Food and Agriculture Organization of the United Nations

Analysis of price incentives for sorghum in Ethiopia for the time period 2005-2012

February 2015

Monitoring and Analysing Food and Agricultural Policies (MAFAP)

Analysis of price incentives for sorghum in Ethiopia for the time period 2005-2012

February 2015

This technical note is a product of the Monitoring and Analysing Food and Agricultural Policies (MAFAP) programme. It may be updated as new data becomes available.

MAFAP is implemented by the Food and Agriculture Organization of the United Nations (FAO) in collaboration with the Organisation for Economic Co-operation and Development (OECD) and national partners in participating countries. It is financially supported by the Bill and Melinda Gates Foundation, the United States Agency for International Development (USAID) and FAO.

The analysis presented in this document is the result of partnerships established in the context of the MAFAP programme with The Ethiopian Development Research Institute.

This technical note was prepared by Berihu Assefa of the Ethiopian Development Research Institute with support and contributions from Barthélemy Lanos of the FAO.

For more information: **www.fao.org/in-action/mafap**

Recommended citation:
FAO. 2015. *Analysis of price incentives for Sorghum in Ethiopia.* Technical notes series, MAFAP, by Assefa B. Lanos B., Rome.

CONTENTS

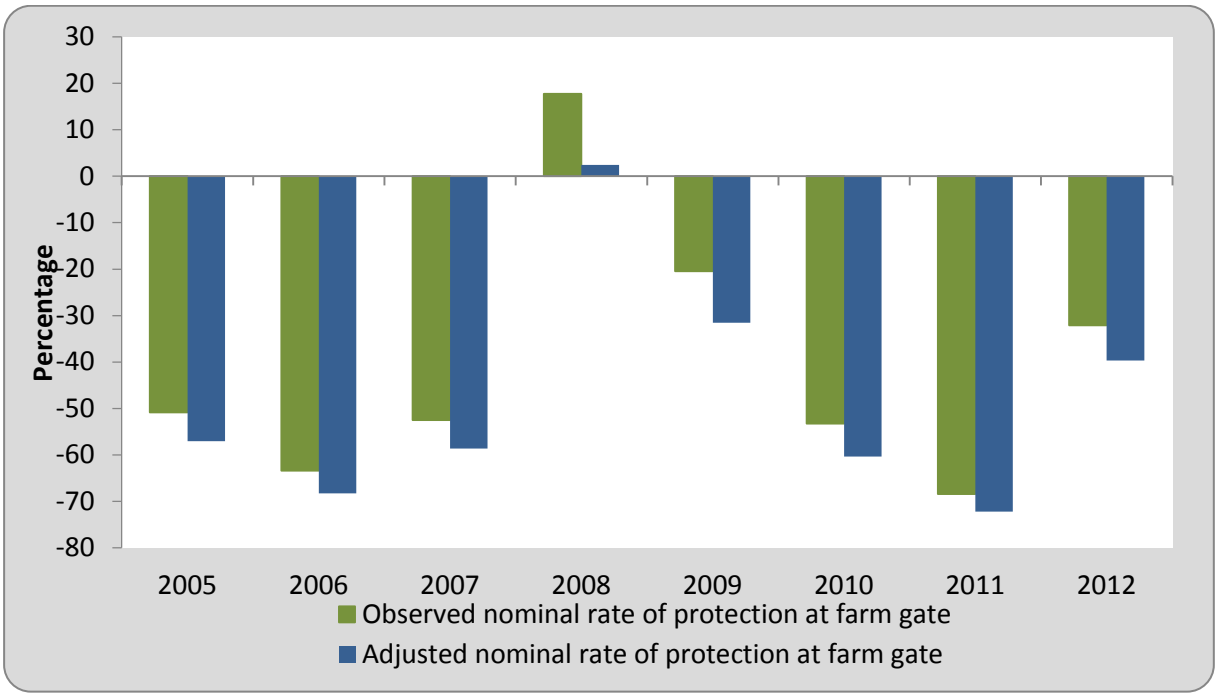
SUMMARY OF THE NOTE

Product: Sorghum
Period analysed: 2005 - 2012
Trade status: Import in all years

COMMODITY CONTEXT

- Sorghum accounts for the third largest share of total cereal production;
- Ethiopia is the second largest sorghum producer in Africa, after Sudan;
- Area under sorghum cultivation expanded from 1.30 million ha in 2004/05 to 8.5 million in 2011/12;
- Sorghum accounted for about 20.1 percent of per capita cereal intake in 2011/12;
- Sorghum is the single most important staple in drought prone areas;
- The majority of sorghum imports take the form of food aid;
- The sorghum value chain is long and involves too many small operators.

Observed and Adjusted Nominal Rate of Protection at Farm Gate for Sorghum in Ethiopia, 2005-2012



Source: Author's Calculations, 2014

The observed Nominal Rate of Protection (NRP, green bars) in the graph above measures the effect of policy distortions and overall market performance on price incentives for producers. The adjusted NRP (blue bars) captures the same elements as the observed NRP, in addition to any market distortions resulting from inefficiencies in the commodity's value chain and exchange rate misalignment. The difference between the two bars reflects the estimated cost that value chain inefficiencies and exchange rate misalignment represent to producers.

DRIVING FACTORS

- Our results show that incentives (positive NRP) occurred only under special circumstances of very high domestic prices. Disincentives were substantial in normal years and arose from (i)

overvalued exchange rate, (ii) export ban, (iii) distribution of imported wheat at subsidized prices with negative implications for substitute crops, such as sorghum, and (iv) weak market structure and high transport costs;

- The change from disincentive (2005-07) to incentive (2008 and 2009) and back to disincentive (2010-2012), though it started to improve in the period 2011-2012, implies uncertainty in the incentive environment;
- Sorghum production has increased in recent years owing to the expansion of area under cultivation, but an improved and stable policy environment is needed to enhance investment in yield-enhancing technologies.

RECOMMENDATIONS

Actions to be taken to reduce disincentives could include:

- Policy makers need to reconsider policies, including currency overvaluation and export bans, that have resulted in the implicit taxation of sorghum production;

- Reducing extreme fluctuations in domestic prices, giving clear policy signs to the agents, through policies that would transform the current state of limited trade and support regional exporting and importing of sorghum could have a significant positive impact on stabilizing and improving the price incentive for producers and value chain operators;

- Supporting the development of market structures and connecting farmers throughout the grain value chain and then, improve research and thus, the access to new technologies such as striga-resistent cultivars;

- Reducing the distribution of non-targeted and subsidized grain that depressed overall domestic food prices;

- Improving producers' power country-wide by supporting access to finance for the private sector to develop warehousing capacity for producers to store their produce until they get the right price signal; making an efficient and spread market information system and developing road infrastructure to link better value chain's agents.

1. PURPOSE OF THE NOTE

This technical note is an attempt to measure, analyse and interpret price incentives for sorghum in Ethiopia over the period 2005-2012.

For this purpose, yearly averages of domestic farm gate and wholesale prices are compared with reference prices calculated on the basis of the price of the commodity in the international market. The price gaps between reference prices and domestic prices along the commodity's value chain indicate the extent to which incentives (positive gaps) or disincentives (negative gaps) were present at the farm gate and wholesale level. The price gaps are expressed in relative terms as a percentage of the reference price, referred to as the Nominal Rate of Protection (NRP). These key indicators are used by MAFAP to assess the effects of policy and market performance on prices.

This technical note begins with a review of the commodity's production, consumption/utilization, marketing and trade, value chain and policy context (Chapter 2). It also provides a detailed description of how key data elements were obtained and indicators were calculated (Chapter 3). The indicators were then interpreted in light of existing policies and market characteristics (Chapter 4), and key policy recommendations were formulated on the basis of this interpretation (Chapter 5). Finally, the note concludes with a few main messages, limitations of the analysis and areas identified for further research to improve the analysis (Chapter 6).

The results and recommendations presented in this analysis of price incentives can be used by stakeholders involved in policy-making for the food and agriculture sector. They can also serve as input for evidence-based policy dialogue at the national, regional or international level.

This technical note should not be interpreted as an in-depth value chain analysis or detailed description of the commodity's production, consumption/utilization, marketing and trade or policy context. All information related to these areas is presented merely to provide background on the commodity under review, help understand major trends and facilitate the interpretation of the indicators.

All information in this technical note is subject to review and validation.

2. COMMODITY CONTEXT

Sorghum is one of the major staple crops grown in the poorest and most food insecure regions of Ethiopia. The crop is typically produced under adverse conditions such as low input use and marginal lands. It is well adapted to a wide range of precipitation and temperature levels and is produced from sea level to above 2000 m.a.s.l (Fetene, 2011). Its drought tolerance and adaptation attributes have made it the favourite crop in drier and marginal areas. Ethiopia is often regarded as the centre of domestication of sorghum because it has the greatest genetic diversity in the country for both cultivated and wild forms (Fetene, 2011).

PRODUCTION

With an annual production of approximately 4 million tonnes in 2011/2012 (CSA, 2013), sorghum is the second most important cereal produced in Ethiopia. Sorghum accounts for 20 percent of the total cereal produced in the country and covers about 20 percent of the total area under cereals. Sorghum production has significantly increased in recent years, from 1.7 million tonnes in 2004/05 to nearly 4.0 million in 2011/12 (130 percent) (see Table 1). Ethiopia is also the second largest producer of sorghum in eastern and southern Africa, after Sudan.

The large improvement in sorghum production is driven by both land expansion and yield improvement: yield increased from an average of 1.4 tonne/ha in 2004/05 to an average of 2.1 tonne/ha in 2010/11, increasing by 50 percent, while area under sorghum production increased by 51 percent (from 1.2 million ha in 2004/05 to 2.054 million ha in 2011/12). It should be noted that FAOSTAT yield and production figures during the period 2007 to 2012 are lower than the government (CSA) figures presented above.

Table 1: Cereals Area, Production, Yield and Annual Change (Smallholder Farms, Meher Season) – Ethiopia, 2004/05-2011/12

	2004/2005				2010/2011				2011/2012				Expansion rate			
	Area 000 ha	Production 000 tonnes	Yield (tonnes/ha)	Share in Total Cereals Area (%)	Area 000 ha	Production 000 tonnes	Yield (tonnes/ha)	Share in Total Cereals Area (%)	Area 000 ha	Production 000 tonnes	Yield (tonnes/ha)	Share in Total Cereals Area (%)	Area 000 ha	Production 000 tonnes	Yield (Tonnes/ha)	Share in Total Cereals Area (%)
Grain	981	11907			1182	20349			1208660	21857			20.5	70.9		
Cereals	763	10031			9691	17761			9588	18809			26.9	77.1		
Teff	213	2026	0.95	28.0	2761	3483	1.26	28.5	2731	3497	1.281	28.481	29.3	72.0	33.0	1.9
Barley	109	1328	1.21	14.3	1047	1703	1.63	10.8	9481	1585	1.672	9.88	-4.5	28.3	34.2	-24.7
Wheat	139	2177	1.56	18.3	1553	2856	1.84	16.0	1437	2916	2.029	14.9	11.1	31.2	18.1	-12.4
Maize	139	2394	1.72	18.2	1963	4986	2.54	20.3	2054	6069	2.954	21.4	40.9	108.3	47.8	11.1
Sorghum	125	1716	1.37	16.4	1898	3960	2.09	19.6	1923	3951	2.054	20.1	51.4	130.8	52.4	19.3
Finger millet	313	333	1.06	4.1	408	635	1.56	4.2	432	651	1.50	4.5	30.4	90.8	46.3	2.8
Oats / 'Aja'	45	57	1.26	0.6	31	48	1.54	0.3	30	49	1.61	0.3	-31.6	-16.1	22.7	-46.1
Rice	-	-	-	-	30	90	3.03	0.3	30	89	2.89	0.3	-	-	-	-

Source: Author's computation using CSA data

*Total Area cultivated and total production includes: Grain, Vegetables, root crops, Fruit crops, Chat, Coffee and Hops

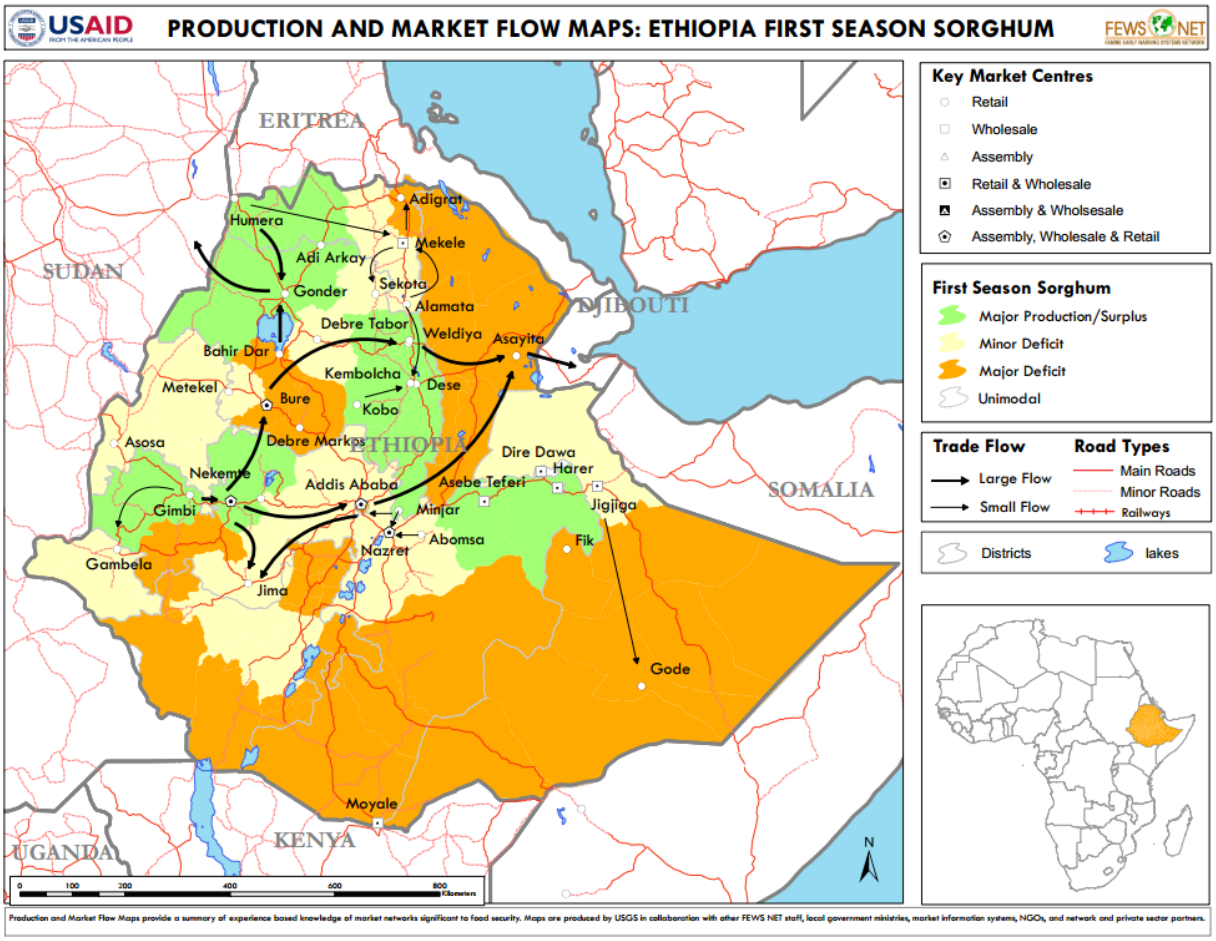
Sorghum is cultivated by nearly 4.5 million smallholders located in the eastern and north-western parts of Ethiopia (Figure 1), where the weather is dry and soil fertility is poor. Table 2 shows that the main sorghum producing regions are Oromia and Amhara, accounting for nearly 80 percent of total production. The leading sorghum producing zones are East and West Hararge in Oromiya and North Gondar and North Shoa in Amhara. The SNNPR and Tigray regions are relatively less important, contributing 11 and 4 percent of the national production, respectively.

