1%	1.9%
Trade (wholesaling)	Unions	1153	75%	Barley grain: 1032 Transportation: 85 Un/loading: 7 Total: 1124	97.5%	2.5%
Processing	Malt factory	1540	100%	Deprecation: not accounted Barley grain: 1153 Processing cost: 136 Total: 1289	83.7%	16.3%

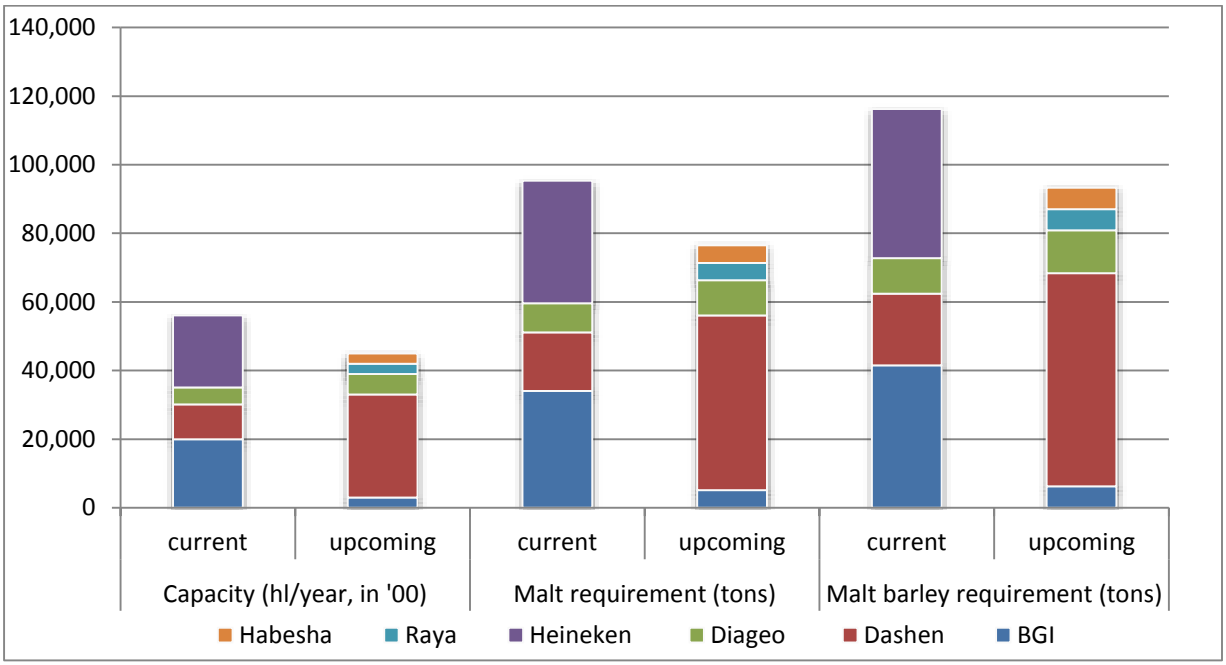
Source: Based on primary information collected by the authors ‘during October 2014.
Note: the farmers production cost calculation assumes a 101 person days of labor per hectare from land preparation to harvest (40 birr per day), 20 oxen days for ploughing and threshing (110 birr per pair of oxen), and 22 quintal per hectare production of malt barley, on average. The price and cost calculation

for malt factory is based on 77 percent extraction rate (i.e., a total of 23 percent cleaning and malting loss per quintal) and include depreciation cost.

4.2.3 Processing

The industry response to increasing domestic demand is well manifested by recent changes in the processing sector. Our synthesis of the evidence suggests that there are changes in the industry structure that are worth highlighting. First, **the structure of malt processing in Ethiopia has been changing.** Until 2013, Assela Malt Factory was the only malting factory in the country and carried out both domestic and international procurement of malt barley. In the domestic market, the factory enjoyed **monopsony power (one buyer but many sellers) over the malt barley sellers and, consequently, enjoyed some price setting power.** The entry of new market players— Heineken and Diageo—and a new malt factory, Gondar Malt, led to competition in the sector. The Assela Malt Factory had to change its purchase prices three times in 2014, with the initial price increased from 600-700 Birr per quintal to 900-1035 Birr per quintal. Thus if we find that the market locations are well integrated, this implies that malt barley farmers have benefited because of competition.

Figure 6 Estimated current and upcoming capacity and malt and malt barley requirement of breweries



Source: Alemu et al. (2014) and based on the primary information collected by the authors' during October and November 2014.

Note: The malt demand is based on an average requirement of 17 kgs of malt to produce 1 hectoliter of beer. Moreover, the malt barley requirement is estimated based on 82 percent average extraction rate reported by the Assela and North Gondar malt factories.

In fact, we can use our estimated margins in Table 13 to come up with a rough estimate. According to our estimates, the farmers' share of the final price is 65 percent, which means that farmers would have received ETB 390 if the price was ETB 600, but due to an increase in price (assuming markets are competitive) their share of the final price jumped to ETB673, equivalent to an increase of 72 percent. **This demonstrates the fact that beneficiaries of competition are not the industry per se, but the numerous actors in the value chain, especially the farmers.**

The second point is obvious from Figure 6—that is, all the main breweries are planning to expand their scale of operation (labeled by the bars "upcoming'). For instance, Dashen Brewery, which currently has a capacity of about 1.0 million hectoliter, is planning to invest in an additional 3.0 million hectoliters of processing, quadrupling their capacity. Other breweries are also planning to scale up their domestic processing capacity. When combining all of the major companies together, the malt barley requirement is expected increase from 116 thousand tons in 2014 to 210 thousand tons once the expansion plans are executed. In other words, the domestic demand for malt barley is likely to increase by more than 80 percent.

A higher number of actors entering the processing sector can result in several important implications. One short-term opportunity is for farmers to meet the increase in domestic demand. Assuming a mill gate price of US$500, the total value of all malt barley would be about US$105 million per year. While this is not a very large number, given the size of Ethiopia's agriculture, historical evidence suggests that several import-substituting policies can lead to more competition, and, eventually, enough surplus to start exporting. While beyond the scope of this paper, it can be implied that malt barley has the potential to become an exportable commodity in the future through improved productivity and reduced transactions costs. Thus, supportive policies to bolster the barley sector can have a much larger payoff in the future.

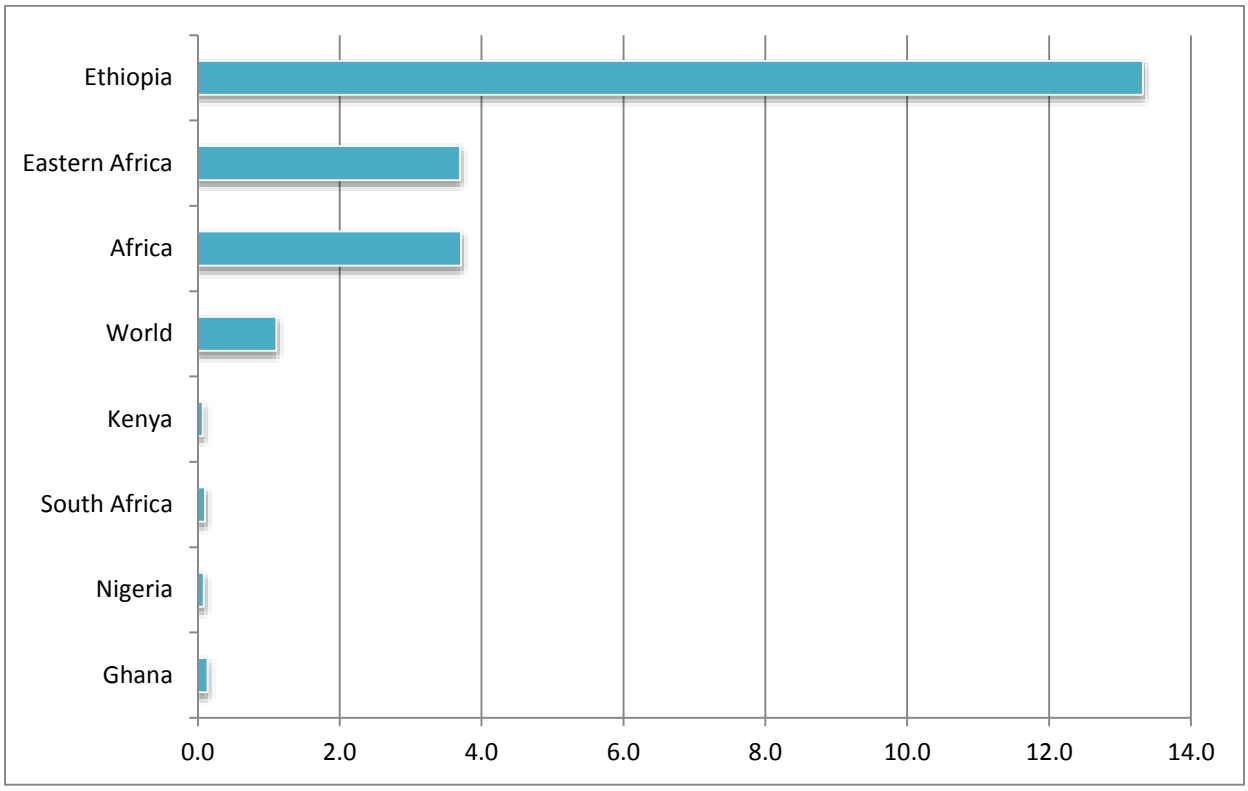
4.3 Consumption of barley and barley products

Ethiopia is not only the largest producer but also the biggest consumer of barley and various barley products in Africa south of the Sahara (SSA). Barley is a main ingrediant in staple foods (e.g., injera, porridge, and bread) and local drinks (e.g., Tella and Besso) in addition to its use for malting and animal feed. In 2013/14, household consumption accounted for 64 percent of the total barley production in the country (CSA, 2014). Barley serves as food, beverage, and feed for many highlanders in the country and as a substitute for other cereals. At the national level, it accounts for about 6 percent of the per capita calorie consumption (Berhane et al., 2011).

