MAFAP
SPAAA

Monitoring African Food and Agricultural Policies

Suivi des politiques agricoles et alimentaires en Afrique

ANALYSIS OF INCENTIVES AND DISINCENTIVES FOR SORGHUM IN GHANA

Draft Version

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This technical note is a product of the Monitoring African Food and Agricultural Policies project (MAFAP). It is a technical document intended primarily for internal use as background for the eventual MAFAP Country Report. This technical note 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.

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For more information: **http://www.fao.org/mafap**

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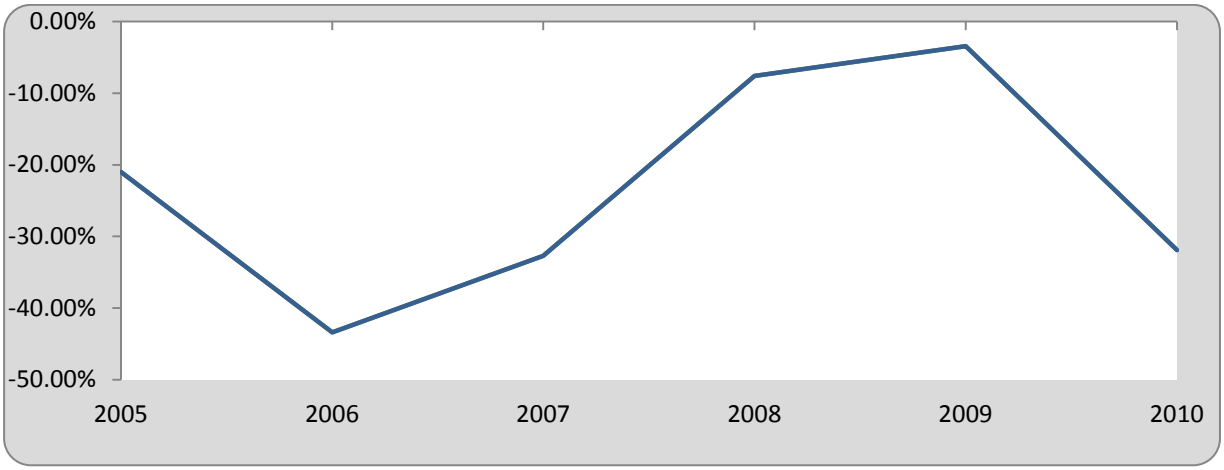
SUMMARY OF THE NOTE

Product: Sorghum
Period analyzed: 2005 – 2010
Trade status: Import in all years

- Both exports and imports of sorghum are negligible with a slight prevalence of imported over exported volumes.
- Total production from 135,800 tons in 1990 to 324,422 in 2011.
- Sorghum is cultivated mainly for household consumption (food and beer) and to a lesser extent for marketing.
- Sorghum is an important crop for food security especially for the Northern regions.
- No information is available on specific policies targeting the Sorghum sector.



The observed Nominal Rate of Protection (NRP, green line) indicates that Sorghum farmers have received price disincentives under the prevailing cost structure in the value chain.

- Disincentives are mainly due to high transport costs in rural areas.
- The importance of sorghum in terms of area harvested has been decreasing during the last decade due to the rising importance of maize and its boost in production.
- Actions to be taken to reduce disincentives could include investing in technological and agronomic research to make sorghum more suitable for industrial and commercial use.

CONTENTS

PURPOSE OF THE NOTE

This technical note aims to describe the market incentives and disincentives for sorghum in Ghana.

This technical note was prepared upon a request of the Ministry of Food and Agriculture of Ghana as sorghum does not rank amongst the priority commodities as per the MAFAP crop selection criteria and results for Ghana[1].

For this purpose, yearly averages of 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 the reference prices and the prices along the value chain indicate to which extent incentives (positive gaps) or disincentives (negative gaps) are present at farm-gate and wholesale level. In relative terms, the price gaps are expressed as Nominal Rates of Protection. These key indicators are used by MAFAP to highlight the effects of policy and market development gaps on prices.