Table 2: Sorghum Area, Production and Yield by Regions – Ethiopia (2011-12)

	Area in hectare	Production in tonnes	Yield (t/ha)	Share of production (%)
Oromia	743,379.32	1626,737.441	2.188	41.184
Amhara	7,330,117.68	1,432,067.373	1.954	36.255
Tigray	215,142.84	473,678.177	2.202	11.992
S.N.N.P.	122,731.01	196,715.893	1.603	4.980
Other	108,907.5	220,685.004	9.564	5.587
Ethiopia	**8,520,278.35**	**3,949,883.888**	**0.4635**	**100**

Source: Author's calculation based on CSA data, 2011/2012

Figure 1: Ethiopia Sorghum Production Area in Ethiopia, 2009



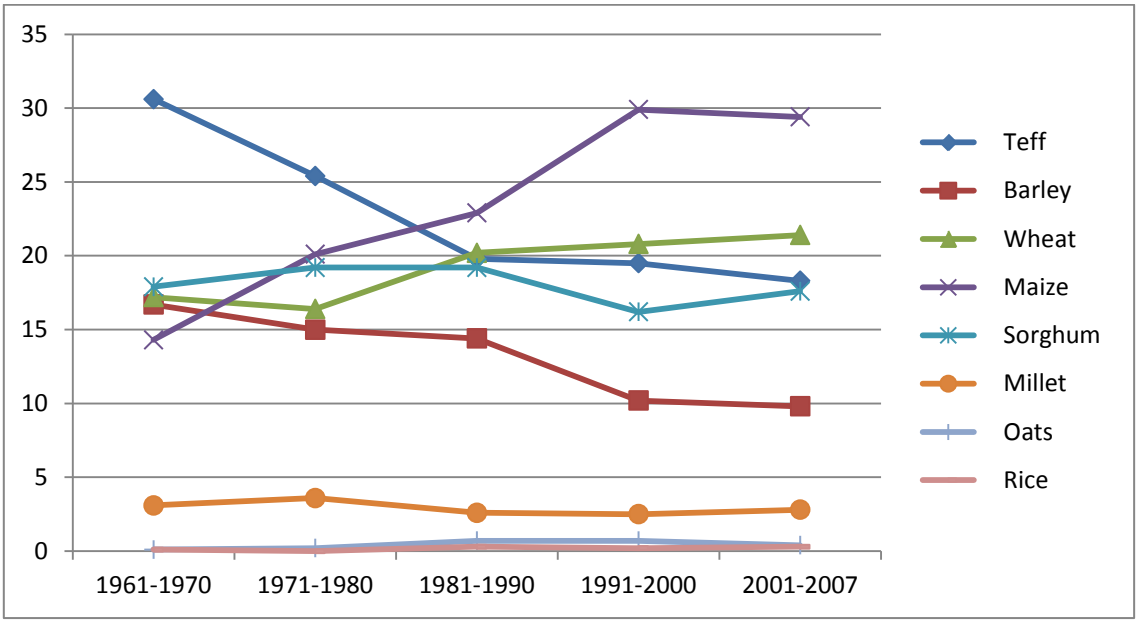
Source: Fewsnet, 2014

CONSUMPTION/UTILIZATION

Sorghum accounts for an average of 10 percent of the daily caloric intake of households living in the eastern and north-western areas of the country (USDA, 2012). About three-quarters of the sorghum grain in Ethiopia is used for making injera (the traditional bread, made from teff in more productive areas of the country). Another 20 percent is used for feed and local beer production, and the remainder is held for seed. The entire plant is utilized; sorghum stalks are used as firewood for cooking and for constructing houses, while leaves are used as animal fodder.

Sorghum is a close substitute for teff, therefore when teff prices decline, the consumption of sorghum declines, and vice versa. Per capita consumption of sorghum has increased in areas affected by adverse climate conditions, which favour the production of sorghum (as a drought tolerant crop) to other cereals. Moreover, because of high teff prices in recent years, even middle class households have increased sorghum consumption, mixing sorghum with teff to make injera (USDA, 2012). The share of sorghum in total cereal consumption at the national level has increased in recent years (Figure 2). It accounted for about 18 percent of the total cereal consumption from 2001 to 2007.

Figure 2: Consumption Trends of Major Staples in the Total Cereal Consumption



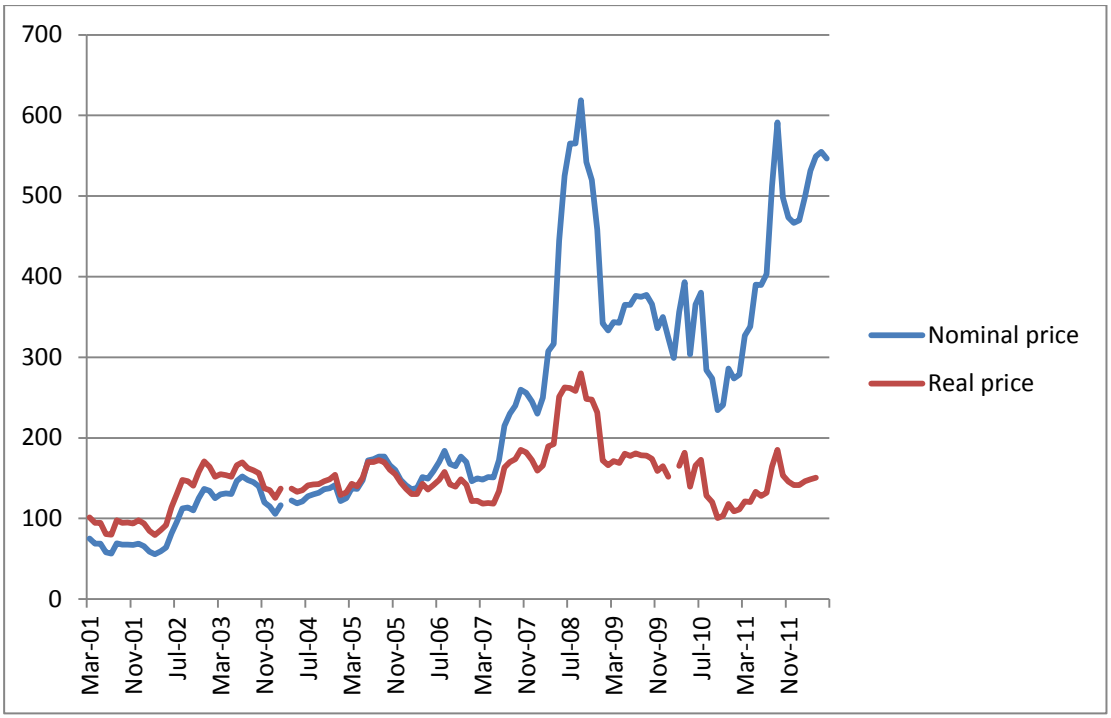
Source: Author's elaboration based on FAOSTAT data

MARKETING AND TRADE

The marketing system for sorghum in Ethiopia is poorly developed and has limited industrial use. Only 11.5 percent of the crop is sold, with 74 percent being consumed at the local level. The remaining 9.2 percent is retained as seed, while the rest is used as a payment of wages in kind (1.2 percent) and animal feed (0.9 percent) (AATF, 2011).

The nominal price of sorghum has risen sharply in recent years, with major spikes towards the end of 2008 and 2011 in the Addis Ababa central grain market. However, real prices increased marginally in 2008 and have been falling for much of 2009 and 2010. Owing to high inflation rates, changes in real prices were minimal compared to the huge changes in nominal prices. In 2010, real sorghum prices fell to as low as 2001 levels, before slightly increasing in 2011 (Figure 3).

Figure 3: Nominal and Real Prices of Red Sorghum at Addis Ababa Wholesale Market



Source: Giews Food Price Data and Analysis Tool

The commercial import or export of sorghum has not been significant in recent years. Sorghum imports have been limited to food aid imports, amounting to 16 120 tonnes in 2005 and 253 000 tonnes in 2008. On the other hand, sorghum exports were largely made up of informal trade in the north-western part of the country, closer to North Sudan.

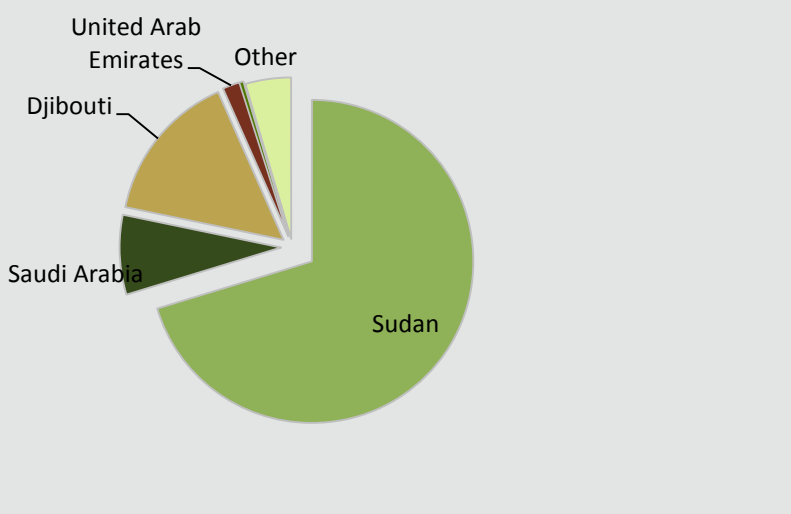
Table 3: Sorghum International Trade in Ethiopia (tonnes), 2005-2012

	2005	2006	2007	2008	2009	2010	2011	2012
Import Qt (T)	2,861	-	-	252697	69 770	113260	33,790.13	3720
Export Qt (T)	13,420	1 371	2402	2 224	-	21 786	29,105.32	7263.16
Net trade	10,559	1,371	2,402	-250,473	-69,770	-91,474	-4,684.81	-3,543.16
International price (USD/tonne)	267.19	384.11	335.74	308.91	289.21	420.08	756.55	429.42

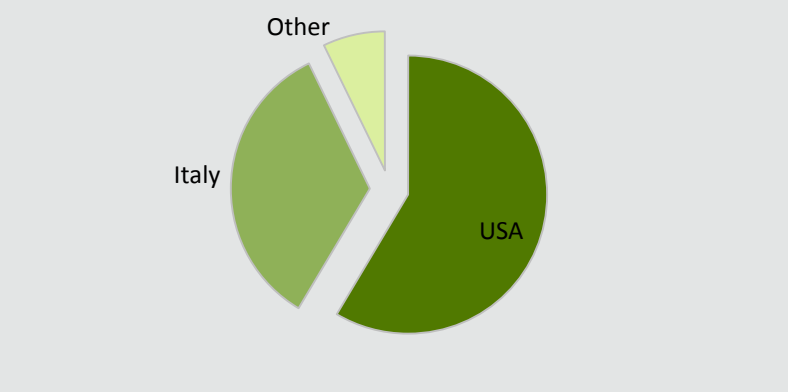
Source: UNComtrade, 2013

According to UNComtrade data, Ethiopia, a net exporter in the first three years of the study period (2005-07), became a net importer from 2008 to 2010 (Table 3). However, the volume of imports was more significant in 2008 and 2010 (113 000 tonnes), which is mainly attributed to food aid imports originating from the USA (Figure 4). Ethiopia exports mainly to neighbouring countries such as Sudan and Djibouti, and imports from the USA and Italy.