Ethiopia's per capita food barley consumption is by far the largest compared to other African countries (Figure 7). According to the FAO's food balance sheets, Ethiopia's annual per capita consumption of food barley in 2011 was 14 kilograms, which is more than three times the average for Eastern African[13] , four times that of Africa, and fourteen times the world average of consumption (Figure 7). However, food barley and barley products' contribution to the Ethiopian diets is small compared to other staple foods. In fact, it is the least important staple in both quantity and share of calories in total consumption (Berhane et al., 2011). Only 20 percent of households in Ethiopia consume barley and barley products, and its share in the total value of consumption is estimated at 9 percent (Table 15).

[13] The Eastern African average food barley consumption (3.7 kg/capita/year) is highly influenced by the Ethiopian consumption rate. If we exclude Ethiopia, the average food barley consumption rate of other Eastern African countries (i.e., Uganda, Rwanda, Burundi, Eretria, Djibouti, Somalia, Kenya, and Tanzania) is estimated at below 0.1 kg/capita/year.

Figure 7 Barley per capita consumption in Ethiopia, compared other countries (kg/capita/year)



Source: FAOSTAT (http://faostat3.fao.org/download/FB/FBS/E).

The consumption patterns appear to vary across the region and also depends on where a household resides. As shown in Table 14, a higher proportion of rural households (21 percent) consumes barley and barley products relative households in towns (17 percent) and cities (15 percent). Not only a higher proportion of rural households consume barley, but they also consume larger quantities. Average per capita consumption in the rural areas is estimated to be 15kgs, which compares with 3kgs to 6kgs in the cities and towns. Among the regions, Tigray ranks the highest in terms of both per capita consumption (20kgs) and proportion of households consuming barley and barley products. By contrast, SNNP has the lowest per capita barley consumption (7kgs) compared to the other three main regions, which can partially explain the relatively higher proportion of marketed surplus from SNNP region compared to other regions (Table 7).

Table 14 Consumption of barley by type of household

Household category	% of household in category	% of households consuming Barley products	Quantity of barley consumed		Value of barley consumed		% share in the total value of consumption
			All household	Consumers Only	All household	Consumers Only	
			(Kg/Person/Year)		(ETB/Person/Year)		
Location							
Cities	8	15	3	18	24	164	2
Towns	14	17	6	32	38	225	3
Rural	78	21	15	71	77	371	11
Region							
Tigray	6	26	20	77	120	468	14
Amhara	26	21	15	72	75	363	11
Oromia	38	23	15	67	83	362	9
SNNP	20	15	7	43	35	232	7
Other	9	10	2	17	16	159	2
Sex of HH head							
Male	75	20	12	60	67	330	9
Female	25	18	13	71	70	380	10
Income quintile	Income (birr)						
Poorest	2103	22	15	67	79	356	18
2nd	3301	20	13	69	70	360	11
3rd	4347	19	13	68	67	356	8
4th	5997	20	12	62	66	328	6
Richest	13672	18	9	48	55	304	3
National average	5884	20	12	63	68	342	9

Source: Authors' computation based on the 2009/10 Household Income, Consumption and Expenditure Survey (HICE).

The bottom panel of Table 14 provides some interesting perspectives about barley. While the poorest households consume 15kgs of barley per year, the richest consume only 9kgs, which, to some extent, implies that barley is an inferior staple. In general, this implies that demand for food barley is likely to decline with an increase in income. However, one should be cautious in making this conclusion because taste patterns can change with a better understanding of a staple food's inherent traits and potential for processing. Corn is a good example. In terms of regular consumption, it is perhaps an inferior staple. However, most processed corn products are generally considered to be normal goods. Further, the calculations from Table 14 only reflect consumption for food barley. Therefore, the nature of malt barley demand can be quite different. In fact, the unprecedented growth in beer consumption that has mirrored the country's economic growth implies that malt barley consumption in the country will increase disproportionately with a rise in income.

Table 15 Consumption of various barley products by type of household

Household category	Grain		Flour		Local beer/Besso	
	All household	Consumers only	All household	Consumers only	All household	Consumers only
	(…. kg/person/year...)					
Location						
Cities	0.2	16	0.7	15	1.7	17
Towns	0.6	18	3.3	42	1.6	19
Rural	1.3	23	10.3	80	3.0	33
Region						
Tigray	0.0	5	17.1	95	2.6	23
Amhara	1.2	19	11.7	88	2.0	24
Oromia	1.0	23	10.7	73	3.5	30
SNNP	2.3	26	1.4	30	2.8	51
Other	0.2	16	0.4	14	1.1	17
Sex of head						
Male	1.2	22	8.4	72	2.6	28
Female	0.9	24	9.1	84	3.1	35
Income Quintile						
Poorest	1.7	21	10.0	74	3.2	33
2nd	1.5	29	9.1	77	2.8	30
3rd	1.0	20	9.1	79	2.8	30
4th	0.9	20	8.8	77	2.6	30
Richest	0.6	26	6.0	66	2.2	24
National average	1.2	23	8.6	75	2.7	30

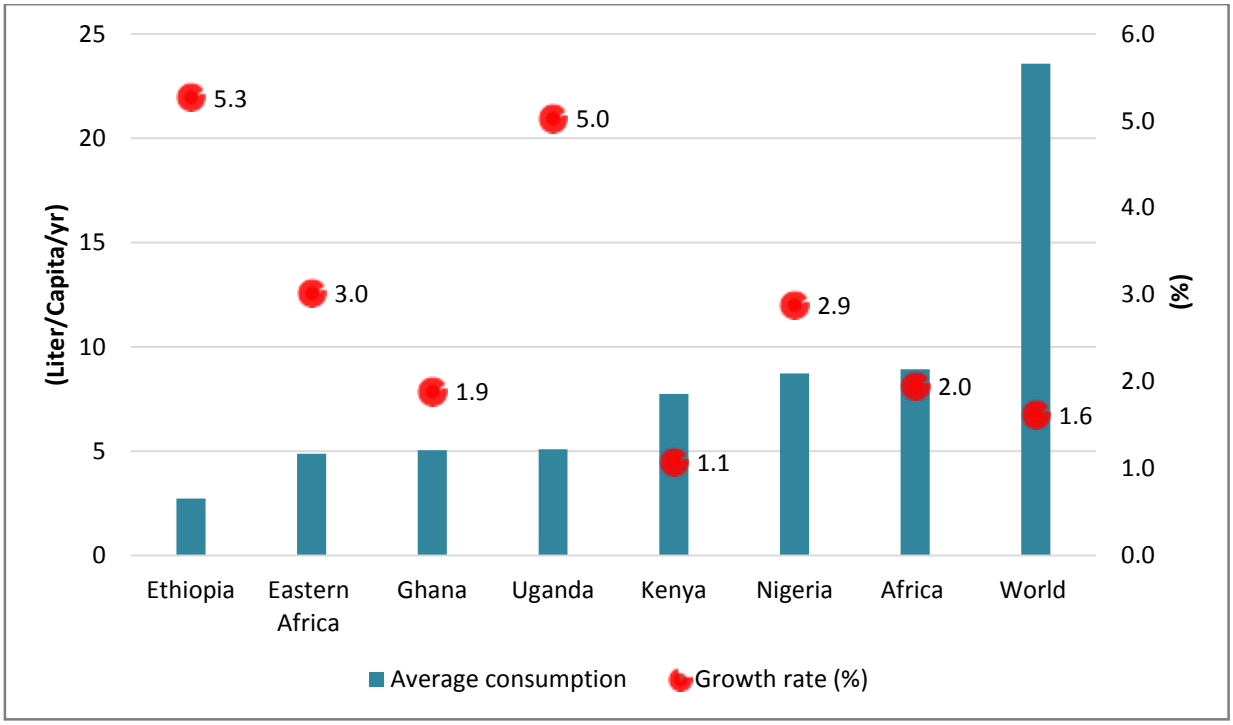
Source: Authors' computation based on the 2009/10 Household Income, Consumption and Expenditure Survey.