The note starts with a brief review of the production, consumption, trade and policies affecting the commodity and then provides a detailed description of how the key components of the price analysis have been obtained. The MAFAP indicators are then calculated with these data and interpreted in the light of existing policies and market characteristics. The analysis that has been carried out is commodity and country specific and covers the period 2005 - 2010. The indicators have been calculated using available data from different sources for this period and are described in Chapter 3.

The outcomes of this analysis can be used by those stakeholders involved in policy-making for the food and agricultural sector. They can also serve as input for evidence-based policy dialogue at country or regional level.

This technical note is not to be interpreted as an analysis of the value chain or detailed description of production, consumption or trade patterns. 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 is preliminary and still subject to review and validation.

[1] http://www.fao.org/mafap/mafap-partner-countries/ghana/country-technical-notes/en/

COMMODITY CONTEXT

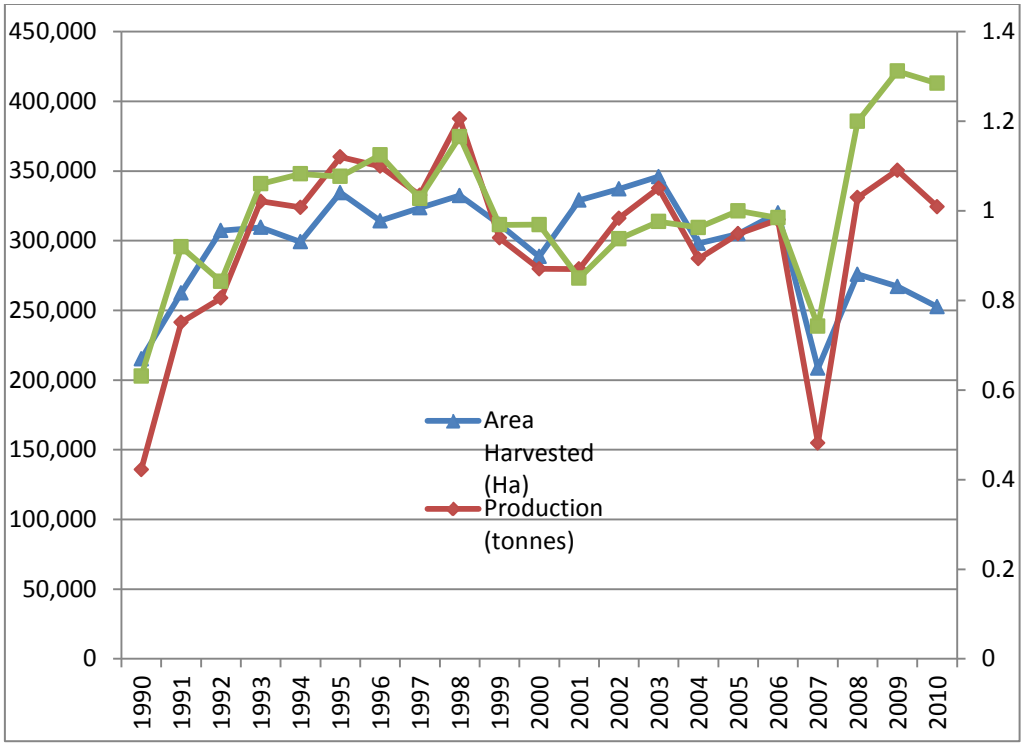
PRODUCTION

Sorghum together with millet and more recently maize is a fundamental crop for North-East Ghana farming systems. It is mainly cultivated by small farmers with average land holdings not greater than 2 ha (Kudadjie et al, 2004). Beyond food security and provision of cash the value of sorghum is linked to the social context and religious ceremonies typical of Ghana rural areas. During these events the sorghum artisanal beer called *pito* is widely consumed.