Figure 4: Share of the Countries Partners for Sorghum Exports and Imports with Ethiopia (%), 2005 - 2012



Export



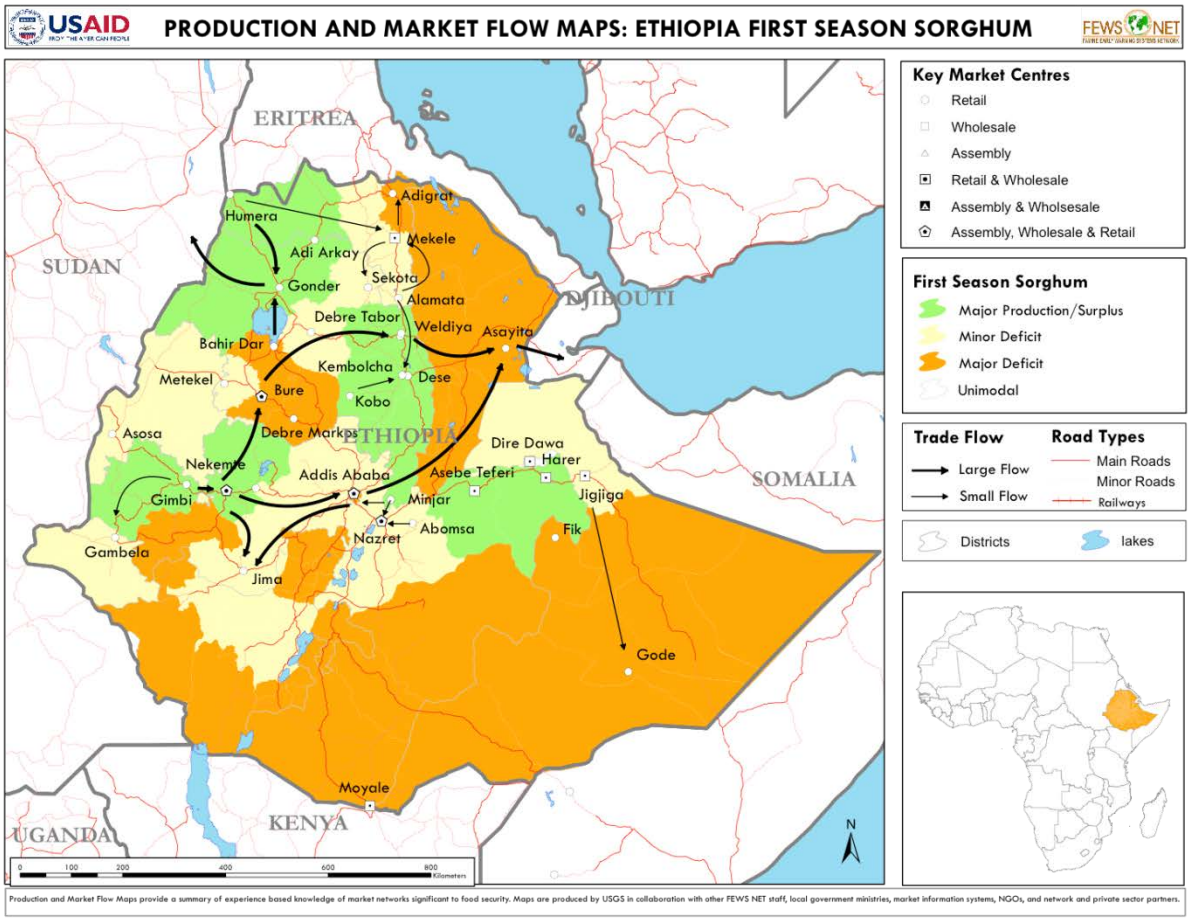
Import

Source: Author's elaboration based on UNCOMTRADE data, 2013

DESCRIPTION OF THE VALUE CHAIN

Sorghum's value chain remains underdeveloped because only about 13 percent of national sorghum production is marketed. It is more widely traded in deficit, marginal and pastoral areas where transport and communication infrastructure is less developed. As shown in Figure 5 below, sorghum from surplus areas is transported to deficit areas such as Mekele, Asayita, Dire Dawa (not shown in the figure), Jijiga and Gode, as well as Addis Ababa. The commodity flow pattern shows that cross-border exports to Sudan come from Gonder, a major market for surplus producing areas in the north.

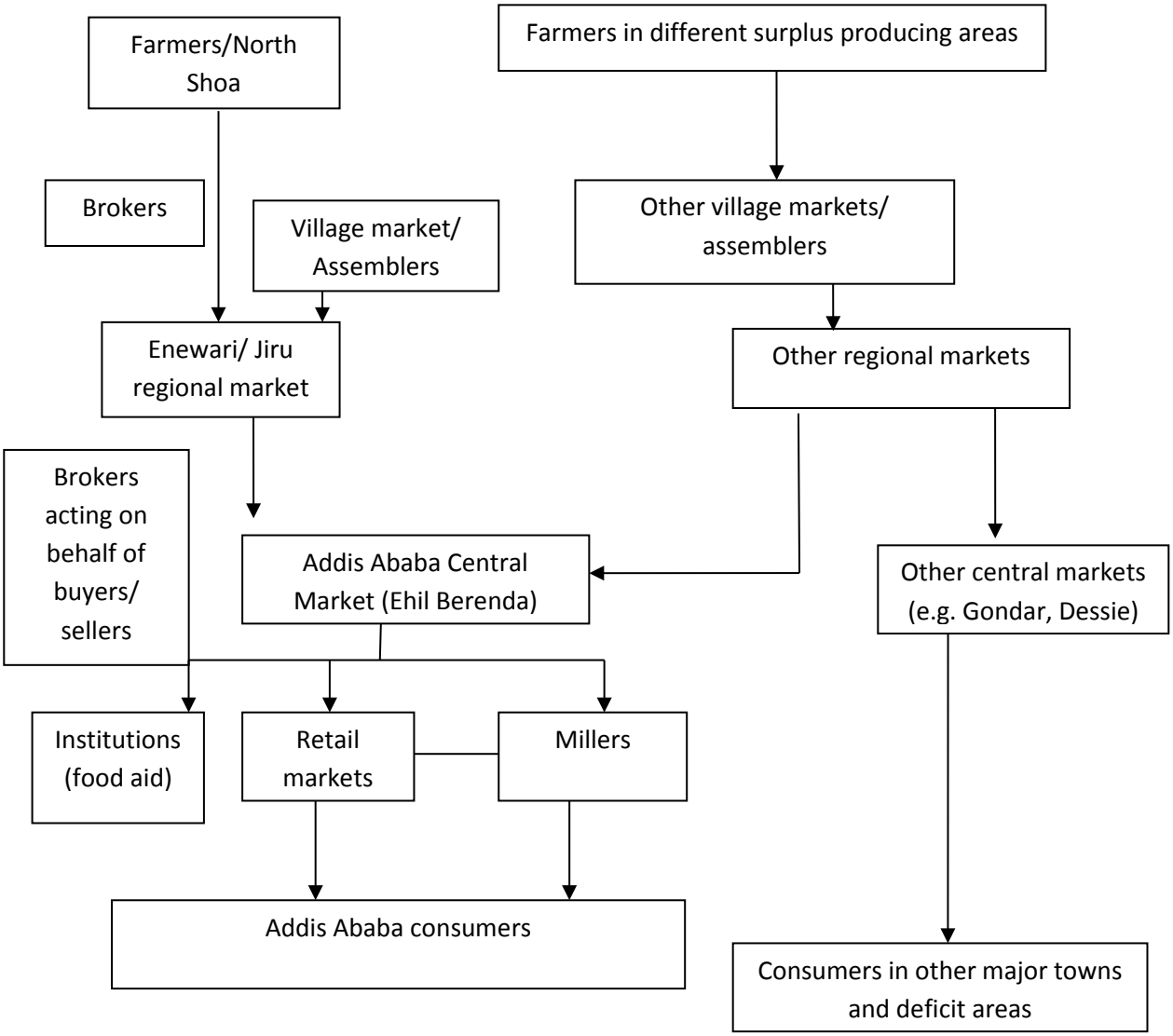
Figure 5: Production and Market Flow Maps of Sorghum in Ethiopia, 2009



Source: FEWSNET, 2009

Sorghum marketing begins with rural assemblers who operate in villages and small rural markets (figure 6), and are the primary sales outlets. They transport and sell to buyers, i.e. wholesalers, retailers and consumers, in the nearest big markets. The wholesalers in major production areas transport and sell most of their supplies to traders in the central markets with the help of brokers. They also sell to traders in food deficit areas and major consumption centres, as well as to surrounding consumers. In recent years, cooperatives and their unions have started participating in sorghum marketing, and it is estimated that they account for 15 percent of the marketable sorghum of small producers. They often act as assemblers and sell to wholesalers.

Figure 6: Sorghum value chain in Ethiopia, 2010



Source: Based on USAID and COMPETE, 2010

POLICY DECISIONS AND MEASURES

Between 1976 and 1990, the former government controlled grain trade through a government parastatal, the Agricultural Marketing Corporation (AMC). Farmers and traders were forced to sell grain to AMC at administratively fixed low prices. The AMC sold food grain that it purchased to urban consumers, mainly in the city of Addis Ababa, through food rationing shops (Gabre-Madhin, 2001).

After 1991, the new Government of Ethiopia introduced policy reforms that restored private trade and the AMC was transformed and renamed the Ethiopian Grain Trade Enterprise (EGTE). The EGTE now operates in the open market against the private sector, with the objective to (i) stabilize prices for producers and consumers; (ii) earn foreign exchange through exporting grain; and, (iii) facilitate the purchase and distribution of the Emergency Food Security Reserve. Over the years, the public enterprise has moved away from its price stabilization role to exporting pulses and oilseeds (Rashid and Negassa, 2011). In addition to pulses and oilseeds, the EGTE exported cereals such as maize in

2010 and 2011. The number of traders at primary, secondary or central market levels has increased considerably and many operate without licenses, undercutting formally registered traders (Demeke, et al. 2012). However, there has been no study to estimate the number of traders.

The Ethiopian Commodity Exchange (ECX) was established in 2008 to provide a marketplace where buyers and sellers could come together to trade. The Exchange has plans to expand its operation from export crops (coffee, sesame and haricot beans) to food crops; however, sorghum is not among the food crops identified (maize, wheat and teff) for ECX trading.

Sorghum production is predominantly based on traditional seeds with limited use of commercial fertilizer or other chemicals. There is a relatively strong sorghum research program in Ethiopia, such as the Ethiopian Institute of Agricultural Research, which has a long history of research on striga, a parasitic weed. However, striga resistant/tolerant varieties are not widely adopted because farmers prefer local varieties for meeting their food and biomass needs (fuel wood, animal feed and construction). Research capacity to confer striga resistance to preferred sorghum varieties seems to be weak.[1]

The Agricultural Transformation Agency (ATA) has been established (2010) to enhance productivity and production of smallholder farmers and pastoralists as a part of the current five-year (2011-15) Growth and Transformation Plan (GTP). Its primary aim is to promote agricultural sector transformation by supporting existing structures of government. Sorghum is not included amongst the priority crops that the agency has identified, which include teff, wheat, maize, barley, pulses, oilseeds, rice and livestock.

In short, sorghum is a neglected crop despite its considerable importance for food security for the vast majority of vulnerable populations. Sorghum production and marketing are affected by lack of government attention and inadequate support from research, agricultural programs and rural development policies.

Government policy responses to the price hikes in 2008 and 2011 included the continued sale of imported sorghum, along with other food and grains at subsidized prices and lifted value-added & turnover taxes on imported foods (USDA, 2013). Beginning in April 2008, the government's rationing of foreign exchange inhibited private sector imports, which finally resulted in less imports and higher prices. Beyond implicit private import restriction, the government explicitly banned grain exports in February 2008. This was lifted for cereals, such as maize, in July 2010, only to be re-imposed again in March 2011 as rising food prices started to take a toll on the general inflation;[2] a measure that is still in place. Exports were occasionally allowed to neighbouring countries once domestic supply needs were met (USDA, 2013). The lack of reliable and real time data poses a major threat in these circumstances because the *sufficiency* of national supply is decided based off of the data available.

[1] African Agricultural Technology Foundation (2011), Feasibility study on Striga control in Sorghum, Nairobi, AATF.

[2] http://ethiopiantimes.wordpress.com/2011/03/19/government-re-imposes-maize-export-ban/

3. METHODOLOGY

MAFAP methodology seeks to measure price incentives for producers and other marketing agents in key agricultural value chains. The analysis is based on the comparison between observed domestic prices and constructed reference prices. Reference prices are calculated from the international price of the product at the country's border, where the product enters the country (if imported) or exits the country (if exported). This price is considered the benchmark price free of influence from domestic policies and markets. MAFAP estimates two types of reference prices – observed and adjusted. *Observed reference prices* are those that producers and other marketing agents could receive if the effects of distortions from domestic market and trade policies, as well as overall market performance, were removed. *Adjusted reference prices* are the same as observed reference prices, but also exclude the effects of any additional distortions from domestic exchange rate policies, structural inefficiencies in the commodity's value chain, and imperfect functioning and non-competitive pricing in international markets.

MAFAP's price incentives analysis is based on the law of one price, which is the economic theory that there is only one prevailing price for each product in a perfectly competitive market. This law only applies in the case of homogeneous goods, if information is correct and free, and if transaction costs are zero. Thus, this analysis was conducted for goods that are either perfectly homogeneous or perfect substitutes in the local market in terms of quality, or, failing that, are simply comparable goods. Indicators calculated from reference and domestic prices will, therefore, reveal whether domestic prices represent support (incentives) or a tax (disincentives) to various agents in the value chain.

Domestic prices are compared to reference prices at two specific locations along commodity value chains – the farm gate (usually the main production area for the product) and the point of competition (usually the main wholesale market where the domestic product competes with the internationally traded product). The approach for comparing prices at each location is summarized below, using an imported commodity as an example. In this situation, the country is importing a commodity that arrives in the port at the benchmark price (usually the unit value CIF price at the port of entry). In the domestic market, we observe the price of the same commodity at the point of competition, which is in this case the wholesale market, and at the farm gate. We also have information on observed access costs, which are all the costs associated with bringing the commodity to market, such as costs for processing, storage, handling, transport and the different margins applied by marketing agents in the value chain. These include access costs between the border and wholesale, as well as between the farm gate and wholesale.

The benchmark price is made comparable to the domestic price at wholesale by adding the access costs between the border and wholesale, resulting in the observed reference price at wholesale. This takes into account all the costs incurred by importers and other agents to bring the commodity to market, which in effect, raises the price of the commodity. The reference price at wholesale is further made comparable to the domestic price at the farm gate by deducting the access costs between the farm gate and wholesale, resulting in the observed reference price at farm gate. This takes into account all the costs incurred by farmers and other agents to bring the commodity from the farm to the wholesale market. Mathematically, the equations for calculating the observed

reference prices at wholesale(RP_{owh}) and farm gate $\left(RP_{ofg}\right)$for an imported commodity are as follows:

$$RP_{owh} = P_b + AC_{owh}$$

$$RP_{ofg} = RP_{owh} - AC_{ofg}$$

where AC_{owh} are the observed access costs from the border to wholesale, including handling costs at the border, transport costs from the border to the wholesale market, profit margins and all observed taxes and levies, except tariffs, and P_b is the benchmark price. AC_{ofg} are the observed access costs from the farm gate to wholesale, including handling costs at the farm, transport costs from farm to wholesale market, processing, profit margins and all observed taxes and levies.