The HICE survey data allow us to examine further the variations in per capita consumption among different types of households by type of barley products (i.e., grain, flour, and local beer and Besso). As shown in Table 15, on average, barley is consumed more in the form of flour (8.6kgs) than in the form of local beer/Besso (2.7kgs) and grain/kollo (1.2kgs). This is true across locations and income groups of households, and contrasts industrialized countries where barley is mainly consumed in the form of beer (malting) and used for animal feed.

A cross-country comparison provides further insight into the future growth of malt barley demand. Between 1995 and 2012, Ethiopia had experienced the highest growth in per capita beer consumption compared to its neighbors, the continent, and the world average (Figure 8). However, this mainly reflected the fact that the country started from a low base, and most of data on consumption in the past was based on domestic production, which was not accounted for in the numbers. A more interesting statistic is the level of per capita consumption, which remains the lowest in Ethiopia compared to its neighbors. In the past decade and a half, per capita beer consumption has averaged only about 3 liters per year—far less than any of the comparators. Ethiopia's per capita consumption is only 1/3rd of Africa's average consumption (9

liters/year), only about 38 percent of Kenya and Uganda, and only 1/8th of the world average. These differences are far more striking than other estimates. For instance, according a recent United Nation's World Health Organization (WHO, 2014), the average Kenyan consumed about 4.0 liters of pure alcohol in 2008-2010; of which about 20 percent was beer. Assuming an average alcohol content of 5 percent, this implies that per capita beer consumption in Kenya in that period was 16 liters per year—almost double the estimate of FAO estimates presented in Figure 8. **Thus, we find that there is significant growth potential for higher malt barley consumption in the country.**

Figure 8 Cross-country comparisons of beer consumption and growth rate (1995-2013)



Source: FAOSTAT (http://faostat3.fao.org/download/FB/FBS/E)

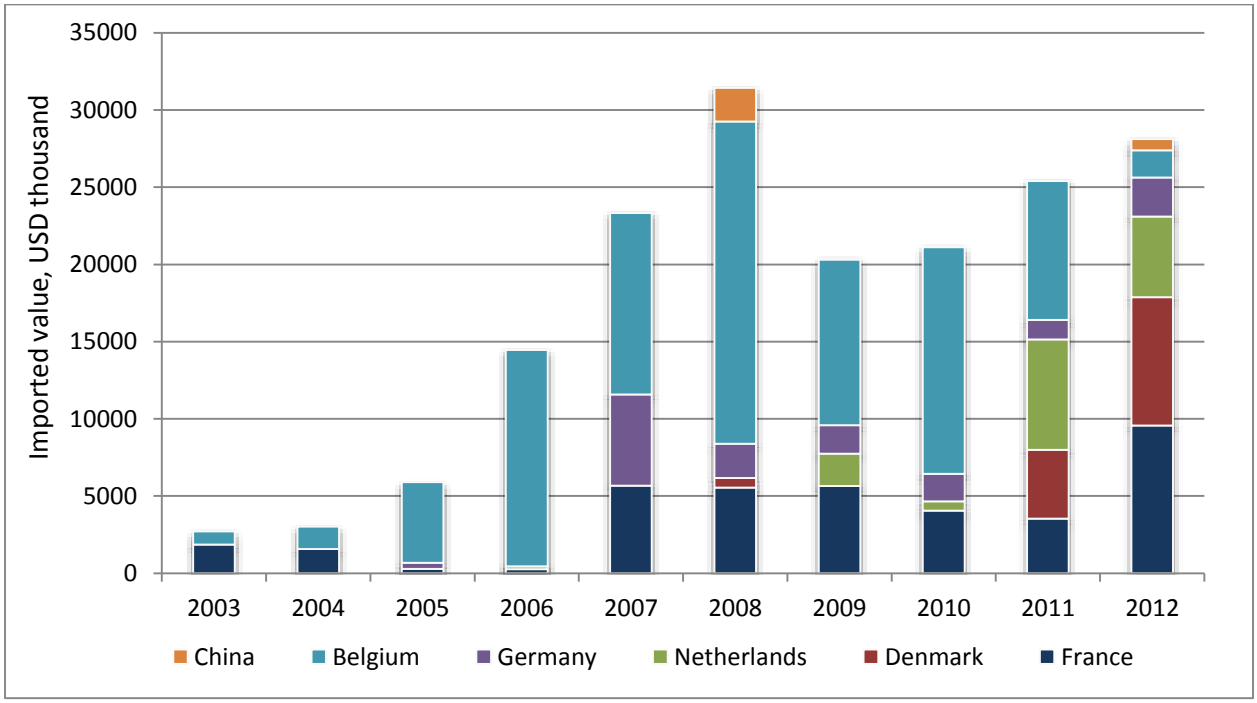
4.4 Comparative advantage in malt barley production

An assessment of the comparative advantage of any given agricultural commodity is an independent study in its own right. Such a study not only generates various measures of comparative advantage but also provides estimates of distortions that are due to policy action. OECD countries regularly generate estimates of Producer Subsidy Equivalent (PSE), and there are a host of studies that measure commodity specific rates of distortions (e.g., Winter-Nelson and Argwings-Kodhek, 2007; Masters and Winter-Nelson, 1995; Nelson and Panggabean, 1991; and Monke and Pearson, 1989), as well as country-specific measures of distortions (Rashid et al., 2009; Anderson and Masters, 2009). Therefore, this section of the report goes beyond the scope of ATA's value chain ToR; however, as the team began the assessment of the trends in imports and exports of barley, it became clear that such an analysis could directly contribute to a better understanding of the potential for malt barley in the county (see Figure 9).

Two messages can be drawn from this figure. First, the total import value is increasing at an unprecedented rate. In 2003, the total value of malt barley imports to Ethiopia was US$863 thousand and jumped to about US$28 million in 2012. The most recent figure shows that malt barley imports reached over US$42 million in 2014[14]. As pointed out earlier, given Ethiopia's current balance of payment situation, finding alternative options is needed; and much insight can be gained by analyzing the comparative advantages.

Second, notice that there has been a change in trade partners over time. Until 2005, Ethiopia had only two trade partners for the importation of malt barley, Belgium and France. This started to change in 2008 when Germany, China, and Denmark entered the market. According to Ethiopian Custom Authority data, this has further changed since 2012. In 2014, the country imported malt barley from 10 different countries, with Denmark becoming the largest partner, occupying about 27 percent of the total import of US$42.0 million. Behind Denmark are Belgium and France, each capturing about 25 percent of the market share (Custom Authority, 2014). The size of imports by trade partners between 2009 and 2013 indicate a shift from Belgium (although it is a competitive supplier)[15] to the Netherlands, France, and Denmark. For instance, the growth in Ethiopia's imports from France and the Netherlands is greater than France and the Netherland's export growth to the world (Figure A2), and the reverse holds true in the case of Belgium.

Figure 9 Trends in the importation of malt barley to Ethiopia by trade partners, 2003-2012



[14] Graphical analyses based on the International Trade Center (ITC) data future substantiate this trend. It indicates that between 2009 and 2013, import of non-roasted malt by Ethiopia increases comparatively with the world export growth. Ethiopia's import of roasted malt, on the other hand, increased more rapidly than the world export growth during the same period (Figure A5).

[15] Belgium's export growth to the world is larger and rapid than Ethiopia's import growth from Belgium.

Source: International Trade Center (ITC)

Nonetheless, an increase in the number of trade partners reflects competitiveness[16] but note that over 75 percent of imports came from EU countries. Given this context, there are two reasons to examine the comparative advantages. First, historically, agriculture in EU countries has been heavily subsidized. Until recently, EU countries had high export subsidies, which were eliminated to comply with WTO. However, income support to farmers continues. Second, given the high level of productivity of malt barley in those countries, estimates from PAM can provide further insights into whether there are policy options to enhance productivity.

4.4.1 Description of method

We use the Policy Analysis Matrix (PAM), developed by Monke and Pearson (1989), to examine the comparative advantage of Malt Barley in Ethiopia. The method is flexible enough to generate various measures of comparative advantage of a commodity such as Domestic Resource Costs (DRCs), Social Cost-Benefit Ratio (SCBR), and nominal and effective protection coefficient.[17] The PAM consists of two accounting identities. The first one measures the profits as the difference between the revenue and costs, represented in both private and social terms. The second identity is simply the difference between the private and social profit. Social profits differ from private profits when there are distortionary public policies, as these policies can make social price, also known as shadow price, higher or lower than the private price. Examples of distortionary policies include farm subsidies, taxation, and exchange rate overvaluation or undervaluation. For instance, if farmers receive subsidies, which is the case in most OECD countries, the private price will be lower than the social price; and the difference would be equal to the per unit subsidy. For taxation, it would be the opposite, that is, the social price would be lower than private price.