Of the cereal crops grown in Ghana, sorghum ranks third in terms of production value, after maize and rice, with a share of 12% on total cereal production value. The importance of sorghum in terms of area harvested has been decreasing during the last decade. Sorghum used to be the second largest agricultural crop in terms of area harvested up to 2004 and it is now the 5th. The decrease in the importance of sorghum in Ghana cropping systems is mainly due to the shift from sorghum to white maize which has mainly occurred in the northern parts of Ghana as a result of a series of interventions aimed at improving food security in the area by boosting maize production. The introduction of early maturing maize varieties was well accepted by farmers in these regions due to the reduction of lean periods and hence food insecurity.

On the other hand, yields have increased from an average 0.9 Mt per hectare to around 1.2 Mt/Ha although yields of about 2 Mt ha are achievable (Atokple, 1995; SRID, 2004).

Figure 1: Sorghum area and production trends in Ghana (1990-2010)



Source: FAOSTAT, 2012

Despite its untapped potential as a cash crop for industrial brewing sorghum has received sporadic and limited attention by policy makers especially with respect to the need to develop more productive and pest resistant varieties (Kudadjie et al, 2004)

The brewery industry has shown its interest in sorghum starting from 1980s when investigations were made into the possibility of using sorghum malt as a substitute for barley malt in the production of lager beer. This would have allowed industrial breweries to save foreign exchange. Although experiments proved successful, the lack of local sorghum varieties suitable to local conditions and in terms of grain quality made industries lose interest in the local sorghum production. When the first sorghum variety suitable for beer production was released, the Kapaala variety, breweries in Ghana started to partially substitute imported barley with sorghum. Furthermore, between 2001–2004 several efforts were made to contract farmers in the three sorghum producing regions, Northern, Upper West and Upper East, to produce sorghum via out-grower contract farming schemes, but with little success due to the difficulties encountered by farmers in adopting the new varieties.

A second attempt was made through the Guinness-TechnoServe partnership (2006-2011). This initiative as opposed to the previous one entails a closer support offered to farmers in terms of agronomic practices to be adopted for the cultivation of malting sorghum varieties. The project relies on nucleus farmers who act as grain trading intermediaries between the farmers and the brewer. The Ghanaian government also participates through its Capital Venture Trust Fund which provides credit to farmers. The partnership is based on an agreement in which the brewery agreed to buy sorghum produced under the partnership for a period of five years at a price that may vary within a certain price band.

However, the above initiatives involving the private sector are sporadic and constitute an exception to the generalized scarce diffusion of improved varieties of sorghum released by research and/or the lack of agronomic and technical assistance to farmers which has limited the levels of adoption and performance of the varieties.

The dearth of suitable varieties and appropriate agricultural practices has negatively affected yields that vary from 500kg to 900kg/ha in the Northern region, and 700 to 1000kg/ha in the Upper East and Upper West regions, depending on the year. The low yields are due to the cultivation of indigenous, land race varieties with inherent low yield potential as well as scarce fertilizer use and the low plant densities in the traditional mixed cropping systems.