The same steps described above can be taken a second time using benchmark prices and access costs that have been adjusted to eliminate market distortions due to exchange rate misalignments, structural inefficiencies in the commodity's value chain[3] and imperfect functioning and non-competitive pricing in international markets, where possible and relevant. The adjusted benchmark prices and access costs are then used to generate a second set of *adjusted* reference prices, in addition to the first set of *observed* reference prices calculated.

For exported commodities, a slightly different approach is used. In this case, the border is generally considered the point of competition (wholesale), and the unit value FOB price for the commodity is normally taken as the benchmark price. Furthermore, observed and adjusted reference prices at wholesale are obtained by subtracting, rather than adding, the access costs between the border and wholesale. Mathematically, the equations for calculating the observed reference prices at wholesale(RP_{owh}) and farm gate $\left(RP_{ofg}\right)$for an exported commodity are as follows:

$$RP_{owh} = P_b - AC_{owh}$$

$$RP_{ofg} = RP_{owh} - AC_{ofg}$$

After observed and adjusted reference prices are calculated for the commodity, they are subtracted from the domestic prices at each point in the value chain to obtain the observed and adjusted price gaps at wholesale and farm gate. *Observed price gaps* capture the effect of distortions from trade and market policies directly influencing the price of the commodity in domestic markets (e.g. price ceilings and tariffs), as well as overall market performance. *Adjusted price gaps* capture the same as the observed, in addition to the effect of any distortions from domestic exchange rate policies, structural inefficiencies in the commodity's value chain, and imperfect functioning and non-competitive pricing in international markets. Mathematically, the equations for calculating the observed price gaps at wholesale(PG_{owh}) and farm gate $\left(PG_{ofg}\right)$are as follows:

$$PG_{owh} = P_{wh} - RP_{owh}$$

$$PG_{ofg} = P_{fg} - RP_{ofg}$$

[3] Structural inefficiencies in commodity value chains may include government taxes and fees (excluding fees for services), high transportation and processing costs, high profit margins captured by various marketing agents, bribes and other non-tariff barriers.

where P_{fg} is the domestic price at farm gate, RP_{ofg} is the observed reference price at farm gate, P_{wh} is the domestic price at wholesale, and RP_{owh} is the observed reference price at wholesale.

A positive price gap, resulting when the domestic price exceeds the reference price, means that the policy environment and market functioning as a whole generate incentives (support) to producers or wholesalers. For an imported commodity this could be due to distortions such as the existence of an import tariff. On the other hand, if the reference price exceeds the domestic price, resulting in a negative price gap, this means that the policy environment and market functioning as a whole generate disincentives (taxes) to producers or wholesalers. For an imported commodity this could be due to distortions such as a price ceiling established by the government to keep domestic prices low.

In general, price gaps provide an absolute measure of the market price incentives (or disincentives) that producers and wholesalers face. Therefore, price gaps at wholesale and farm gate are divided by their corresponding reference price and expressed as a ratio, referred to as the ***Nominal Rate of Protection (NRP)***, which can be compared between years, commodities, and countries.

The *Observed Nominal Rates of Protection* at the farm gate (NRP_{ofg}) and wholesale (NRP_{owh}) are defined by the following equations:

$$NRP_{ofg} = \frac{PG_{ofg}}{RP_{ofg}} \; ; \; NRP_{owh} = \frac{PG_{owh}}{RP_{owh}}$$

Where PG_{ofg} is the observed price gap at farm gate, RP_{ofg} is the observed reference price at the farm gate, PG_{owh} is the observed price gap at wholesale and RP_{owh} is the observed reference price at wholesale.

Similarly, the *Adjusted Nominal Rates of Protection* at the farm gate (NRP_{afg}) and wholesale (NRP_{awh}) are defined by the following equations:

$$NRP_{afg} = \frac{PG_{afg}}{RP_{afg}} \; ; \; NRP_{awh} = \frac{PG_{awh}}{RP_{awh}}$$

Where PG_{afg} is the adjusted price gap at farm gate, RP_{afg} is the adjusted reference price at the farm gate, PG_{awh} is the adjusted price gap at wholesale and RP_{awh} is the adjusted reference price at wholesale.

If public expenditure allocated to the commodity is added to the price gap at farm gate when calculating the ratios, the ***Nominal Rate of Assistance (NRA)*** is generated. This indicator summarizes the incentives (or disincentives) due to policies, market performance and public expenditure.[4] Mathematically, the Nominal Rate of Assistance is defined by the following equation:

$$NRA = \frac{PG_{afg} + PE_{csp}}{RF_{afg}}$$

[4] The NRA indicator was not calculated for any of the commodities analyzed because of insufficient data on public expenditure. However, it will be developed in the forthcoming reports, as the public expenditure analysis is improved and better data are made available.

Where PE_{csp} is commodity-specific public expenditure that has been identified and measured as monetary units per tonne.

Finally, MAFAP methodology estimates the ***Market Development Gap (MDG),*** which is the portion of the price gap that can be attributed to "excessive" or inefficient access costs within a given value chain, exchange rate misalignments, and imperfect functioning of international markets. "Excessive" access costs may result from factors such as poor infrastructure, high processing costs due to obsolete technology, government taxes and fees (excluding fees for services), high profit margins captured by various marketing agents, bribes and other non-tariff barriers. Therefore, the total MDG at farm gate is comprised of three components – gaps due to "excessive" access costs, the exchange rate policy gap and the international market gap. When added together, these components are equivalent to the difference between the observed and adjusted price gaps at farm gate.

Similar to the price gaps calculated, the MDG is an absolute measure, which is also expressed as a ratio to allow for comparison between years, commodities, and countries. This relative indicator of the total MDG affecting farmers is derived by calculating the ratio between the total MDG at farm gate and the adjusted reference price at farm gate as follows:

$$MDG_{fg} = \frac{(ACG_{wh}+ACG_{fg}+EXPG+IMG)}{RP_{afg}}$$

Where ACG_{wh} is the access cost gap at wholesale defined as the difference between observed and adjusted access costs at wholesale, ACG_{fg} is the access cost gap at farm gate defined as the difference between observed and adjusted access costs at the farm gate, ERPG is the exchange rate policy gap, and IMG is the international market gap.

A more detailed description of the methodology applied in this analysis is available on MAFAP's website at **www.fao.org/in-action/mafap**.

4. DATA REQUIREMENTS AND CALCULATION OF INDICATORS

To calculate MAFAP's price incentives indicators, several types of data are needed. This section presents the data that was obtained and methodological decisions that were taken in this analysis.

TRADE STATUS OF THE PRODUCT

Based on the figures reported by the Ethiopian Customs (2014), the country was a net exporter in 2005, 2006, 2007 and 2012 (see Table 4); however, the exports reported are not significant, as they account for only 0.1 percent of total production. Sorghum imports in deficit were much more relevant, reaching up to 2.9 percent of total production for import years (in 2010). Furthermore, imports were nil in the period 2005-2007, owing to Ethiopia's reliance on stocks built from international aid received in 2003/2004, following a crisis in 2002/2003 and good harvest years from 2005 to 2007. Ethiopia is thus considered a net importer of sorghum for the period 2005 to 2012.

Table 4: Trade export and import volumes for sorghum in Ethiopia, in Tonnes, 2005-2012

Item	Unit	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**
Imports Volume	Tons	0	0	0	252697	69770	113260	33790	3720
Exports Volume	Tons	2640	1318	2401	2226	0	21786	29105	7263
Trade status		x	x	x	m	M	m	m	m

Source: Ethiopian Customs and Revenue Authority, 2014

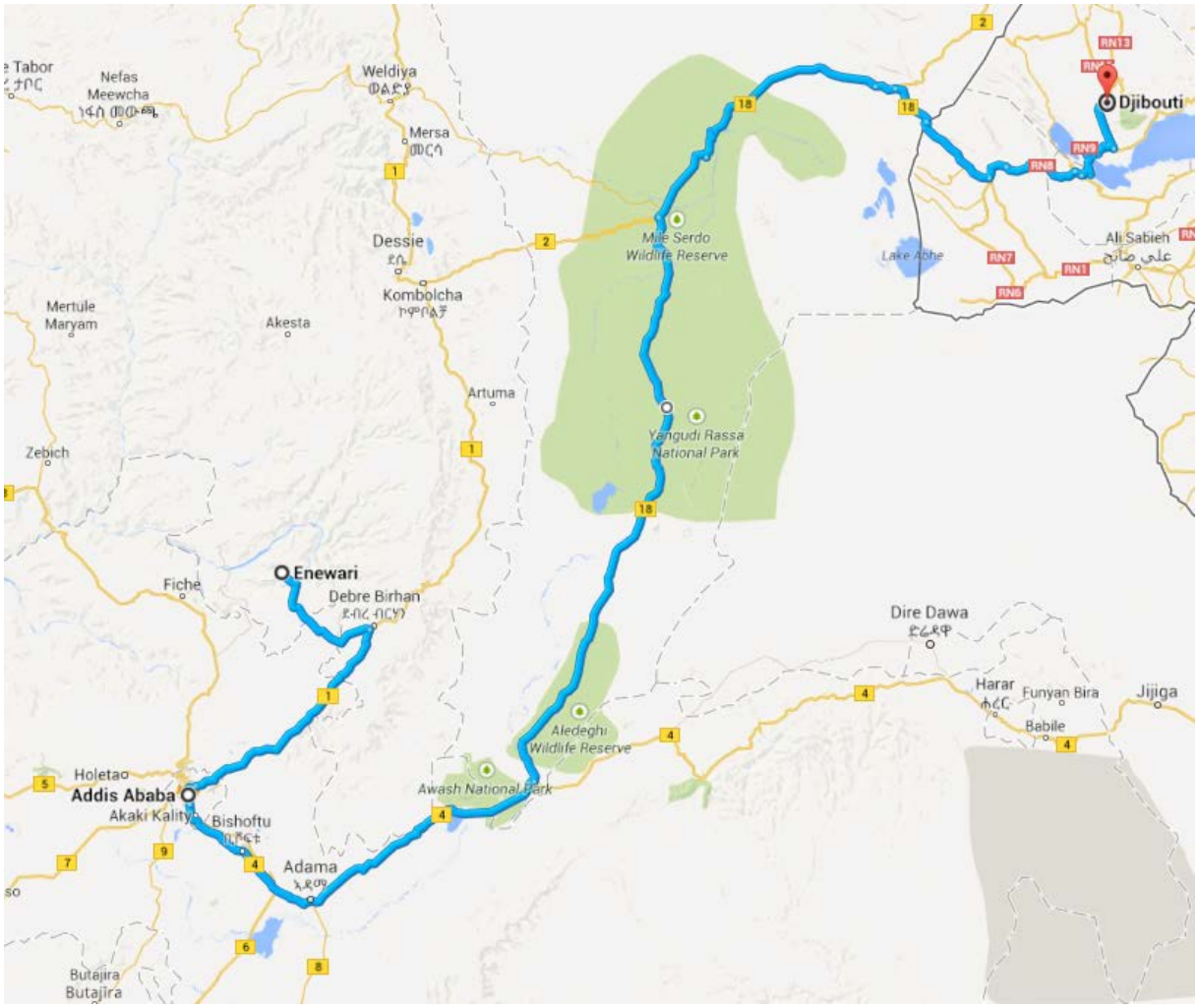
MARKET PATHWAY ANALYSED

The Oromia and Amhara regions are the main sorghum growing areas in Ethiopia, accounting for 41 and 36 percent of total sorghum production volume in the country, respectively. The town of Enewari/Jiru (North Shoa) was chosen as the farm gate for our analysis, as it is located in a major sorghum-producing area, situated 200 km north of Addis Ababa, itself part of the Amhara region (see Figure 7).

Imported sorghum and sorghum from the main producing areas then reach the major market centers in Addis Ababa. Therefore, Addis Ababa was considered the point of competition between locally produced and imported sorghum.

When imported, the port of Djibouti is the main entry point for sorghum in Ethiopia, and was considered as such in the analysis. Imported sorghum is then traded to Addis Ababa through the town of Asayita (also see MARKETING AND TRADE).

Figure 7: Market Pathway Analysed for Sorghum in Ethiopia: Enewari, Production Area (C), Addis Ababa, Point of Competition (B), and Port Djibouti Point of Entry (A)



Source: Authors, from Google Maps

BENCHMARK PRICES

Observed

The basis for calculating a reference parity price to determine whether sorghum producers receive market incentives or disincentives is to establish a benchmark (border) price, which represents the market price for sorghum that would prevail in the absence of domestic policy interventions and market inefficiencies. Since Ethiopia is considered a net importer of sorghum in our analysis, a nominal CIF price was used as the benchmark price (Table 5). It was calculated as the ratio between volume and values of imported sorghum declared by ERCA at the port of Djibouti. The CIF price that was used for sorghum is referred to as ''grain sorghum'' in the ERCA dataset, HS code 100700. Since sorghum exported from the United States of America to international markets is primarily used for animal feed (Clay, 2003), it was assumed that the CIF price reflects the price for red sorghum, which is of lower quality and less preferred by consumers.