Table 16 Illustration of Policy Analysis Matrix (PAM)

Valued	Revenue	Costs		Profit
		Tradable input	Domestic factors	
At private prices	A	B	C	D
At social prices	E	F	G	H
Divergence	I	J	K	L

Source: Monke and Pearson, 1989.
Definitions:

Private profit, D= A – (B+C); Social profits, H = E – (E+G); Output transfers, I = (A-E)
Input transfers, J = (B-F); Factor transfers, K = (C-G); Net policy transfers, L = (D-H)
Domestic Resource Costs (DRC) ratio = G / (E-F); Social Cost Benefit Ratio = (F+G)/ E

For an illustration, consider Table 16, where the first line represents the private profitability (D), measured as the revenue (A) minus the total costs (B+C)—all variables valued at market prices.

[16] Figure A3 in the appendix shows prospects for further diversification of suppliers for malt barley.
[17] We are aware of the fact that DRC and SCB can generate varying results and SCB is preferred. See, Masters and Winter-Nelson,

The values in the second row represents the social prices (i.e., reflect the true scarcity values). For example, suppose that a government subsidizes a tradable input, say fertilizer, by 30 percent. Then the social price of fertilizer will be 30 percent higher than what a farmer pays at a fertilizer dealership. In other words, if private the price is B, the social price F will be B (1+0.30). Another intuitive example would be to consider the case of over-valued exchange rate. When the currency of a country is over-valued, imports becomes cheaper, and export becomes more expensive. Now suppose that the Ethiopian Birr is 10 percent over-valued, this would imply that the private costs of a ton of fertilizer would be 10 percent lower than the social costs. Similarly, private costs of a ton of imported malt barley would be 10 percent cheaper than social costs. Things get even more complicated when the importing country also has distortionary policies.

The last line of Table 16 represents the second identity, which is simply the difference between private and social profitability. If the policies to address market failure do not exist, this line will represent some forms of distortions in the markets. All key measures of comparative advantage follow from the above table. For instance, the social cost-benefit ratio (SCB) is the sum of social costs (F+G) divided by social revenue (E). A value of SCB less than one for a commodity implies that the country has a comparative advantage in producing that commodity. Another measure of comparative advantage, the Domestic Resource Costs (DRC), which is the ratio of the shadow value of the domestic factors (social factor costs, G) to the net inputs to the shadow value of net output (i.e., E-F). Like SCB, a DRC value less than one also implies comparative advantage.

Several measures for distortions—Nominal Protection Coefficient (NPC), Effective Protection Coefficient (EPC), and Producer Subsidy Equivalent (PSE)—can easily be calculated from the PAM. Definitions of each of these measures and their interpretations are as follows:

NPC for inputs, NPC_i = B/F; any estimate < 1 implies protection
NPC for outputs, NPC_o = A/E; any estimate >1 implies protection
EPC = (A-B)/ (E-F); estimates >1 implies protection
PSE = L/A; estimates >0 implies subsidy
Subsidy Ratio to Producer (SRP) = L/B; estimates >0 implies subsidy

We present key results for three malt barley production sites (i.e., Arsi, Bale, and North Gondar) in the next section.

4.4.2 The PAM results

Three sets of PAM results are presented in this section. We begin with a discussion of the comparative advantage and then move on to a discussion on the distortion to incentives.

Comparative advantages: The results of the base scenario for the three malt barley growing locations in Ethiopia are presented in Table 17, which is essentially Table 16 with each of the cells filled in with relevant estimates for three malt growing locations. The results are no surprise: **both the private and social benefits of growing malt barley in these locations outweigh the respective costs**. These estimates indicate that Ethiopia enjoys a comparative advantage in malt barley production. However, a few other points need to be highlighted for a better understanding of the subsector and mechanics of PAM. Let's begin with two different inputs—namely, tradable and domestic factors.

Table 17 PAM results for malt barley production in 2014 (Birr/Ha)

Values	Revenue	Costs		Profit
		Tradable Inputs	Domestic Factors	
Arsi/Hittoya (Malt Barley)				
Private	33,534	4,318	10,748	18,469
Social	34,350	4,488	10,666	19,196
Divergence	-816	-170	82	-728
Bale/Dinsho (Malt Barley)				
Private	31,759	5,170	9,103	17,486
Social	32,311	5,275	9,045	17,990
Divergence	-551	-105	59	-504
Gondar/Area (Malt Barley)				
Private	27,544	4,605	10,368	12,571
Social	28,160	4,787	10,281	13,092
Divergence	-616	-182	87	-521

Source: Authors computations based on the primary data collected from the specific locations.

The tradable inputs include machinery, fertilizer, pesticides, herbicides, and other inputs that can be traded in international markets. Now, in an economy without distortionary policies, private and social costs of tradable inputs should be equal, but our results suggest that divergence between private and social costs of tradable inputs are negative. In other words, private costs are lower than the social costs. How can this be possible? It happens largely through the overvaluation of the Ethiopian Birr. According to the estimates that we have used, the Ethiopian Birr in 2014 was about 10 percent overvalued, making all tradable inputs cheaper than their respective social costs. It should also be noted that the import taxes makes importable goods expensive, but in the aggregate, overvaluation appears to have a larger effect than the import taxes. The private costs of domestic factor markets are higher than the social costs and this results mainly from assumed factor market distortions and, although not reported here, removal of the assumed factor market distortions equalizes private and social costs of domestic factors.

What do the numbers in Table 17 mean? Let's consider the location. In Arsi, total private revenue from one hectare of malt barley production is ETB 33,534, which is total output per hectare multiplied by the local market price. The corresponding social cost, which is the valuation of the same output at the border price (accounting for taxes, exchange effects, etc.), is ETB 34,350. Therefore, the divergence, which is also known as policy effects, is -816 Birr. This implies that with due policy action, malt barley can add an additional ETB 816 of revenue for each hectare of malt barley cultivation. The corresponding numbers for tradable inputs and net profits for Arsi are ETB -170 and ETB -728, respectively. One can use net profit numbers to extrapolate (very roughly) overall social gains. As an example, consider that Ethiopia allocates 1.0 million hectares of land to malt barley and from each hectare there is potential for an additional gain of ETB 584 (average of Arsi, Bale, and North Gondar). This means that total gains would be ETB 584 million Birr, equivalent to US$29.0 million, which would be a lower end estimate because PAM does not account for many multiplier effects.

Now we turn to the discussion on the estimates of two main measures of comparative advantages: the DRC and SCBR, which are presented in the top panel of Table 18. Notice that our estimates of both DRC and SCBR are much lower than 1, implying that Ethiopia has a comparative advantage in producing malt barley in the selected locations. A natural question arises when the estimates of DRCs and SCBs are so low: why is Ethiopia importing malt barley if the country enjoys such a strong comparative advantage? The answer lies in the level of market development and in the policy environment. Imported malt barley is better in terms of quality, reliability, and the ease of transactions. Many of the malt barely growing areas are in remote locations; and even though we have estimates of transactions costs, at various times of the year, the roads can become impassable, which can potentially cause supply disruptions. This fact was highlighted during our focus group interviews—with both farmers and processors—in north Gondar, where aggregation of malt barley continues to pose a problem and the malt factory only buys locally if the transaction size is at least 5 tons. In terms of quality, we were told that locally grown malt barley contains up to 6 percent of impurities. While one makes adjustments for quality, it is hard to come up with a quantitative estimate of uncertainty in the supply chain. Clearly, this will evolve over time, but the role of policy would be to expedite the process of value chain transformation.

Distortions to incentives: Various measures of distortions of malt barley production incentives are presented at the bottom panel of Table 18. All estimates are less than 1, but they have varying implications. The Nominal Protection Coefficient for output (NPC_0) is around 0.98, implying that, given all the considerations in PAM, producers are net taxed by about 2.0 percent. The coefficient for the inputs ranges between 0.96 and 0.98, implying that the government policies protect farmers in procuring tradable inputs. This comes largely through exchange rate overvaluation and some import taxes, which makes all importable inputs roughly 10 percent cheaper. Since values of output are higher than the values of tradable inputs, malt barley as a whole is net taxed. This is evident in the estimates of PSE, which is negative for all three locations, and the estimates range from 1.6 to 2.2 percent. The estimates of SRP are slightly smaller than the PSE but have the same sign.

Table 18 Comparative advantage and distortions to incentives in Ethiopian malt barley

Indicator	Arsi/Hittoya (Malt Barley)	Bale/Dinsho (Malt Barley)	Gondar/Ayeba (Malt Barley)
Comparative Advantage			
DRC	0.357	0.335	0.440
SCB	0.441	0.443	0.535
Protection and Distortion			
NPC_o	0.976	0.983	0.978
NPC_i	0.962	0.980	0.962
EPC	0.978	0.984	0.981
PSE	-0.022	-0.016	-0.019
SRP	-0.021	-0.015	-0.019

Source: Authors Computations based on Field survey.