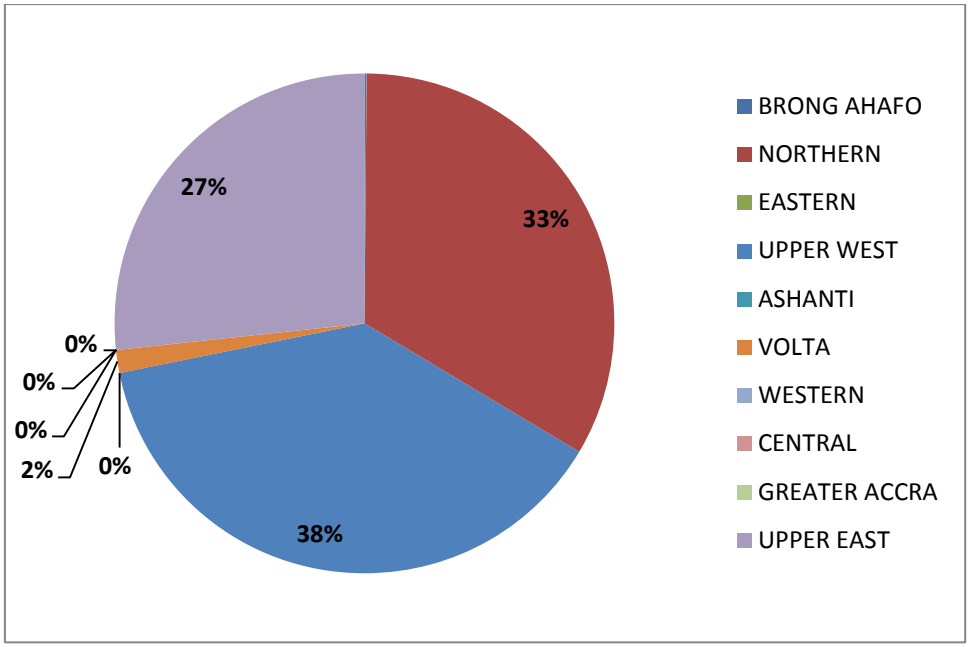
Agronomic research on sorghum has been mandated to the Savanna Agricultural Research Institute (SARI). The most significant research efforts at improving sorghum and pearl millet have been undertaken through SARI's Sorghum and Millet Improvement Programme with funding from the Ghana Government and GIZ. The objective of the sorghum improvement programme (which started in the late 1960s) was to develop high yielding varieties of sorghum with specific adaptation to different ecological conditions of the savanna. Specifically, the sorghum and millet research programme has aimed at developing early and medium maturing varieties that have good grain quality and are resistant or tolerant to the major pests and diseases which normally affect sorghum, including the striga weed.

Sorghum is mainly grown in the Guinea and Sudan savannah Zones, which are found in the Upper West, Upper East and Northern regions of the country where the mean annual rainfall is 1000mm and 990 mm respectively. The crops are grown by small-scale farmers, under rain-fed conditions, and usually in combination with other crops. Spatial patterns of sorghum are significant as opposed to

some other crops, including maize, cassava, tomato, which are grown by many households in all the four agro-ecological zones. (OECD, 2010).

The three Northern regions where sorghum is grown are also the poorest in Ghana as 40% of the population in these regions lives below the poverty line (Ghana Statistical Service, 2000). The resilience of sorghum – in terms of drought resistance and ability to withstand high temperatures – makes it crucial for food security in these regions (Kudadjie et al, 2004).

Figure 2: Distribution of production of Sorghum in Ghana by region in 2010 (%)