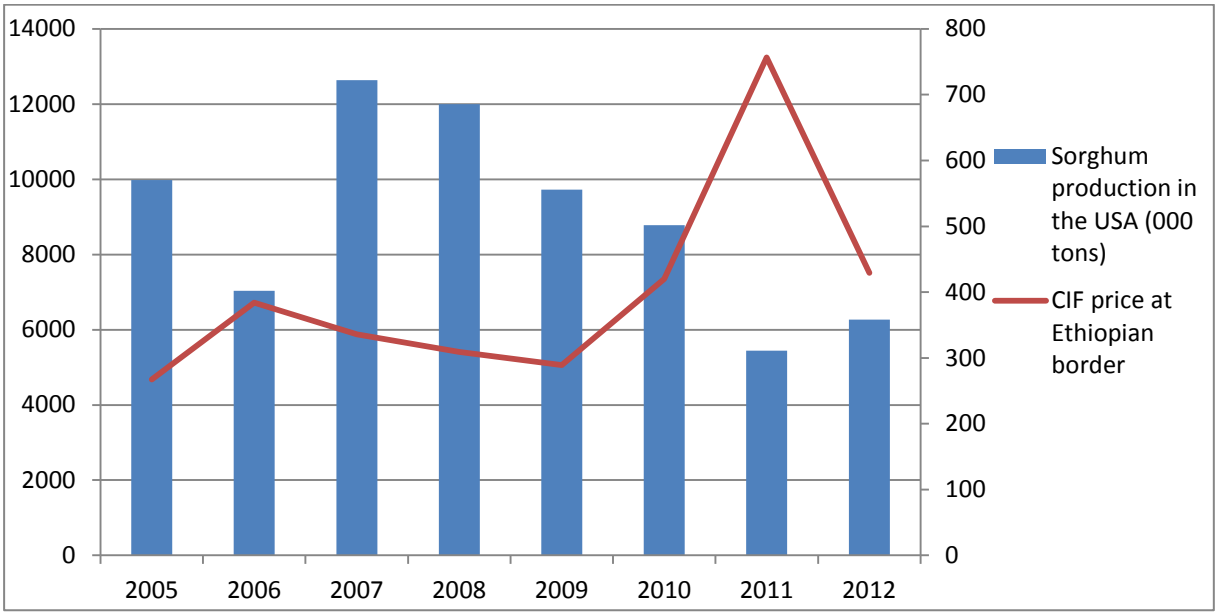
Table 5: Benchmark Price for Sorghum in Port Djibouti (USD/tonne), 2005-2012

Year	2005	2006	2007	2008	2009	2010	2011	2012
Benchmark price	267.1	384.1	335.7	308.9	289.2	420	756	429.4

Source: ERCA, 2014

The benchmark price remained relatively stable between 2006 and 2009, with an average change of 9 percent and a slight decrease from 2007 to 2009. Between 2009 and 2010, the price strongly increased (+45 percent), surging (+85 percent) to over 700 USD/tonne in 2011, which is almost twice the price of 2006. It then decreased to just above 400 USD/tonne in 2012 (Figure 8).

Figure 8: Benchmark Price for Sorghum in Ethiopia, in USD/tonne, and Production Volumes in the USA (000 tonnes), 2005-2012



Source: Author's own calculation based on data obtained from Ethiopian Customs Authority (ERCA), and FAOSTAT, 2013

The CIF price trend is linked to the level of production in Ethiopia's main importing partner, the United States. In 2006 and 2011, the CIF price of imported sorghum in Ethiopia surged, likely owing to a drop in the production of American sorghum (Figure 8). In 2011 especially, the production reached its lowest level for the period, with a decrease of almost 40 percent from the previous year, corresponding to an international price increase of 80 percent from 2010 levels.

Adjusted

No adjustments to benchmark prices were made.

DOMESTIC PRICES

Observed prices at point of competition

The two main types of sorghum consumed in Ethiopia are red and white sorghum, but white is most preferred for human consumption. Over the January 2005-April 2014 period, the price of white sorghum was 57 percent higher than that of red at Addis Ababa wholesale (GIEWS, 2014). Based on this assumption and owing to higher data availability, red sorghum was selected as the focus for this analysis. Thus, all domestic prices were collected and calculated for red sorghum instead of white.

The average annual wholesale prices for red sorghum in Addis Ababa were used in this analysis (Table 6). These prices were derived from monthly wholesale prices available on the Ethiopian Grain Trade Enterprise's (EGTE) website (http://egtemis.com/marketstat.asp).

Table 6: Observed Wholesale Prices for Red Sorghum in Addis Ababa, 2005-2012

	2005	2006	2007	2008	2009	2010	2011	2012
ETB/tonne	1,536	1,590	1,971	4,453	3,561	3,118	5,258	8,103

Source: EGTE, 2014

Observed prices at farm gate

As stated in the MARKET PATHWAY ANALYSED section, Enewari/Jiru (North Shoa), a major sorghum-producing region that is situated 200 km north of Addis Ababa, was selected as the farm gate in this analysis. Due to lack of available data from 2005 to 2010, farm gate prices were calculated for those years by deducting access costs from wholesale prices in Enewari/Jiru. Since the EGTE does not provide wholesale prices for sorghum in Enewari/Jiru, prices in Debre Berhan, located 70 km from Enewari/Jiru, were used instead. The price difference was assumed to be insignificant because of the proximity of the two markets. However, the wholesale prices in Debre Berhan were only available for white sorghum, so the prices were adjusted to reflect red sorghum prices using a white to red sorghum price ratio determined from the price of the two commodities in Addis Ababa's main market.

Access costs incurred by traders, who buy sorghum from local farmers and sell in Enewari/Jiru, include local transport, handling and the traders' margin, and are estimated as half of the estimated net margin obtained by traders selling sorghum in Addis Ababa (see Table 7), based on discussions with traders. Observed farm gate prices for red sorghum in Enewari/Jiru, after the necessary adjustments, are shown in Table 7.

Table 7: Observed Farm Gate Prices for Red Sorghum in Enewari/Jiru, in ETB/tonne, 2005-2010

		Unit	2005	2006	2007	2008	2009	2010
1	Wholesale price for white sorghum in Debre Berhan (proxy for the wholesale price in Enewari/Jiru)	ETB/T	2100	2514	3109	6140	5883	5260
2	Adjustment factor for converting white sorghum to red sorghum		1.40	1.63	1.69	1.41	1.74	1.80
3	Wholesale price for red sorghum in Enewari/Jiru (1/2)		1,505	1,547	1,838	4,357	3,373	2,920
4	Farm gate price for red sorghum in Enewari/Jiru (after deducting costs from Enewari/Jiru to farm gate)		1,430	1,472	1,763	4307	3323	2870

Source: EGTE, 2012

Producers' prices were obtained through the EGTE for 2011 and 2012, directly at the farm gate at Enewari/Jiru. The farm gate prices used in the analysis are reported in Table 8.

Table 8: Farm Gate Prices Used for the Analysis for Red Sorghum in Ethiopia, in ETB/tonne, 2005-2012

	2005	2006	2007	2008	2009	2010	2011	2012
Farm gate price for red sorghum in Enewari/Jiru	1,430	1,472	1,763	4,307	3,323	2,870	4,157	5,537

Source: EGTE, 2012 and 2014

EXCHANGE RATES

Observed

The observed official mean of annual exchange rates is derived from daily exchange rates applied in inter-bank transactions by the National Bank of Ethiopia.[5] The rates increased from Birr 8.67 to 17.60 Birr per USD between 2005 and 2012 (Table 9).

Table 9: Observed Exchange Rate in Ethiopia, in Birr/tonne, 2005-2012

	2005	2006	2007	2008	2009	2010	2011	2012
Exchange rate (Birr per US$1)	8.67	8.74	9.21	9.80	12.10	12.89	16.90	17.60

Source: National Bank of Ethiopia, 2014

Adjusted

Ethiopia adopts a floating exchange rate that is under strong government control. The National Bank of Ethiopia is the sole provider of foreign exchange, and only authorized banks and investors who are able to bid for at least USD 0.5 million are allowed to participate in the weekly foreign exchange auction. The marginal rate of each auction (once a week) serves as the official rate until a new rate is established in the next round (a week later).

It is believed that the domestic currency (Birr) was overvalued over the 2008-2012 period, especially in 2008, 2009 and 2010 (Demeke, 2012). The extent of overvaluation was estimated at 40 percent during this period, and the government was forced to devalue the Birr by 25 percent in September 2010 (Rashid, 2010). Another study (Dorosh, et al., 2009) showed that the real exchange rate appreciated by 9.7, 12.8, 14.9 and 33.8 percent in July 2005, July 2006, July 2007, July 2008 and by 26.3 percent in June 2009, respectively. The major causes of currency appreciation in Ethiopia are the high rates of inflation (relative to the low inflation rate among its trading partners) and the increasing pressure on foreign exchange reserves. Between 2005 and 2008, inflation rates hit double digits and then declined to 8.5 and 7 percent in 2009 and 2010, increasing again to 35 and 21 percent in 2011 and 2012, respectively (CSA).

In 2007 and 2008, the foreign currency reserve fell short of the critical requirement of 12 weeks' worth of imports and so the government instituted foreign exchange rationing (Rashid, 2010). In March 2008, access to foreign exchange for imports was indeed rationed to curb the excessive drawdown of foreign exchange reserves.

[5] http://www.nbe.gov.et/market/dailyexchange.html

For this analysis, it is assumed that the local currency was, on average, 20 percent overvalued during the period 2005-2010. The exchange rate has been adjusted accordingly in our calculation of adjusted reference prices (Demeke, 2012). Similarly in 2011 and 2012, a respective adjustment rate of 13 and 12 percent was taken, as per the information from the IMF and the World Bank. The adjustment factor approximates the depreciation of the local currency, had a more liberal fiscal policy been pursued.

Table 10: Observed and Adjusted Exchange Rate (Ethiopian Birr, ETB, per 1 USD), 2005-2012

	2005	2006	2007	2008	2009	2010	2011	2012
Official Exchange rate ETB/USD	8.67	8.74	9.21	9.80	12.10	12.89	16.90	17.60
Adjustment factor	1.20	1.20	1.20	1.20	1.20	1.20	1.13	1.12
Adjusted Exchange rate	10.40	10.49	11.05	11.76	14.52	15.47	19.10	19.70

Source: NBE (2014), Rashid (2010) and IMF (2014)

ACCESS COSTS

Observed

Border to point of competition

Observed access costs from the Djibouti Port (border) to Addis Ababa (wholesale) include surtaxes and withholding taxes, port handling, transport, unloading and miscellaneous costs (equal to 5 percent of the CIF price). These cost estimates (Table 11 and Table 13) were based on a USAID Bellmon study (USAID, 2010); trader margins are included under miscellaneous costs. Over the years, the variations in the costs from the USAID study correspond to access costs obtained from major grain traders and trade associations for 2005-2010, confirming their reliability. They were updated for 2011 and 2012 using the Consumer Price Index for Ethiopia, and triangulated with trader interviews.

Table 11: Observed Access Costs from Djibouti to Addis Ababa for Red Sorghum, ETB/tonne, 2005-2012

		2005	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**
Surtax & Withholding tax	ETB/T	51	62	83	119	97	92	104	104
Port Handling	ETB/T	233	233	233	233	233	233	233	233
Transport costs	ETB/T	380	380	387	438	528	570	600	850
Unloading	ETB/T	32	32	32	32	32	32	32	32
Miscellaneous (5% of CIF)/tonne	ETB/T	116	168	155	151	175	271	150	150
Total costs – observed	ETB/T	837.2	904.9	930.9	1037.4	1109.8	1209.0	1148.5	1409.0

Source: ESL and USDA, 2011

Farm gate to point of competition

Access costs from Enewari/Juru (farm gate) to Addis Ababa (wholesale) for each year are based on information gathered from group discussions with traders/brokers and traders' associations at the Addis Ababa central grain market. These costs include loading, transport, brokers' fees for truck service, unloading, storage, losses, brokers' fees for selling sorghum in Addis Ababa and margins for traders. As per discussions with traders, the sorghum market is very tight and thus, traders' margins have been estimated at 2.5 percent of the producer price for the 2005-2008 period. From 2009, they were estimated at 2 percent of the producer price to reflect the decline in margins from 2008 that was reported by traders and in a recent study by Rashid and Negassa (2011). The decrease in margins might be because of excessively high prices, which forced traders to squeeze their margins in order to be competitive. Traders have indicated that their profits have declined with soaring prices, especially in 2011 and 2012, as most customers have cut back on their purchases.

Some of these costs are only faced under rare occasions. For example, in cases where brokers are unable to sell their grain directly off the truck, they are forced to unload at a nearby warehouse, incurring unloading and storage costs, as well as losses due to rodents and other problems. All itemized costs, as well as the total observed access costs from the farm gate to wholesale, are provided in Table 12.

Table 12: Observed Access Costs from Farm Gate to Enewari/Jiru and to Addis Ababa for Red Sorghum, 2005-2012

	Unit	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**
Loading/unloading	ETB/T	20	20	20	20	30	30	54	60
Transportation costs	ETB/T	100	100	150	200	250	300	450	450
Broker fees for truck service	ETB/T	4	5	10	10	12	13	13	13
Brokers' fee for selling grain in Addis	ETB/T	10	10	15	20	25	30	100	100
Estimated margins (2.5 percent of producer price from 2005 to 2008, 2 percent to 2009 to 2012)	ETB/T	36	37	44	108	66	57	83	111
Local transport, handling and the trader's margin (from farm gate to Enewari/Jiru)	ETB/T	75	75	75	50	50	50	80	80
Total costs	ETB/T	**245**	**247**	**314**	**408**	**433**	**480**	**780**	**814**

Source: based on information collected from traders and trader association at the central grain market, Ehil Berenda, Addis Ababa

From 2005 to 2010, the access costs between Enewari and Addis Ababa exceeded the price differential between the Enewari farm gate and the Addis Ababa wholesale market. This suggests that for those six years (i) traders, on average, sold at a loss; (ii) reported overestimated access costs during interviews with the analysts; and/or (iii) there were inaccuracies in the farm gate and/or wholesale prices. However, the ratio of the total differential over the wholesale price between 2005 and 2010 never exceeded 9 percent. Thus, the negative differential could very well be because of the noise in the price data used in the analysis. For example, had the wholesale price figure been 5 percent higher (possibly with more accurate information from traders, who tend to underestimate the prices they report) in 2007, there would not have been a negative differential between the access costs and the wholesale-farm gate price differential.

Table 13: Comparison Between the Price Differential Between the Addis Ababa Wholesale and the Enewari Farm Gate Prices for Red Sorghum, and the Access Costs Between Addis Ababa and Jimma for Red Sorghum, in ETB/tonne, 2005-2012

	2005	2006	2007	2008	2009	2010	2011	2012
Price differential	106	118	209	146	238	247	1101	2566
Access costs	245	247	314	408	433	480	780	814
Total differential	**-139**	**-129**	**-105**	**-262**	**-196**	**-233**	**321**	**1752**
Ratio differential over wholesale price	9%	8%	5%	6%	5%	7%	6%	22%

Source: Authors calculations

Adjusted

Border to point of competition

Since transport costs used in this analysis (as obtained from the USAID study) are less than 0.06 USD/tonne/km, which is considered reasonable by African standards[6] (though not by the Ethiopian Government's standards[7]), no adjustments were made to the observed transport costs.