There are many alternative scenarios that can be generated using PAM constructed for this study. Some of the important further simulations may include changes in comparative advantage and protections if (a) world prices go up (or down); (b) transaction costs are reduced, (c) productivity

is enhanced, (d) farming practices are changed, (e) higher import duties are imposed, (f) domestic taxes eliminated, and (g) exchange rates are adjusted to equilibrium levels. However, most of such analyses are beyond the scope of this study. Our primary objective in this study has been to understand the broad parameters of comparative advantage. **We can conclude that the country does enjoy a comparative advantage, but there are small distortions (about 2 percent) to producing malt barley due to macro policies, especially through overvalued exchange rates and domestic taxes. Given that exchange rate policies have larger policy implications, it is wise to avoid making the case of exchange rate policy reform based on one commodity value chain study.**

5. Summary and Policy Implications

There have been some unusual trends in the Ethiopian Barley sub-sector, despite the fact that Ethiopia is the second largest barley producer in Africa, accounting for about 25 percent of the production on the continent. While the country has consistently been a net exporter of food barley, it has been deficient in malt barley. With an increase in domestic demand, the size of the deficit has grown significantly in recent years. The net barley import bill jumped from US$240 thousand in 1997 to US$40 million in 2014. Given the current trend, domestic demand will continue to grow, and so will the country's barley import bill. In fact, one projection suggests that Ethiopia's barley import bill could reach as high as US$420 million by 2025. Against this backdrop, this paper has analyzed the barley value chain to identify constraints and potential for the subsector's future growth. Different methods have been employed to examine various aspects of the value chain. Three sets of CSA surveys, long series of production and price data, as well as in-depth focus group interviews were carried out for the study. Analytical methods included simple trend analysis, GIS mapping, regression methods, and Policy Analysis Matrix (PAM) to examine the comparative advantage. **A general challenge in carrying out this study has been the lack of disaggregated data: neither household surveys nor nationally published statistics distinguish between malt and food barley. Therefore, one of the first recommendations of this study is to gather and publish disaggregated data, which will enable more targeted policy analysis.** We now present key results and their implications by the segments of the value chain.

5.1 Upstream (production and productivity)

The barley subsector lags behind other major cereals. While total production increased between 2003/4 and 2013/14, the share of barley in total cereal production has dropped, and barley has experienced the least growth. Furthermore, among the major cereals, barley is found to have experienced the highest fluctuations (measured by the coefficient of variation and Cuddy le Valle Index). These numbers point to the fact that barley has received far less attention compared to the other major cereals, especially *tef*, maize, and wheat.

It is widely known that barley production is concentrated in the regions of Amhara and Oromia. However, more disaggregated analysis suggests that **production is concentrated in a handful of woredas in the highlands of Oromia and Amhara regions, which are responsible for the bulk of the production and marketed surplus**. Twenty-three out of the top 24 barley producing woredas are located in these two regions. More importantly, most of the woredas are from Arsi-Bale and West Shewa zones of Oromia region and North Shewa and North Gondar zones of Amhara region. These results beg a serious policy and strategy question: **should barley promotion efforts be concentrated in the high concentration or high potential areas or should they be expanded to the less favored areas?** Conventional wisdom is to focus on high potential areas, but there are also studies to suggest that public investment in less favored areas can generate higher social benefits.

The cross-country analysis suggests that there is a high potential for enhancing barley productivity in Ethiopia. While barley yields in Ethiopia are higher than the continent-wide average, it is significantly behind Kenya and South Africa and far behind much of the developed world. During the past decade, barley yields in Ethiopia have averaged 1.43 tons, which is less

than half of the barley yields in both Kenya (3.26 tons /ha) and South Africa (2.93 tons/ ha). In high-performing countries of the developed world—such as France, Germany and the Netherlands—average barley yield is over 6 tons per hectare. Thus, it can be concluded that, despite recent growth in the sub-sector, barley yields in Ethiopia remains significantly lower than global and regional averages.

However, there are many yield constraining factors in barley. Our results suggest that **barley farmers in Ethiopia do not fully adopt the productivity-enhancing modern inputs like fertilizer and modern seeds** (CSA, 2014; Mulatu and Lakew, 2011). About two third of the barley growers do not apply any fertilizer to their plots. Even though a large share of land has been fertilized in recent years (42 percent in 2014), it is far below all other cereals except sorghum. Furthermore, barley growers apply only about 30 kilogram of fertilizer, which again is far lower than all other cereals. **The trend in modern seed use is more discouraging. Our analysis suggests less than one percent (0.6 percent) of barley growers use modern seed varieties—far less than any other cereal except sorghum.** The shortage of improved barley varieties is associated with both the research system, which is required to generate primary or early generation seeds, and the seed enterprises that are mandated for multiplication and distribution of seeds. For instance, of the total seed marketed by the regional seed enterprises (RSE); only 4 percent is barley, which compares with 18, 63, and 13 percent for *tef*, wheat, and maize, respectively.

5.2 **Midstream** (storage and marketing)

Storage plays a central role in improving the value chain of an agricultural commodity. Proper storage with appropriate institutions—such as Warehouse Receipts System—can alleviate a farmer's liquidity constraints, reduce price volatility, and improve well-being of both consumers and producers. Except for cash crops, mainly coffee and exportable pulses, commodity storage in Ethiopia is primitive and similar to most other developing countries. Barley is no exception. Three key results are worth highlighting. First, **farmers store barley mainly for future consumption, implying very limited commercialization.** At the national level, 92 percent of the farmers reported that the primary reason for storage was for consumption; and the main secondary reason is reported to be seed and future sale (only 14 percent). Second, farmers appear to use very primitive storage facilities. **At the national level, no farmers used metallic storage facilities for their cereals; 58 percent of the farmers store their barley in bags on the floor, with the proportion ranging from 78 percent in Oromia to 28 percent in Amhara.** Finally, our analysis of focus group interviews, as well as secondary data, suggest that storage is a pervasive and systemic problems at all segments of the value chain. In most of the kebeles and woredas, the largest storage facilities are owned by the cooperatives; and neither retailers nor wholesaler reported to have large storage facilities. Moreover, **many traders reported that grain storage is discouraged by the government. Many studies across the developing world suggest that such interventions are counter-productive to value chain development**.

Marketing evolves when there is a **marketable surplus**. Therefore, one of the study's main emphasis was on understanding the marketed surplus. It worth repeating that **there is a difference between marketed and marketable surpluses: while marketable surplus refers to**

voluntary sales, marketed surplus generally includes both voluntary and distress sales. The estimates in Ethiopia fall into the latter category.

Our analysis of marketed surplus leads to two major observations. First, **marketed surplus of barley is relatively small, implying that the barley sub-sector is largely subsistence in nature, with very little commercialization.** Home consumption and seed use account for more than 80 percent of the total production. Second, despite steady 6 percent growth in barley production, the share of marketed surplus has remained the same over the last seven years (CSA, 2008; 2014), which is considered puzzling by both statistical agencies and policy makers because the population growth has been far lower at 2.6 percent only. **We argue that one should use caution in linking production growth and the marketed surplus. From a theoretical perspective, an increase in total production does not necessarily have to lead to an increase in marketable surpluses, especially given population and income growth**.

The analysis at the midstream level of the value chain focused on mapping the main market actors and estimating marketing margins. The study finds that, at the national level, **traders are the single largest actors in barley marketing, handling over 70 percent of the marketed surplus. The next two largest market players are the consumers and farmers, accounting for 17.1 and 10.4 percent, respectively**.

Based on the assessment of the marketing chain, we conclude that small traders (mainly local assemblers, because these are farm level data) are the main actors in the barley value chain. As the value chain develops, the roles of these actors will diminish, and the farmer will have more direct access to the terminal markets. **However, given the current state of the market fundamentals—that is, infrastructure, institutions, and information—these actors perform an important market function, namely product aggregation.** We also find that despite the heavy public emphasis on farmers' organizations, **cooperatives appear to play a minimal role in the barley value chain.** Less than half a percentage of marketed barley passes through cooperatives, with very little effects on the cooperatives revenues. Finally, about 10 percent of the marketed barley, equivalent to 23,000 tons in 2014, changed hands through farmer-to-farmer transactions. Given sales to consumers are defined separately; these transactions refer mainly to seed sales. Therefore, if the seed sector develops over time, which appears to be policy focus now, **marketable surplus will further increase through two channels: (i) increased productivity and (ii) reduction in farmer-to-farmer seed sale.**

Marketing chains vary depending on a host of different factors. The study could not depict a complete marketing chain using the secondary data obtained from CSA and other household and market surveys. Therefore, rapid rural appraisals were conducted in late last year in two zones (i.e., Arsi and North Gondar). While farmers in Arsi produce both food and malt barley and market through cooperatives and traders, farmers in north Gondar exclusively market their malt barley through cooperative. The marketing chain constructed for this study offer several insights:

- A large number of actors are involved at the beginning of the marketing chain, that is, in providing input supplies. Several government agencies (national research system, seed enterprises), cooperative promotion, holding companies, NGOs, and private seed companies are involved in seeds marketing. Therefore, it is very surprising that modern

input use is so ridiculously low. An obvious implication is that perhaps there is **very little coordination among these actors towards promoting input supplies to the barley growers. This implies that enhancing coordination among actors and streamlining their mandates, if necessary, can contribute towards improving modern input supplies and ultimately enhancing barley productivity.**