Source: MOFA, 2012

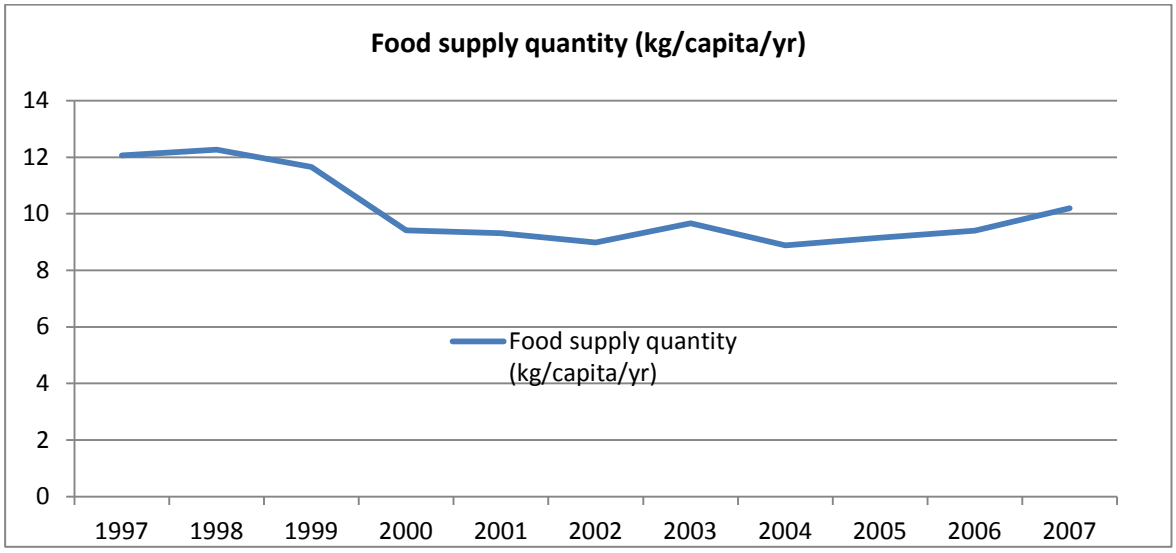
CONSUMPTION

Sorghum can be defined as a multi-purpose crop. The milled grains are used to prepare food (*tuo zaafi, koko* and *masa*) as well as the local opaque beer known as *pito*. Sorghum brewing is an important cottage industry in northern Ghana. Moreover sorghum leaves can serve as fodder for farm animals while the stalks are used for fencing, staking, roofing, weaving baskets and mats and also for fuel.

The form under which sorghum is consumed is strictly linked to the variety. Varieties such as Naga red and Belko have several uses hence many farmers grow them. Even though, Naga red variety is more widely consumed as beer (62%) while Belko peleg is better suited for the local food (*tuo zaafi*) and porridge.

The introduction and growing importance of maize in the Northern parts of Ghana may be one of the main determinants of the reduction in per capita consumption of sorghum starting from year 1999 (Figure 3). It seems however that sorghum per capita consumption has started to re-gain momentum between 2006 and 2007.

Figure 3: Ghana sorghum consumption per capita, 1997 - 2007 (kg/per capita/year)



Source: FAOSTAT Food Balance Sheets

Farmers cultivate sorghum for both household consumption (food and beer) and marketing. However the majority of farmers in the North cultivate sorghum for their consumption only (69%), 25% grow sorghum for both consumption and the market, while very few (6%) grow sorghum for the market only.

Table 1: Sorghum Balance sheet, 2007 (tons; %)

	2007	Share on domestic supply
Production (tons)	350,000	99%
Import Quantity (tons)	3,691	1%
Stock Variation (tons)	0	0%
Export Quantity (tons)	1	0%
Domestic supply quantity (tons)	**353,690**	**100%**
Seed (tons)	3,400	1%
Waste (tons)	57,809	16%
Processing (tons)	59,447	17%
Food (tons)	233,033	66%