However, surtaxes and withholding taxes have been deducted from the observed access costs to arrive at the adjusted access cost from the border to wholesale market in Addis Ababa (see Table 14).

Table 14: Calculation of Adjusted Access Costs Between Djibouti and Addis Ababa for Red Sorghum, in ETB/tonne, 2005-2012

	Item	Unit	2005	2006	2007	2008	2009	2010	2011	2012
1	Observed access costs	ETB/T	837	905	931	1037	1110	1209	1149	1409
2	Surtax & Withholding tax	ETB/T	51.4	62	82.7	118.5	97.4	92.2	103.5	104
3	**Adjusted access costs (1-2)**	**ETB/T**	**786**	**843**	**848**	**919**	**1012**	**1117**	**1045**	**1305**

Source: Authors

[6] Transport prices in Africa are, on average, higher than in South Asia or Brazil. In 2007, prices (per ton-kilometer (tkm)) on the Central African Douala–N'Djame´na route (linking Cameroon with Chad) are more than three times higher (11 US cents/ per ton/km) than in Brazil (3.5 cents per ton per km) and more than five times higher than in Pakistan (2 cents per ton per km). Only the Durban–Lusaka corridor (6 cents per ton per km) in Southern Africa approaches the price level of other regions of the world. Our observed cost varied between 4.5 and 4.8 cents, which is not too high, given the inefficiency and long delays at the points of loading and unloading, the recent high cost of fuel, and poor road conditions, among other factors. See for instance, Teravaninthorn, S. and GaëlRaballand, Transport Prices and Costs in Africa: A Review of the Main International Corridors, Africa Infrastructure Country Diagnostic (AICD), Working Paper 14, July 2008 (http://www.infrastructureafrica.org/system/files/WP14_Transportprices.pdf).

[7] A recent government report indicated that the price/ton/km of transporting commodities via the Djibouti corridor is very high compared to other countries: the price/ton/km in Ethiopia is 6 US cents, compared to 2.3 cents in Pakistan or 4 cents in Brazil. The high cost is associated with excessive downtime and high inefficiency in fuel consumption. On average, a vehicle can make a maximum of 3 round trips per month, while it is possible to do 5. See for instance, The Reporter (newspaper), 11 February, 2012: http://www.thereporterethiopia.com/News/govt-to-tighten-grip-on-trade-logistics.html

Farm gate to point of competition

Transport costs, the major component of the total access cost, more than doubled in nominal terms between 2005 and 2012, mainly owing to the high cost of fuel, high inflation rates and the use of smaller trucks (often less than 10 tonne capacity) instead of larger trucks with lower costs per unit. Consequently, transport costs from Enewari/Juru to Addis Ababa were reduced by 20 percent in 2008 and 2009, and by 25 percent from 2010 to 2012 (Table 15). The adjustment was intended to reduce the cost of transport to between 6.1 and 7.4 US cents/km/tonne, an average of 6.75 US cents/tonne/km, which is slightly higher than the rates charged along the Djibouti-Addis Ababa road.

Brokers' fees for trucks and grain selling were also adjusted. In fact, such fees are considered excessive and would be lower with measures in place to increase market information and producers' bargaining power, such as farmers' cooperatives, expansion of mobile networks and information systems on truck availability. They have thus been considered null in the adjusted access costs.

Table 15: Calculation of Adjusted Access Costs Between Addis Ababa and Enewari for Red Sorghum, in ETB/tonne, 2012

	Item	Unit	2005	2006	2007	2008	2009	2010	2011	2012
1	Observed access costs	ETB/T	245	247	314	408	433	480	780	814
2	Transport costs inefficiencies	ETB/T	0	0	0	40	50	75	112.5	112.5
3	Broker fees for selling grain in Addis	ETB/T	10	10	15	20	25	30	100	100
4	**Adjusted access costs (1-2-3)**	**ETB/T**	**235**	**237**	**299**	**348**	**358**	**375**	**548**	**581**

Source: Authors

BUDGET AND OTHER TRANSFERS

Budget transfers to sorghum were not identified in the write-up of this note, but may be revised based on the MAFAP agricultural expenditure analysis.

QUALITY AND QUANTITY ADJUSTMENTS

Neither quality nor quantity adjustments were made.

DATA OVERVIEW

Following the discussions above, the table below summarizes the main data sources used and methodological decisions taken for the analysis.

Table 16: Data Sources and Methodological Decisions

		Description	
Concept		***Observed***	***Adjusted***
Benchmark price		*CIF Djibouti price for sorghum, HS code 100700.*	*N.A.*
Domestic price at point of competition		*Annual average of wholesale price in Addis Ababa market for red sorghum as reported by Ethiopia Grain Trade Enterprise*	*N.A*
Domestic price at farm gate		*2005-2010: annual average of wholesale price in Enewari (from the proxy of D/Berhan) for white sorghum, as reported by EGTE, adjusted into red sorghum and minus marketing costs between Enewari wholesale market and the farm gate. 2011-2012: annual average of producer price in Enewari from EGTE*	
Exchange rate		*Annual average of exchange rate as reported by National Bank of Ethiopia*	*Adjustment of +20 percent, assuming an overvaluation as reported by Rashid (2010) from 2005 to 2010 and adjustment factor from IMF for 201 and 2012.*
Access cost from the point of competition to the border		*Loading, Transportation costs, Port Handling, Surtax & Witholding tax, Miscellaneous, determined from ESL, USDA and interviews with traders.*	*Adjustment of surtax & withholding tax.*
Access costs from the point of competition to farm gate		*Loading, Transportation costs, Broker fees for truck - per tonne, Broker's fees for selling grain in Addis, Estimated margins for traders. Determined from discussions with traders and Ehil Berenda*	*Transportation costs adjustment to reduce transport cost (6.7-8.9 USD cents/km/tonne); brokers' fees for selling grains removed*
QT adjustment	Bor-PoC	*N.A.*	*N.A.*
	PoC-FG	*N.A.*	*N.A.*
QL adjustment	Bor-PoC	*N.A.*	*N.A.*
	PoC-FG	*N.A.*	*N.A.*

The data used for this analysis is summarized below.

Table 17: Data Used for the Analysis

		Year	*2005*	*2006*	*2007*	*2008*	*2009*	*2010*	*2011*	*2012*
		Trade status	*m*	*m*	*m*	*m*	*m*	*m*	*m*	*m*
DATA	*Unit*	*Symbol*								
Benchmark Price										
Observed		$P_{b(int\$)}$	**267,19**	**384,11**	**335,74**	**308,91**	**289,21**	**420,08**	**756,55**	**429,42**
Adjusted		P_{ba}								
Exchange Rate										
Observed		ER_o	8.67	8.74	9.21	9.8	12.1	12.89	16,90	17,60
Adjusted		ER_a	10.4	10.49	11.05	11.76	14.52	15.47	19,10	19,70
Access costs border - wholesale										
Observed		AC_{owh}	837	904	930	1037	1109	1208	1148	1409
Adjusted		AC_{awh}	785	842	848	918	1012	1116	1045	1305
Domestic price at wholesale		P_{dwh}	**1,535.63**	**1,589.75**	**1,971.17**	**4,452.64**	**3,560.51**	**3,117.61**	**5,258.51**	**8,103.26**
Access costs wholesale - farm gate										
Observed		AC_{ofg}	245	247	314	408	433	480	780	814
Adjusted		AC_{afg}	235	237	299	348	358	375	548	581
Farm gate price		P_{dfg}	**1,429.53**	**1,471.87**	**1,762.56**	**4,306.70**	**3,322.61**	**2,870.29**	**4,157.14**	**5,537.30**
Externalities associated with production		E	-	-	-	-	-	-	-	-
Budget and other product related transfers		BOT	-	-	-	-	-	-	-	-
Quantity conversion factor (border - point of competition)	Fraction	QT_{wh}	-	-	-	-	-	-	-	-
Quality conversion factor (border - point of competition)	Fraction	QL_{wh}	-	-	-	-	-	-	-	-
Quantity conversion factor (point of competition – farm gate)	Fraction	QT_{fg}	-	-	-	-	-	-	-	-
Quality conversion factor (point of competition – farm gate)	Fraction	QL_{fg}	-	-	-	-	-	-	-	-

SUMMARY OF INDICATORS

Table 18: MAFAP Price Gaps for Sorghum in Ethiopia, (ETB/tonne), 2005-2012

	2005	2006	2007	2008	2009	2010	2011	2012
Trade status for the year	*m*	*m*	*m*	*m*	*M*	*m*	*m*	*m*
Observed price gap at point of competition	(1,617)	(2,672)	(2,050)	388	(1,048)	(3,507)	(8,676)	(864)
Adjusted price gap at point of competition	(2,029)	(3,282)	(2,586)	(99)	(1,650)	(4,498)	(10,237)	(1,661)
Observed price gap at farm gate	(1,479)	(2,543)	(1,945)	650	(852)	(3,274)	(8,997)	(2,616)
Adjusted price gap at farm gate	(1,900)	(3,163)	(2,495)	103	(1,529)	(4,370)	(10,790)	(3,646)

Source: Author's own calculations using data as described above.

Table 19: MAFAP Nominal Rates of Protection and Assistance for Sorghum in Ethiopia, (%), 2005-2012

	2005	2006	2007	2008	2009	2010	2011	2012
Trade status for the year	*M*	*m*	*m*	*m*	*m*	*m*	*m*	*m*
Observed NRP at point of competition	-51%	-63%	-51%	10%	-23%	-53%	-62%	-10%
Adjusted NRP at point of competition	-57%	-67%	-57%	-2%	-32%	-59%	-66%	-17%
Observed NRP at farm gate	-51%	-63%	-52%	18%	-20%	-53%	-68%	-32%
Adjusted NRP at farm gate	-57%	-68%	-59%	2%	-32%	-60%	-72%	-40%
Observed NRA at farm gate	-51%	-63%	-52%	18%	-20%	-53%	-68%	-32%
Adjusted NRA at farm gate	-57%	-68%	-59%	2%	-32%	-60%	-72%	-40%

Source: Author's own calculations using data as described above.

Table 20: MAFAP Market Development Gaps for Sorghum in Ethiopia, (%), 2005-2012

	2005	2006	2007	2008	2009	2010	2011	2012
Trade status for the year	*m*	*m*	*m*	*m*	*m*	*m*	*m*	*m*
Access costs gap to competition point (ACGwh)	51.4	62.0	82.7	118.5	97.4	92.2	103.5	104.0
Access costs gap to farm gate (ACGfg)	(10.0)	(10.0)	(15.0)	(60.0)	(75.0)	(105.0)	(232.5)	(232.5)
Exchange rate policy gap (EXRP)	(463,13)	(671,42)	(618,10)	(605,46)	(699,65)	(1083,18)	(1664,41)	(901,78)
International markets gap (IMG)	-	-	-	-	-	-	-	-

Source: Author's own calculations using data as described above.

5. RESULTS AND INTERPRETATION

Price gaps

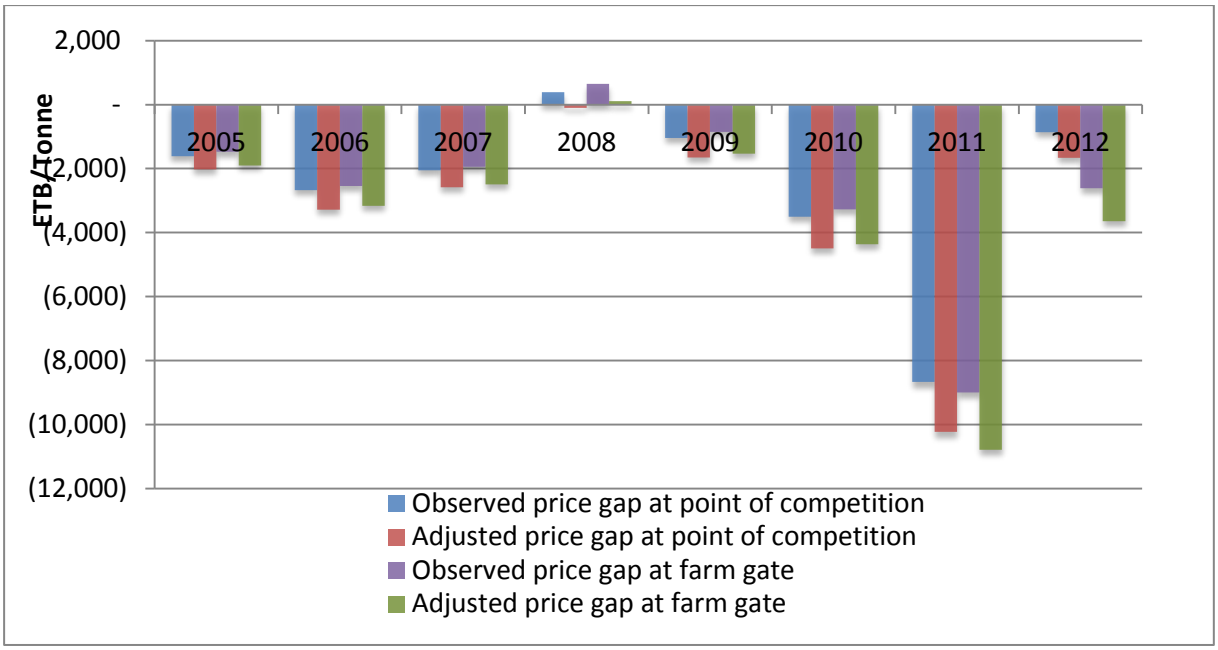
MAFAP analysis is based on the comparison of domestic prices with reference prices at both farm gate and wholesale levels. Reference prices reflect prices that producers would receive in the absence of policy distortions and market inefficiencies. Indicators of price difference between domestic and references prices are calculated at the wholesale and farm level (see the Methodology section).

Figure 9 (extracted from Annex 1 of the complete excel sheet) shows that the price gaps between domestic and reference prices are positive in only one year of the study period, 2008 (see also Table 21). Unadjusted prices at the point of competition and the farm gate were above the reference prices in 2008, when domestic prices were generally very high. The adjusted wholesale price gap was almost nil in 2008, meaning that the sector would have been almost completely free of distortions in that year. Wholesale price gaps (adjusted and unadjusted) were negative in the rest of the study years. Low wholesale prices do not encourage sorghum imports. Traders may not consider importing even when domestic prices are high because international prices are often higher. On the other hand, the limited quantity of sorghum available for exporting and lack of export facilitating infrastructure and institutions (e.g. safety and quality standards) may also contribute to the lack of export competitiveness.