- There have been significant improvements in the infrastructure in the Arsi-Bale areas of the country and the value chain for most commodities have lengthened, with many farmers marketing directly to the terminal markets, such as Addis Ababa. **Therefore, it may be time for the government to re-think the role that cooperatives can legitimately play in addressing market failures or achieving social objectives.**
- Finally, given the current state of institutions and infrastructure, the marking chain appears to be surprisingly competitive. Our estimates suggest that in both Arsi and North Gondar, farmers retain the highest share of the final price. In Arsi, farmers' net margin is estimated to be 35 percent, which compares with less than 10 percent for assemblers and wholesalers combined, and a little over 18 percent in the case of the malt factories. **These results go against the conventional wisdom that agricultural commodity value chains in developing countries are non-competitive and that farmers are often exploited.**

5.3 Downstream (consumption, processing, and comparative advantage)

Consumption: The consumption patterns, as well as future growth potential, are different for malt and food barley. Analysis of HICE data suggests that consumption of food barley declines with an increase in income. **Given the trend in overall economic growth, this implies that consumption of malt barley—the way it is consumed now—will decline in the future.** However, this does not mean that consumption of processed malt barley will decline. In fact, given historical taste patterns, quite the opposite can happen—consumption of processed barley can go up with an increase in income if the right kind of processed barley is introduced to the market.

The prospect of growth in malt barley consumption is very high and is evident in both cross-country comparisons, as well as in domestic demand analysis. While Ethiopia has experienced the highest growth rates in per capita beer consumption, the level of consumption, overall, is still low. Per capita consumption of beer in Ethiopia has only been about 1/3rd of Africa's average and only about 1/8th of the global averages. Even if Ethiopia catches up with the continental average, domestic consumption will be three times higher than the current level of consumption. **Therefore, domestic consumption (demand) for malt barley will likely increase significantly in the foreseeable future.**

Processing: This study did not evaluate the processing of food barley. The processing of barley in Ethiopia is largely informal. Of the total production of 1.9 million tons, only 230 thousand tons comes to market, and the rest remains in the farm household. Therefore, it can be safely assumed that the barley is either processed at home or processed in small local mills. In the case of malt barley, processing has been limited. Until recently, there was only one malt factory, **which enjoyed monopsony (a market structure with single buyers and many sellers) power.** The landscape started changing with an introduction of more players and, thus, increased competition**. In 2014, malt factories revised their price quotations several times, which implies**

that farmers are gaining an increase in bargaining power. Using our estimates of margins, we found that a rise in price from ETB 600 to ETB 1035 resulted in a 72 percent increase in farmers' share of the price. **Therefore, the beneficiaries of competition are not the industry per se, but the numerous actors in the value chain, especially farmers.**

The study also finds that all major breweries are planning to expand their scale of operation in the coming years. Given the increase in market players, the malt barley requirement is expected to increase from 116 thousand tons in 2014 to 210 thousand tons when the expansion plans are executed. In other words, the domestic demand for malt barley is likely to increase by more than 80 percent. However, the potential demand growth will likely outpace the expansion in the scale of operation. There are important implications of the changing structure of the processing sector. One short-term implication is meeting the domestic demand. Assuming a mill gate price of US$500, this implies that the total value of all malt barley would be roughly US$105 million per year. Though not a large number, given the size of Ethiopia's agriculture, historical evidence suggests that many import-substituting policies eventually leads to higher competitiveness and the country can turn into an exporter. While it would require a much larger study to draw a robust conclusion, it can be implied that **malt barley has the potentials to become an exportable commodity in the future through improved productivity and reduced transactions costs. Thus, policy attention paid today can have a much larger payoff in the future**.

Comparative advantage and policy distortions: While it was not in the ToR, we decided to carry out an assessment of comparative advantage and policy distortions, primarily for two reasons: (a) unprecedented growth in import bills and (b) over 90 percent of the imports come from EU countries, where productivity is high and farmers receive policy support. We constructed Policy Analysis Matrices (PAM) to examine comparative advantage and policy distortions. Our results show that **both private and social benefits of growing malt barley in these locations outweigh the respective costs,** implying that Ethiopia does enjoy a comparative advantage in malt barley production.

The two estimates of comparative advantage, the Domestic Resource Costs (DRC) and Social Cost Benefit Ratio (SCBR) are estimated to be less than 1, implying comparative advantage in malt barley production. A natural question arises when the estimates of DRCs and SCBs are so low: **why is Ethiopia importing malt barley if the country enjoys such strong comparative advantage? The answer lies in the level of market development and the policy environment. Imported malt barley is better in terms of quality, reliability, and the ease of transactions.** Many of the malt barely growing areas are in remote locations; and even though we have estimated the transactions costs, they are irrelevant at various times of the years when roads become impassable. This is a disincentive for the buyers to domestically source malt barley, as it makes the supply unpredictable.

The estimates from PAM suggest that there are small degrees of policy distortion in malt barley production in the county. All estimates of distortion are less than 1, but they have varying implications. **The Nominal Protection Coefficient for output (NPC_0) is around 0.98, implying that, given all the considerations in PAM, producers are net taxed by about 2 percent. The coefficient for the inputs ranges between 0.96 and 0.98, implying that the government policies protect farmers in procuring tradable inputs**. This comes largely through exchange rate

overvaluation and some import taxes which makes all importable inputs roughly 10 percent cheaper. Since values of output are higher than the values of tradable inputs, malt barley as a whole is net taxed. This is evident in the estimates of PSE, which is negative for all three locations, and the estimates range from 1.6 to 2.2 percent. The estimates of SRP are slightly smaller than the PSE but have the same sign.

There are many alternative scenarios that can be generated using the PAM constructed for this study. Some of further simulations may include changes in comparative advantage and protections if (a) world price goes up (or down); (b) transactions costs are reduced, (c) productivity is enhanced, (d) farming practices are changed, (e) higher import duties are imposed, (f) domestic taxes eliminated, and (g) exchange rates are adjusted to equilibrium levels. However, most of such analyses are beyond the scope of these studies. Our main objective in this study has been to understand the broad parameters of comparative advantage. **We conclude that the country does enjoy a comparative advantage, but there are small distortions (about 2 percent) to producing malt barley due to macro policies, especially through overvalued exchange rates and domestic taxes. Given that exchange rate policies have larger policy implications, it is wise to avoid making the case of exchange rate policy reform based on one commodity value chain study.**

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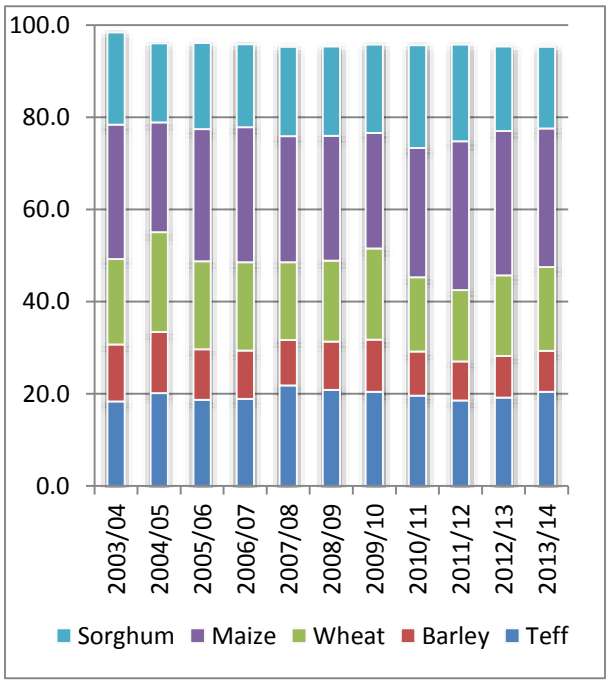
Appendix

Table A1 World average production, area and yield of barely (2003-2013)