Source: Faostat (2012) Commodity Balance Sheets

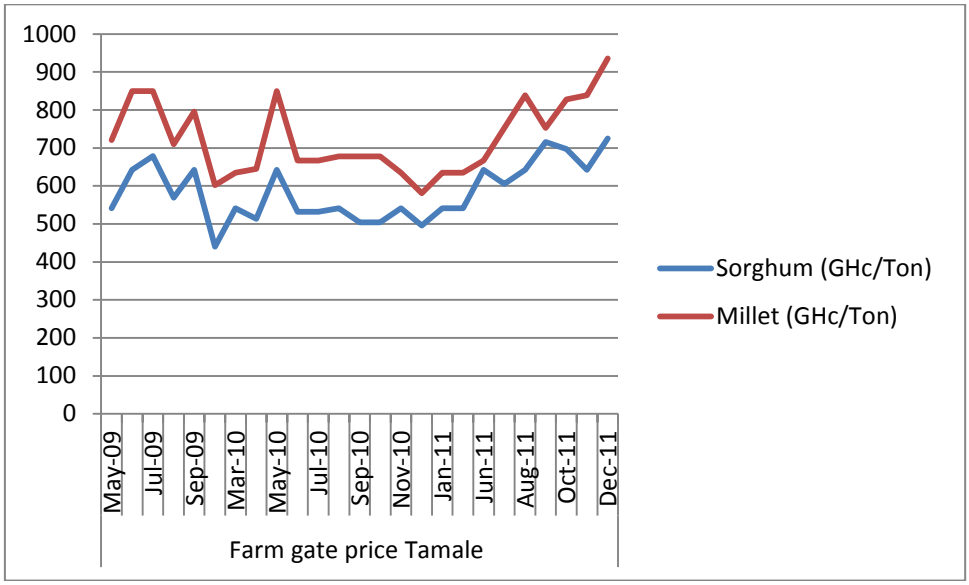
MARKETING AND TRADE

Of the two traditional crops (millet and sorghum), millet is more important for home consumption than sorghum, and so is maize. Home consumption includes food and any other dietary function. Except for early red sorghum, which is mainly processed into the local alcoholic beverage (*pito*), all cereals are used as food. On the other hand, late sorghum has a dual function and may be regarded as the main subsistence crop.

Essentially, as of today, sorghum lost its role as a front-line food security crop and is yet to become a top-ranked cash crop.

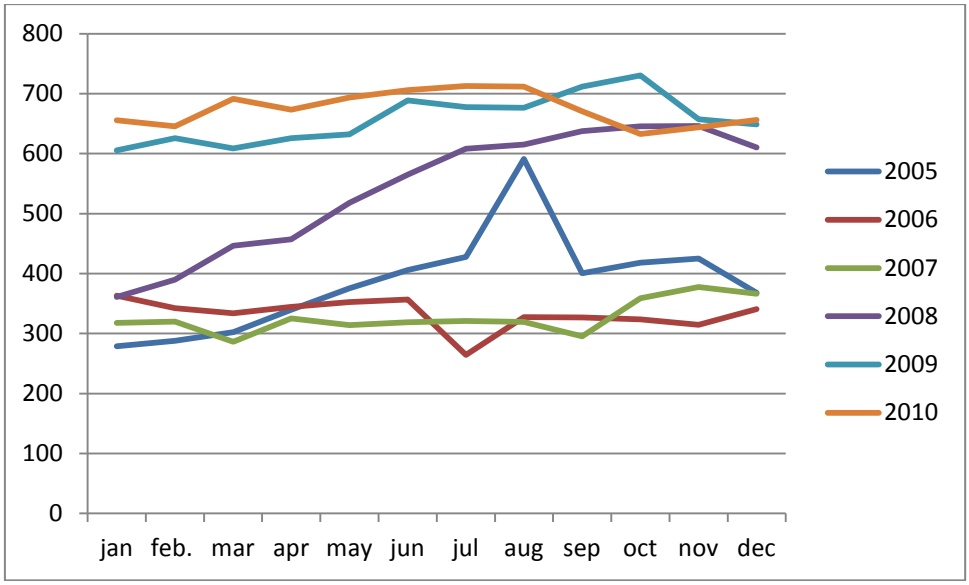
Sorghum prices at both the farm gate and retail level are characterized by a high volatility which is in turn affected by the seasonality of sorghum production that is mainly a rain fed crop (Figure 4 and 5).

Figure 4: Monthly farm gate prices for Sorghum and Millet in Tamale (Northern Region) GHCs/Ton, 2009-2011



Source: MOFA, 2012

Figure 5: National monthly wholesale price for sorghum in Ghana (2005-2011, GHCs/Ton)



Source: MOFA, 2012

As shown in table 2 below and apart from the inconsistencies between FAOSTAT and UN Comtrade data on trade flows, it can be concluded that both exports and imports of sorghum are negligible with a slight prevalence of imported over exported volumes (Table 2).

Over the period of analysis, Ghana is mainly purchasing sorghum from the USA, Canada and South Africa.