The situation is similar at the farm gate level; observed and adjusted price gaps were positive only in 2008. The incentive to produce sorghum is weak because farmers received a lower price than they could have, except for in 2008, when domestic prices increased significantly (by 144 percent at farm gate level) and the international price decreased by 8 percent. Positive incentives (positive price gaps) do not appear to last long, and producers may consider high prices as temporary departures from a more general pattern of low prices. As shown above (Figure 3), sorghum prices remained very low until 2007, and even after 2007, real prices have not shown a marked increase.

In 2011, both PGs at the point of competition and farm gate were considerably high. Both wholesalers and farmers received prices very much below the prevailing prices in a value chain free of distortions and inefficiencies. In fact, owing to a fall in production in the United States that year (the production volumes were the lowest of the whole period), the benchmark price at the border increased dramatically. In addition, with the devaluation of the Birr in the same year, the benchmark price peaked even more drastically in local currency. Wholesalers and farmers did not benefit entirely from this surge, although they obtained better returns than previous years as prices increased by 68 and 44 percent, respectively.

Figure 9: MAFAP Price Gaps for Sorghum in Ethiopia, 2005-2012 (Birr/tonne)



Source: Author's calculations based on MAFAP calculations.

Table 21: MAFAP Price Gaps for Sorghum in Ethiopia, 2005-2012 (Birr/tonne)

	2005	2006	2007	2008	2009	2010	2011	2012
Trade status	m	M	m	m	m	m	m	m
Observed price gap at point of competition	(1,617)	(2,672)	(2,050)	388	(1,048)	(3,507)	(8,676)	(864)
Adjusted price gap at point of competition	(2,029)	(3,282)	(2,586)	(99)	(1,650)	(4,498)	(10,237)	(1,661)
Observed price gap at farm gate	(1,479)	(2,543)	(1,945)	650	(852)	(3,274)	(8,997)	(2,616)
Adjusted price gap at farm gate	(1,900)	(3,163)	(2,495)	103	(1,529)	(4,370)	(10,790)	(3,646)

Source: Author's calculations based on MAFAP calculations.

Nominal rate of protection

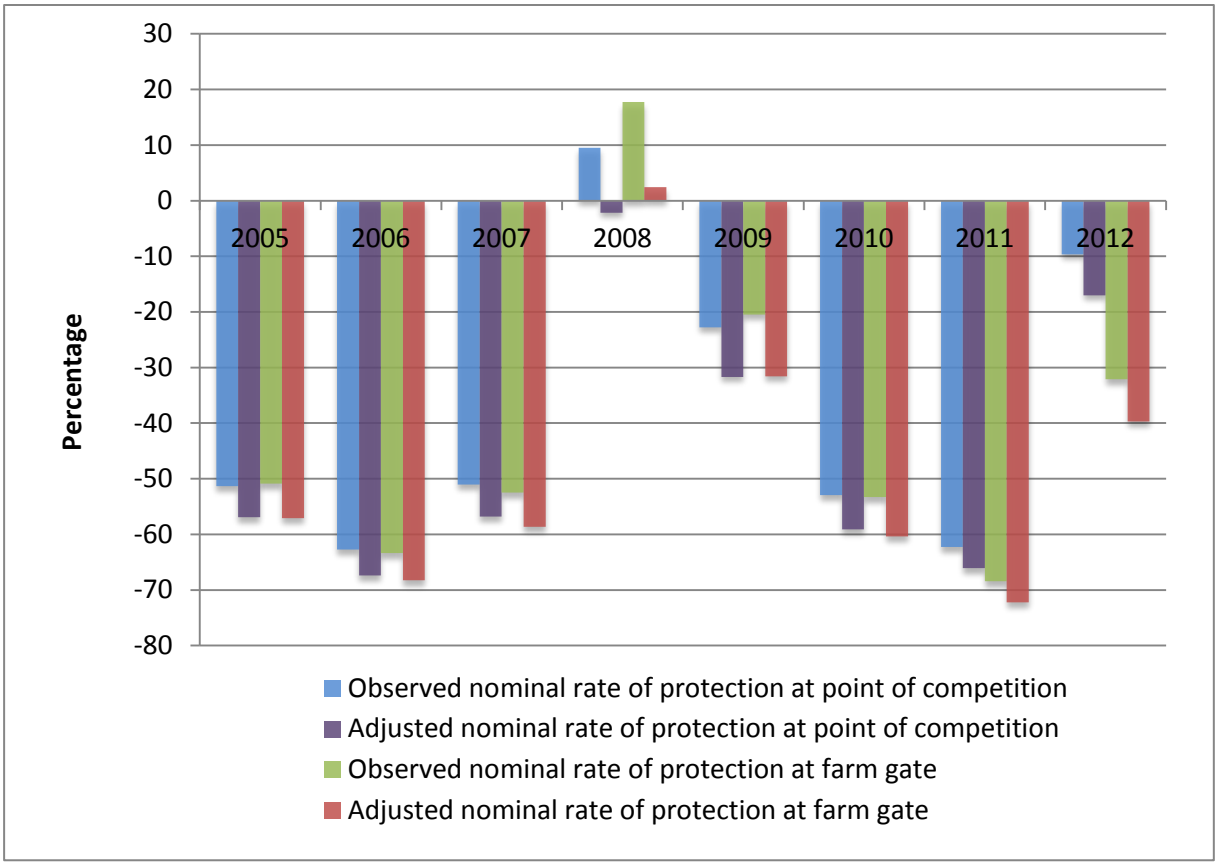
The nominal rates of protection (NRP) were negative at the wholesale, as well as at the farm gate level, except for in 2008 (Figure 10 and Table 22, based on Annex 1). The observed (unadjusted) NRP at wholesale level (NRPowh) averaged -38 percent from 2005-12, with a high of +10 percent in 2008 and a low of -63 percent in 2006. Both in 2006 and 2011, the wholesalers and farmers were highly taxed and had huge disincentives to produce and trade sorghum.

In 2006, the international price increased significantly, whereas the domestic prices remained stable over the year. Here it is important to recall that the CIF price is from the USA, where the sorghum production decreased substantially in this year and thus, prices increased. Moreover, one reason why this high international price was not transmitted to the domestic market is because of the limited trade of sorghum. Value chain agents could not benefit from the international market because most of the sorghum was consumed locally (as stated in AATF).

The significant increase of the domestic price at both levels in 2008 resulted in incentives for the domestic agents of the value chain. One explanation of the shift to positive NRPs is the decrease of the international price by 8 percent, following two years of high production in the USA (around 12 000 000 tonnes in 2007 and 2008). On the other hand, the government applied a strict control of foreign currency in March 2008 that hindered private imports, and would have reduced the supply of sorghum available in the country and thus, caused a surge in domestic prices.

The extent of disincentives worsened with the adjusted NRPs, averaging -46.5 percent during the study period. The results confirm that sorghum buyers at wholesale were generally paying less than the equivalent border prices, while producers and wholesalers were implicitly taxed. The sharp increase in domestic prices in 2011 was accompanied by an even greater increase in international prices, leading to one of the worst periods for farmers' disincentives (-72 percent adjusted NRP at farm gate). In 2012, domestic prices continued rising, while international prices declined sharply, resulting in substantial improvement of incentives compared to 2011 (Figure 10).

Figure 10: MAFAP Nominal Rate of Protection Sorghum in Ethiopia, 2005-2012 (%)



Source: Author's calculations based on MAFAP calculations.

Table 22: MAFAP Nominal Rates of Protection (NRP) for Sorghum in Ethiopia, 2005-2012 (%)

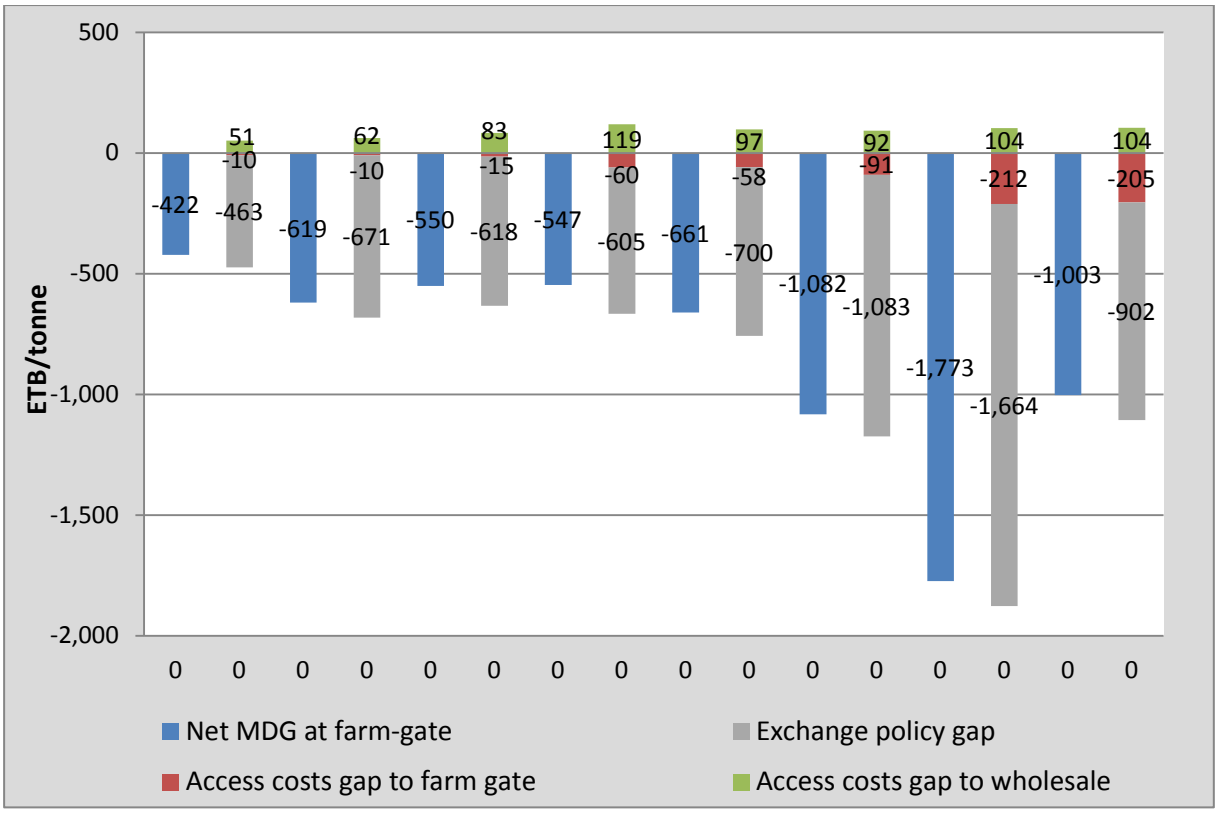
	2005	2006	2007	2008	2009	2010	2011	2012
Trade status	**m**	**m**	**m**	**m**	**m**	**M**	**m**	**M**
Observed nominal rate of protection at point of competition	**-51%**	**-63%**	**-51%**	**10%**	**-23%**	**-53%**	**-62%**	**-10%**
Adjusted nominal rate of protection at point of competition	**-57%**	**-67%**	**-57%**	**-2%**	**-32%**	**-59%**	**-66%**	**-17%**
Observed nominal rate of protection at farm gate	**-51%**	**-63%**	**-52%**	**18%**	**-20%**	**-53%**	**-68%**	**-32%**
Adjusted nominal rate of protection at farm gate	**-57%**	**-68%**	**-59%**	**2%**	**-31%**	**-60%**	**-72%**	**-40%**

Source: Author's calculations based on MAFAP calculations.

Market Development Gaps (MDGs)

Market Development Gaps are the sum of the international markets gap, exchange rate policy gap, access costs gap (to point of competition and to farm gate) and externality gap. MDGs are largely explained by the exchange rate policy gap and access costs gap to farm gate. The rather big fall of the MDG in 2011 was because of the significant international price increase. In fact, its 80 percent increase created a big gap between the benchmark prices in local currency with the observed and adjusted exchange rate. Nevertheless, thanks to the devaluation in past years, the impact of the exchange rate policy had been slightly reduced (85.5 percent to 81.5 percent, on average) during the 2005-2008 and 2009-2012 periods, respectively.

Figure 11: Market Development Gap Breakdown for Sorghum in Ethiopia, 2005-2012 (ETB/tonne)



Source: Author's calculations based on MAFAP calculations.

6. RECOMMENDATIONS

- As a drought tolerant crop, a preferred grain for making ingera (traditional bread) among the rural and urban poor, and as a cereal grown by most vulnerable households, sorghum deserves special attention in government policies and investment programs as one of the most important food security crops. The Agricultural Transformation Agency (ATA) needs to include sorghum as one of its priority crops for enhanced support.
- Policy makers need to reconsider policies, including currency overvaluation and export bans, that have resulted in implicit taxation of cereal production, including sorghum;
- Policies that transform the current state of limited trade and support the regional exporting and importing of sorghum could have a significant positive impact on stabilizing and improving the price incentive for producers and value chain operators;
- Transforming the current subsistence-oriented sorghum production needs to start with improving the market and incentive environment, followed by measures to improve access to new technologies, such as striga-resistent cultivars;
- Given that major sorghum production areas are located in low-lying remote areas, the incentive environment cannot improve without attractive schemes for investors in the value chain of sorghum and significant investment in transport and storage infrastructures.

CONCLUSION

MAIN MESSAGE

The results of the MAFAP price indicators show that the level of disincentives in sorghum production is significant. Producers gained as a result of high world prices (2008 and 2009), but the favourable environment did not last long. Overvalued exchange rates, and the government policy banning exports and distributing imported cereals at subsidized prices (at times of high food prices) have kept domestic cereal prices relatively low. Food aid, which accounts for a significant share of cereal consumption, may have also contributed to the lower domestic price levels.[8]

On the other hand, reference prices are high in Ethiopia because of high transaction and transport costs, in addition to the fact that the country is land-locked. These problems have also meant a substantial gap between import and export parity prices, implying limited opportunity to moderate price fluctuations between import and export parity price extremes.