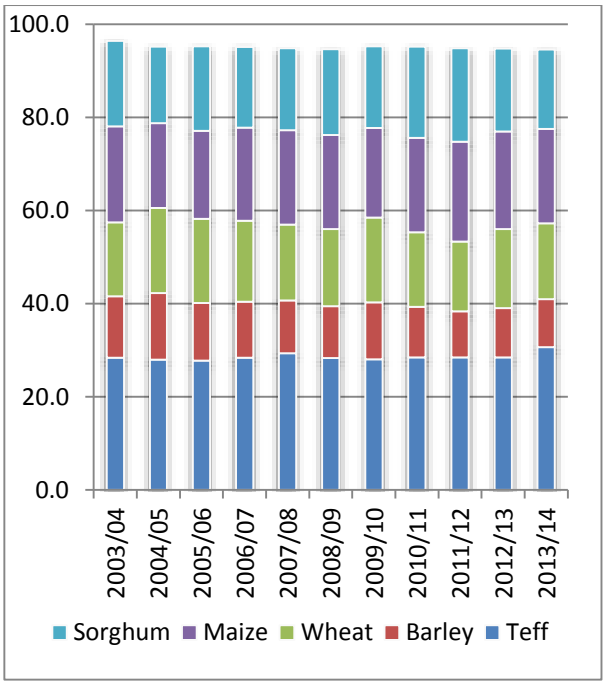
Countries	Average (2003-2013)			Growth Rates (2003-2013)		
	Area (million hectare)	Production (million Mt)	Yield (Mt/Ha)	Area (million hectare)	Production (million Mt)	Yield (Mt/Ha)
Russia	8.26	16.38	1.98	-0.031	-0.026	0.089
Germany	1.84	11.06	5.99	-0.028	-0.017	0.236
Canada	3.18	10.17	3.20	-0.066	-0.041	0.159
France	1.68	10.60	6.31	-0.003	0.001	0.241
Ukraine	4.23	9.16	2.17	-0.034	-0.011	0.104
Morocco	2.10	2.16	1.03	-0.017	0.007	-0.004
Ethiopia	1.07	1.51	1.42	-0.014	0.046	0.057
Algeria	0.90	1.29	1.45	0.141	0.035	0.044
Tunisia	0.42	0.46	1.11	-0.017	0.029	0.020
New Zealand	0.06	0.36	6.12	0.030	0.027	0.238

Source: Author compilation based on Food and Agriculture Organization (FAO) data (2003-2013).

Figure A1 Percentage shares of crops from total cereals production and area cultivated



(a)% share of crops from cereals production



(b) % share of crops from cereals area cultivated

Source: authors' compilation based on CSA-AgSS reports (2003/04 – 2013/14).

Table A2 Time of barley planting by region

	Tigray	Amhara	Oromiya	SNNP	National
September	0.3	5	14	9	8
May	18	33	11	0	17
June	50	37	19	16	29
July	31	21	37	42	32
August	0	1	13	27	10

Source: authors' computation based on CSA's 2013 Post Planting Survey.

Table A3 Barley harvest period by regions

	September	October	November	December	January
Harvest Start					
Tigray	21.11	68.89	8.75	1.25	0.00
Amhara	16.71	36.74	36.39	8.31	1.86
Oromiya	1.72	38.24	28.14	26.82	5.07
SNNP	1.83	24.72	64.23	9.16	0.06
National	9.73	39.53	34.91	13.63	2.21
Harvest End					
Tigray	7.93	69.38	16.94	5.75	0.00
Amhara	6.98	35.26	40.21	13.65	3.89
Oromiya	0.00	18.86	39.49	22.67	18.98
SNNP	0.00	14.36	50.23	35.15	0.20
National	3.55	31.07	38.18	19.92	7.26

Source: authors' computation based on CSA's 2013 Post Harvesting Survey.

Table A4 Period of barley sale, number of transactions, and means of transportation to market

	Tigray	Amhara	Oromiya	SNNP	National
Selling months					
October	0	5	9	0	5
November	90	26	9	15	18
December	10	54	14	38	36
January	0	15	58	42	37
February	0	0	7	2	3
March	0	0	4	2	2
Number of transaction	1	1	1	1	1
Means of transportation					
On foot	94	49	11	46	35
Pack Animals	6	51	89	54	63
Average transport cot (Birr/Qt.)	88	67	24	58	26

Source: authors' computation based on CSA's 2013 Post Harvesting Survey.

Table A5 Production performance of barley in major states of Ethiopia, (2003-2013)

	2003/04	2004/05	2005/06	2006/07	2007/08	2008/09	2009/10	2010/11	2011/12	2012/13
Production ('000 Mt)										
Tigray	82	78	88	121	157	148	144	163	164	159
Amhara	367	399	396	470	430	486	507	431	432	591
Oromia	549	747	693	660	674	724	969	909	872	898
SNNPR	76	99	91	99	91	105	128	198	114	131
National	1,080	1,328	1,271	1,352	1,355	1,519	1,750	1,703	1,585	1,782
Yield (Mt/Ha)										
Tigray	1.07	0.81	1.11	1.19	1.36	1.52	1.35	1.80	1.65	1.62
Amhara	1.03	1.06	1.25	1.34	1.30	1.40	1.31	1.31	1.42	1.52
Oromia	1.30	1.40	1.35	1.38	1.45	1.60	1.79	1.77	1.89	2.00
SNNPR	1.11	1.16	1.12	1.17	1.29	1.38	1.46	1.77	1.38	1.60
National	1.17	1.21	1.27	1.33	1.38	1.55	1.55	1.63	1.67	1.75
Number of holders ('000)										
Tigray	345	371	353	394	450	409	447	435	402	461
Amhara	1,397	1,476	1,285	1,397	1,333	1,400	1,534	1,391	1,395	1,653
Oromia	1,203	1,427	1,499	1,485	1,416	1,494	1,603	1,518	1,483	1,565
SNNPR	502	598	628	627	606	669	768	791	731	769
National	3,474	3,902	3,784	3,924	3,819	3,986	4,365	4,148	4,085	4,462

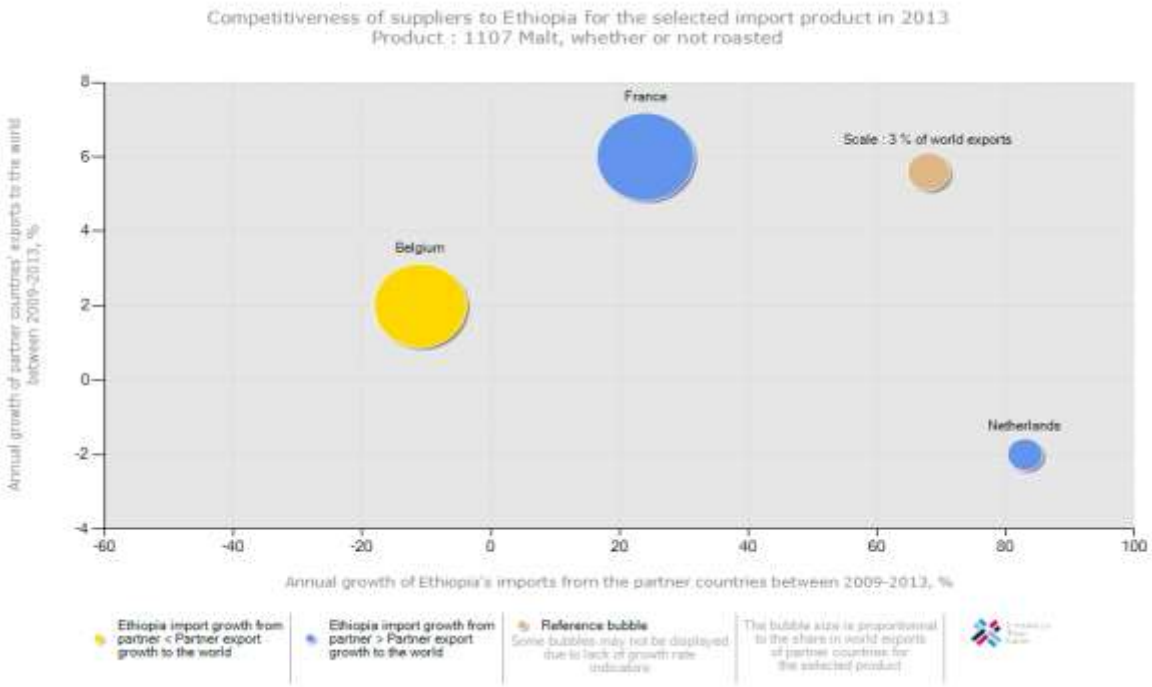
Source: authors' compilation based on CSA-AgSS reports (2003/04 – 2013/14

Table A6 Area, production, yield and number of holders by zone (2004-2013)

Zone				Average 2004-13
	No of Holders ('000)	Area ('000 Ha)	Prod ('000 Mt)	Yield (Mt/Ha)
Tigray	449.7	97.8	110.8	1.13
Central	151.9	18.8	19.4	1.03
East	132.4	27.1	32.2	1.19
South	142.3	50.1	57.3	1.14
Amhara	1,332.9	344.0	423.9	1.23
North Gondar	159.3	51.5	63.9	1.24
South Gondar	207.2	57.8	50.4	0.87
North Wollo	196.3	35.9	45.5	1.27
South Wollo	252.2	38.4	50.9	1.33
North Shewa	177.5	50.8	78.8	1.55
East Gojjam	123.3	45.0	51.9	1.15
West Gojjam	89.9	31.7	37.4	1.18
Oromiya	1,416.5	497.5	693.6	1.39
East Welega	45.1	12.1	11.9	0.98
Jimma	127.1	19.8	19.4	0.98
West Shewa	162.5	74.1	107.4	1.45
South West Shewa	62.9	14.4	17.7	1.23
North Shewa	125.0	82.8	89.1	1.08
East Shewa	52.3	14.9	22.7	1.53
Arsi	210.0	95.5	156.6	1.64
Bale	90.0	96.0	157.2	1.64
S.N.N.P	605.7	80.4	94.9	1.18
Gurage	123.3	13.6	23.5	1.73
Sidama	44.8	9.9	9.8	1.00
National	3,995.0	1,013.8	1,472.6	1.43