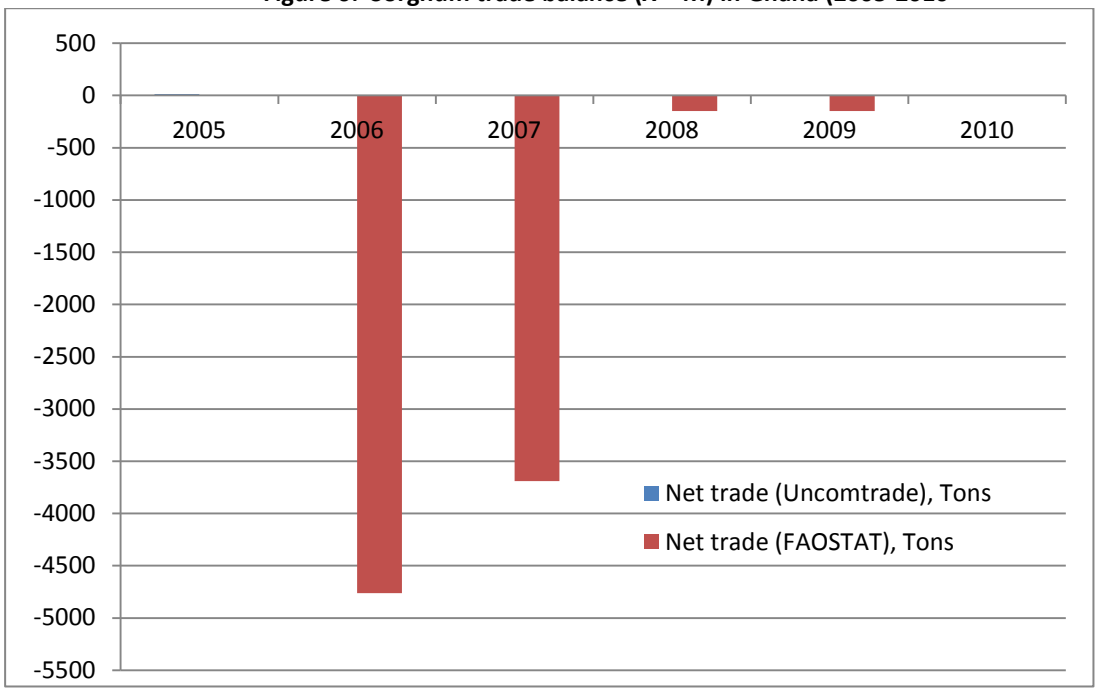
Table 2: Sorghum production, import and export of Ghana (2005-2010)

	2005	2006	2007	2008	2009	2010
Production (tons)	305,000	315,000	154,830	330,950	350,550	324,422
Imports, tons (FAOSTAT)	0	4,765	3,691	150	150	0
Imports, tons (UNComtrade)	N/A	0.6	N/A	0.0	0.2	4.5
Formal exports, tons (FAOSTAT)	3	3	1	1	1	3

N/A = data not available.

Source: FAOSTAT, 2012 and UNComtrade

Figure 6: Sorghum trade balance (X – M) in Ghana (2005-2010



Source: FAOSTAT, 2012

a. Description of the Value Chain and Processing

The dearth of value chain analyses describing the structure and functioning of the sorghum sub-sector in Ghana did not allow for a clear and in-depth description of the commodity pathways relative to the different final uses of this commodity as well as a clear identification of the main value chain actors.