The policy environment needs to improve in order to enhance long-term investment in sorghum production and the structural transformation of agriculture. Ethiopia has a huge and rapidly growing domestic market for sorghum. As teff prices have soared in recent years, sorghum has become the most affordable substitute for low-income people in urban areas. Sorghum is also a preferred substitute among rural communities who produce teff as a cash crop (for sale). As a food security crop, the government needs to improve the incentive environment and increase investment to boost the production and productivity of sorghum.

There is no evidence of monopolistic pricing by traders, as trade margins appear to have declined, especially in years of very high prices. The grain market is dominated by small traders with little market power. On the other hand, transport costs from farm gate to the wholesale market in Addis Ababa were found to be high, which can be attributed to the use of smaller trucks instead of bigger trucks and bulk transport systems. Household production and market supply levels are particularly low and scattered for sorghum. In addition to building roads, the government should facilitate the dissemination of improved sorghum technologies, along with measures to encourage the transition from small scale to large-scale grain transport and trading practices.

With an expansion in production and an improved marketing system, it would be possible to increase the demand for sorghum by diversifying its use into animal feed, ethanol and malt for breweries, as well as promoting exports to regional markets. A well-developed food processing and feed mill sector would have a positive impact on production incentives. Additionally, sorghum could play a major role in the transformation of the livestock sector.

LIMITATIONS

Data on price and access costs are more limited for sorghum than the other major staples (teff, maize and wheat). Information on access costs was collected by an assistant who collected primary data through interviews with a small number of traders and representatives of trader associations. The data reveals a lot of interesting features about the maize market, but further investigation and

[8] Food aid flows are estimated to have depressed domestic prices within the ranges of 2 to 26 percent for wheat, 3 to 13 percent for maize, and 2 to 11 percent for teff during the period 1981 to 2002 (Rashid, Assefa and Ayele, 2007).

consultations with relevant government and private organizations are required to validate the access data.

FURTHER INVESTIGATION AND RESEARCH

Farm gate prices were estimated based on wholesale prices observed in a town (Enewari/Jiru) located in one of the major maize producing areas. Refinement of the results should include the obtainment of actual farm gate prices for Jimma, as well as other locations in different maize producing areas.

BIBLIOGRAPHY

AATF (African Agricultural Technology Foundation) (2011), Feasibility Study on *Striga* Control in Sorghum, Nairobi

Alemayehu Seyoum, et al. (2011), Crop Production in Ethiopia: Regional Patterns and Trends Ethiopia Strategy Support Program II (ESSP II), ESSP II Working Paper No. 0016.

Clay, J.W. (2003) Agriculture and the Environment Volume I: Introduction and Commodities A WWF Handbook on Agricultural Impacts and Better Practices, Chapter 19: Sorghum

Gabre-Madhin, E. (2001) Market Institutions, Transaction Costs, and Social Capital in the Ethiopian Grain Market, Research Report 124, IFPRI, Washington D.C.

Dorosh P, S. Robinson and H. Ahmed (2009), Economic Implications of Foreign Exchange Rationing in Ethiopia, IFPRI/EDRI ESSP2 Discussion Paper 009.

GIEWS Food Price data and Analysis Tool, Food and Agricultural Organization of the United Nations, Consulted in May 13, 2014. http://www.fao.org/giews/pricetool/

Rashid S. (2010). Staple food prices in Ethiopia, Prepared for the COMESA policy seminar on "Variation in staple food prices: Causes, consequence, and policy options", Maputo, Mozambique, 25-26 January 2010

Rashid S., K. Getnet and S. Lemma (2010) Maize value chain potential in Ethiopia: Constraints and opportunities for enhancing the system, IFPRI, Working Paper, July

Rashid S. and A. Negassa (2011), Policies and Performance of Ethiopian Cereal Markets, IFPRI/ EDRI, Ethiopia Strategy Support Program II (ESSP II) ESSP II Working Paper No. 21, May

Rogstadius J. (2009). Visualizing the Ethiopian Commodity Market, Department of Science and Technology Institutionenförteknikochnaturvetenskap Linköping University LinköpingsUniversitet SE-601 74 Norrköping, Sweden 601 74 Norrköping

The RATES Center, Maize Market Assessment and Baseline Study for Ethiopia, Nairobi, Kenya, July 2003

USAID (2011), USAID Office of Food For Peace Ethiopia, Bellmon Estimation, Annex 1 Economic Data and Trends, September

USAID/COMPETE (2010), Staple Foods Value Chain Analysis, Country Report – Ethiopia, http://www.competeafrica.org/Files/ETHIOPIA_Staple_Foods_Value_Chain_Analysis_April_2010.pdf

ANNEX I: Data and Calculations Used in the Analysis

Name of product	SORGHUM
International currency	USD
Local currency	ETB

	DATA		Unit	Symbol	Year trade status	2005	2006	2007	2008	2009	2010	2011	2012	Notes	3-years averages 2005-2007	2006-2008	2007-2009	2008-2010
						m	m	m	m	m	m	m	m					
	Benchmark Price													Customs prices				
1		Observed	XXX/TON	$P_{b(intl\$)}$		267.19	384.11	335.74	308.91	289.21	420.08	756.55	429.42	CIF Price	329.01	342.92	311.29	440.83
1b		Adjusted	XXX/TON	P_{ba}											#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
	Exchange Rate																	
2		Observed	YYY/XXX	ER_o		8.67	8.74	9.21	9.80	12.10	12.89	16.90	17.60		9.10	9.25	10.37	13.86
2b		Adjusted	YYY/XXX	ER_a		10.40	10.49	11.05	11.76	14.52	15.47	19.10	19.70		10.64	11.10	12.44	16.11
	Access costs border - point of competition																	
3		Observed	YYY/TON	ACo_{wh}		837.18	904.86	930.92	1,037.37	1,109.81	1,208.99	1,148.50	1,409.00		927.58	957.72	1,026.03	1,182.73
3b		Adjusted	YYY/TON	ACa_{wh}		785.78	842.86	848.22	918.87	1,012.41	1,116.79	1,045.00	1,305.00		848.93	869.98	926.50	1,079.61
4	**Domestic price at point of competition**		YYY/TON	P_{dwh}		1,535.63	1,589.75	1,971.17	4,452.64	3,560.51	3,117.61	5,258.51	8,103.26	Source: ETHIOPIAN GRAIN TRADE ENTERPRISE	2,387.30	2,671.19	3,328.11	4,898.51
	Access costs point of competition - farm gate																	
5		Observed	YYY/TON	ACo_{fg}		359.00	360.00	420.00	400.00	467.00	523.00	797.00	803.00		384.75	393.33	429.00	598.00
5b		Adjusted	YYY/TON	ACa_{fg}		237.39	239.74	304.28	351.32	381.01	395.94	708.46	785.58		283.18	298.45	345.54	524.46
6	**Farm gate price**		YYY/TON	P_{dfg}		1,429.53	1,471.87	1,762.56	4,306.70	3,322.61	2,870.29	4,157.14	5,537.30		2,242.67	2,513.71	3,130.63	4,038.81
7	Externalities associated w ith production		YYY/TON	E											#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
8	Budget and other product related transfers		YYY/TON	BOT										From PE Analysis	#DIV/0!			
	Quantity conversion factor (border - point of competition)		Fraction	QT_{wh}											#DIV/0!			
	Quality conversion factor (border - point of competition)		Fraction	QL_{wh}											#DIV/0!			
	Quantity conversion factor (point of competition - farm gate)		Fraction	QT_{fg}											#DIV/0!			
	Quality conversion factor (point of competition - farm gate)		Fraction	QL_{fg}											#DIV/0!			

	CALCULATED PRICES		Unit	Symbol	2005	2006	2007	2008	2009	2010	2011	2012	Formula	2005-2007	2006-2008	2007-2009	2008-2010
	Benchmark price in local currency																
9		Observed	YYY/TON	$P_{b(loc\$)}$	2,315.65	3,357.12	3,090.49	3,027.32	3,498.24	5,415.88	12,785.70	7,557.79	[1]*[2]	2,994.98	3,171.44	3,227.09	6,108.93
10		Adjusted	YYY/TON	$P_{b(loc\$)a}$	2,778.78	4,028.55	3,708.58	3,632.78	4,197.88	6,499.06	14,450.11	8,459.57	[1]*[2b]	3,502.24	3,805.73	3,872.51	7,101.48
	Reference Price at point of competition																
11		Observed	YYY/TON	RPo_{wh}	3,152.83	4,261.98	4,021.41	4,064.68	4,608.05	6,624.88	13,934.20	8,966.79	[9]+[3]	-	-	-	-
12		Adjusted	YYY/TON	RPa_{wh}	3,564.56	4,871.40	4,556.81	4,551.65	5,210.29	7,615.85	15,495.11	9,764.57	[10]+[3b]	-	-	-	-
	Reference Price at Farm Gate																
13		Observed	YYY/TON	RPo_{fg}	2,793.83	3,901.98	3,601.41	3,664.68	4,141.05	6,101.88	13,137.20	8,163.79	[11]-[5]	(384.75)	(393.33)	(429.00)	(598.00)
14		Adjusted	YYY/TON	RPa_{fg}	3,327.17	4,631.66	4,252.53	4,200.33	4,829.28	7,219.91	14,786.64	8,978.99	[12]-[5b]	(283.18)	(298.45)	(345.54)	(524.46)

	INDICATORS		Unit	Symbol	2005	2006	2007	2008	2009	2010	2011	2012	Formula	2005-2007	2006-2008	2007-2009	2008-2010
	Price gap at point of competition																
15		Observed	YYY/TON	PGo_{wh}	(1,617.20)	(2,672.23)	(2,050.24)	387.96	(1,047.54)	(3,507.27)	(8,675.68)	(863.53)	[4]-[11]	2,387.30	2,671.19	3,328.11	4,898.51
16		Adjusted	YYY/TON	PGa_{wh}	(2,028.93)	(3,281.65)	(2,585.64)	(99.01)	(1,649.79)	(4,498.24)	(10,236.59)	(1,661.31)	[4]-[12]	2,387.30	2,671.19	3,328.11	4,898.51
	Price gap at farm gate																
17		Observed	YYY/TON	PGo_{fg}	(1,364.30)	(2,430.10)	(1,838.85)	642.02	(818.43)	(3,231.59)	(8,980.05)	(2,626.49)	[6]-[13]	2,627.42	2,907.05	3,559.63	4,636.81
18		Adjusted	YYY/TON	PGa_{fg}	(1,897.64)	(3,159.78)	(2,489.97)	106.37	(1,506.67)	(4,349.62)	(10,629.50)	(3,441.69)	[6]-[14]	2,525.85	2,812.16	3,476.16	4,563.27
	Nominal rate of protection at point of competition																
19		Observed	%	$NRPo_{wh}$	-51.29%	-62.70%	-50.98%	9.54%	-22.73%	-52.94%	-62.26%	-9.63%	[15]/[11]	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
20		Adjusted	%	$NRPa_{wh}$	-56.92%	-67.37%	-56.74%	-2.18%	-31.66%	-59.06%	-66.06%	-17.01%	[16]/[12]	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
	Nominal rate of protection at farm gate																
21		Observed	%	$NRPo_{fg}$	-48.83%	-62.28%	-51.06%	17.52%	-19.76%	-52.96%	-68.36%	-32.17%	[17]/[13]	-682.89%	-739.08%	-829.75%	-775.39%
22		Adjusted	%	$NRPa_{fg}$	-57.03%	-68.22%	-58.55%	2.53%	-31.20%	-60.24%	-71.89%	-38.33%	[18]/[14]	-891.95%	-942.27%	-1006.02%	-870.09%
	Nominal rate of assistance																
23		Observed	%	NRAo	-49%	-62.28%	-51.06%	17.52%	-19.76%	-52.96%	-68.36%	-32.17%	([17]+[8])/[13]				
24		Adjusted	%	NRAa	-57.03%	-68.22%	-58.55%	2.53%	-31.20%	-60.24%	-71.89%	-38.33%	([18]+[8])/[14]				

	-	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%					
	(463.13)	(671.42)	(618.10)	(605.46)	(699.65)	(1,083.18)	(1,664.41)	(901.78)	([2]-[2b])*[1]				

	Decomposition of PWAfg		Unit	Symbol	2005	2006	2007	2008	2009	2010	2011	2012	Formula	2005-2007	2006-2008	2007-2009	2008-2010
25	International markets gap		YYY/TON	IRG	-	-	-	-	-	-	-	-		-	-	-	-
26	Exchange policy gap		YYY/TON	ERPG	(463.13)	(671.42)	(618.10)	(605.46)	(699.65)	(1,083.18)	(1,664.41)	(901.78)	([2]-[2b])*[1]	(507.26)	(634.29)	(645.42)	(992.55)
27	Access costs gap to point of competition		YYY/TON	ACG_{wh}	51.40	62.00	82.70	118.50	97.40	92.20	103.50	104.00	[3]-[3b]	-	-	-	-
28	Access costs gap to farm gate		YYY/TON	ACG_{fg}	(121.61)	(120.26)	(115.72)	(48.68)	(85.99)	(127.06)	(88.54)	(17.42)	[5b]-[5]	(101.57)	(94.89)	(83.46)	(73.54)
29	Externality gap		YYY/TON	EG	-	-	-	-	-	-	-	-		#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
	Market Development Gap		YYY/TON	MDG	(533.34)	(729.68)	(651.12)	(535.65)	(688.23)	(1,118.04)	(1,649.45)	(815.20)	[25]+[26]+[27]+[28]+[29]				
	Market Development Gap		%	MDG	(0.16)	(0.16)	(0.15)	(0.13)	(0.14)	(0.15)	(0.11)	(0.09)	MDG/RPafg				

	Total values		Unit	Symbol	2005	2006	2007	2008	2009	2010	2011	2012	Formula	2005-2007	2006-2008	2007-2009	2008-2010
30	**Production volume**		tons														
	Market price support																
31		Observed	YYY	MPSo	-	-	-	-	-	-	-	-	[17]*[29]	-	-	-	-
32		Adjusted	YYY	MPSa	-	-	-	-	-	-	-	-	[18]*[27]	-	-	-	-

Food and Agriculture Organization
of the United Nations

Monitoring and Analysing Food and Agricultural Policies
www.fao.org/in-action/mafap

I4524E/1/04.15