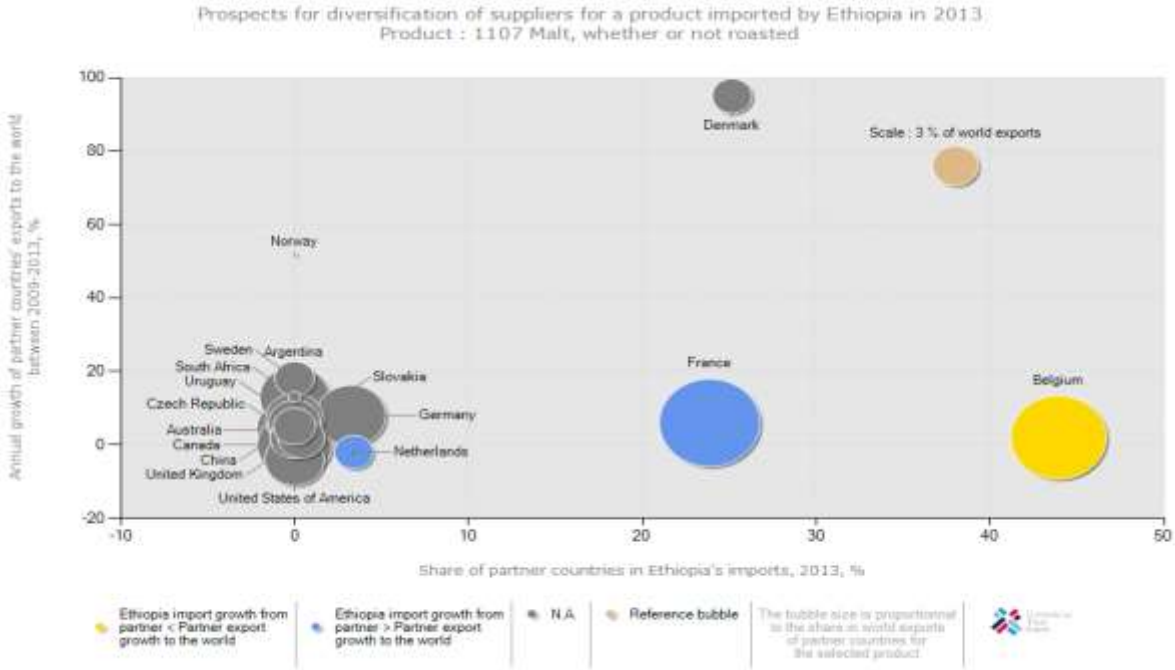
Source: authors' compilation based on CSA-AgSS reports (2004 – 2013).

Figure A2 Competitiveness of malt barley suppliers to Ethiopia



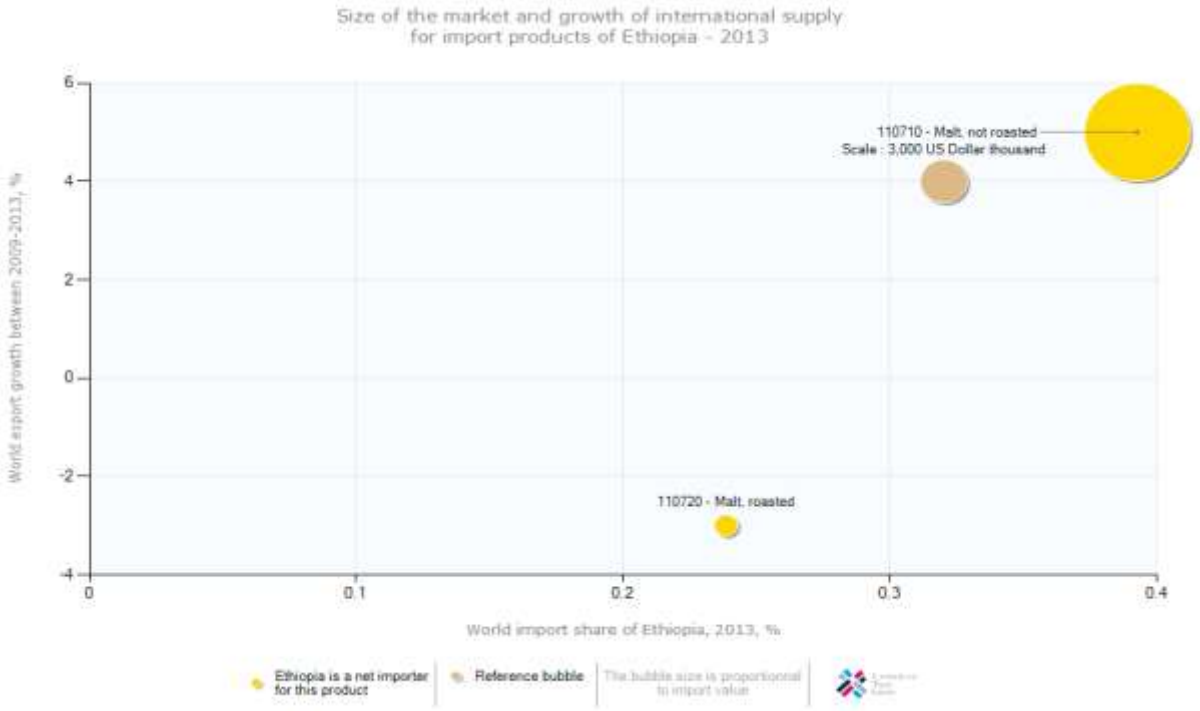
Source: International Trade Center (ITC), trade map.

Figure A3 Prospect for diversification of suppliers for malt barley, Ethiopia



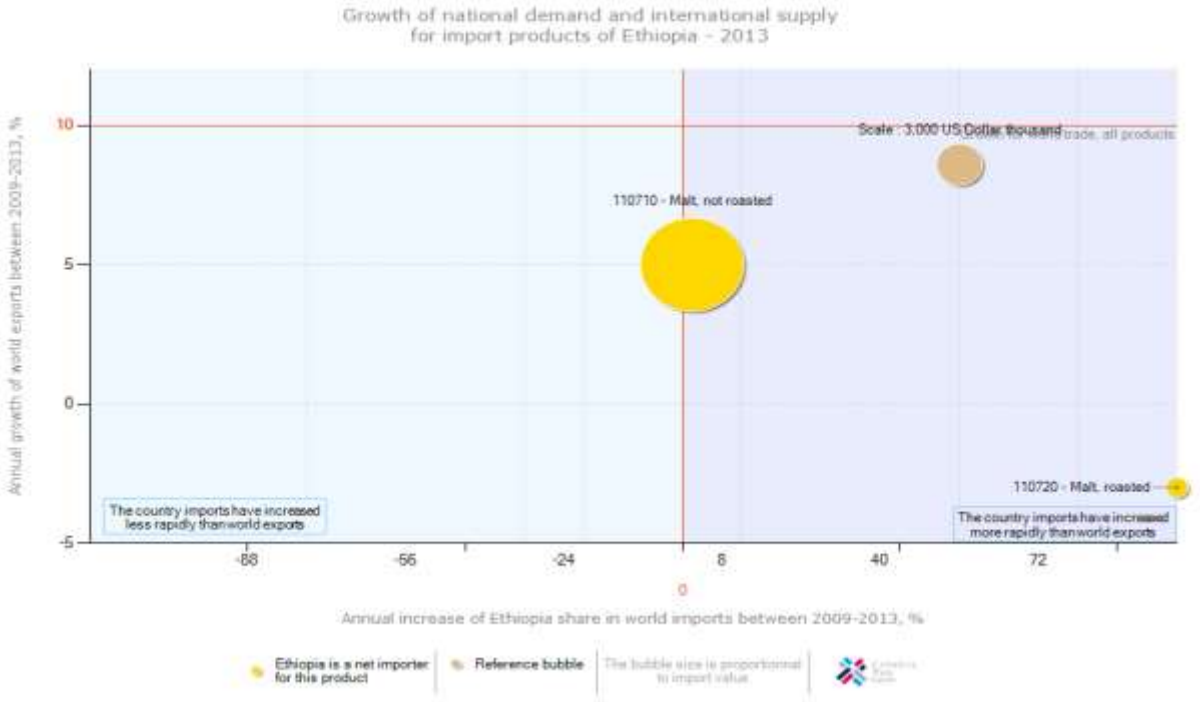
Source: International Trade Center (ITC), trade map.

Figure A4 Size of the market and growth of international supply for malt barley



Source: International Trade Center (ITC), trade map.

Figure A5 Growth of national demand and international supply for malt barley, Ethiopia



Source: International Trade Center (ITC), trade map.