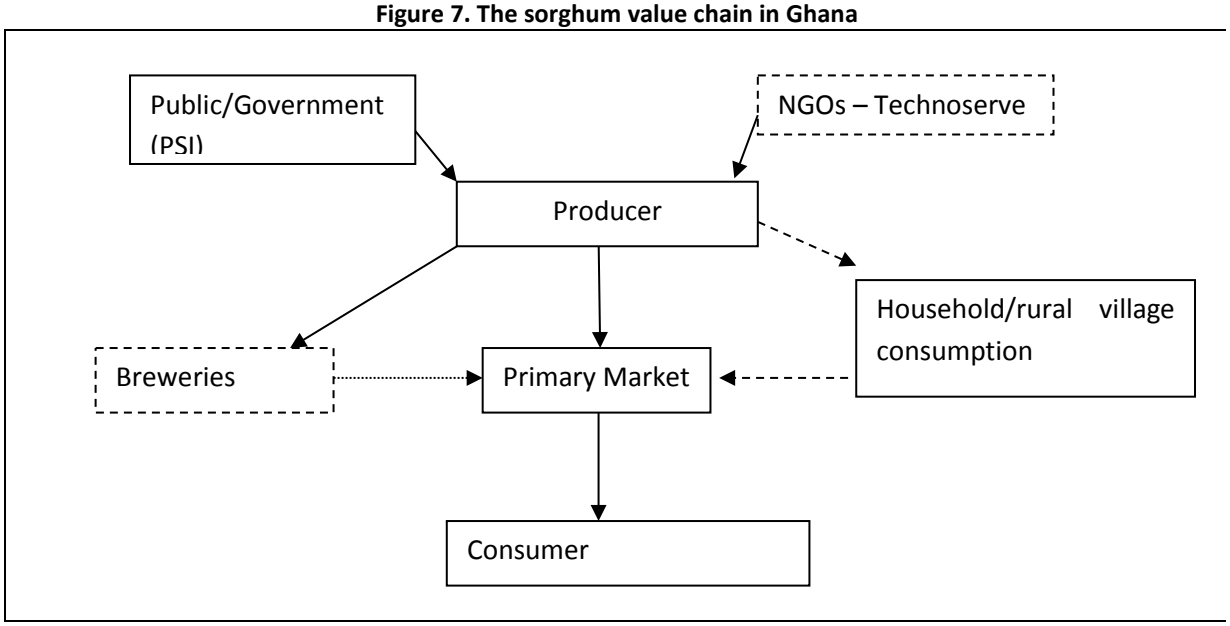
Most of the research work has been dedicated to describing the attempts made in the area of the industrial valorization of sorghum for its utilization in food industries mainly for brewing.

Sorghum is used in industry, as an adjunct or as the main ingredient in the brewing of beer. Thanks to the intervention of international agencies such as UNIDO and the technical assistance by institutions like Technoserve, breweries in Ghana are increasingly using malted sorghum as a substitute for barley in the production of beer. However, it is worth noting that with the appropriate malted sorghum potential demand from industries could reach up to 10,000 tons/year. Currently, breweries' demand is estimated at around 2,500 Tons/Year which is well below the potential.

The objective of one of the largest brewing industries in Ghana, Guinness Ghana, is to replace barley malt, imported from other countries, with sorghum malt and to reduce its importation bill, without a loss in quality. In the past, brewing industries used to import sorghum from countries like Malaysia and Nigeria but now that a suitable variety has been found in Ghana they intend to increasingly make use of this local source if farmers are able to guarantee the required supply. At the moment Guinness Ghana with the assistance of UNDP, is providing financial support to develop better ways of malting and brewing at the national Food Research Institute (FRI) in Accra, and to train farmers on efficient ways of malting sorghum for brewery.

For now, Guinness Ghana is only getting 2% of the sorghum it requires per year for beer production; it could use up to about 4000 metric tons/year of sorghum.

Figure 7. The sorghum value chain in Ghana



Source: Author, based on various value chain analyses

POLICY DECISIONS AND MEASURES

No information is available regarding policies which are specifically targeting the sorghum sector. We know of specific prices paid to farmers who supply malting sorghum to brewery industries however no evidence is available on the size of price support that farmers are receiving in the case of malting sorghum.

Trade policies

Sorghum attracts an import duty of 20% in years 2007-2009. Information on import duties for years 2005, 2006 and 2010 is not available.

Table 3: Import duties on Sorghum and Millet 2005-2010 (%).

	2005	2006	2007	2008	2009	2010
SORGHUM	N/A	N/A	20%	20%	20%	N/A
BARLEY	N/A	N/A	20%	20%	20%	N/A

Source: WITS, 2012

DATA REQUIREMENTS, DESCRIPTION AND CALCULATION OF INDICATORS

In order to calculate the indicators necessary for estimating market incentives and disincentives (NRP, NRA) and the market development gap, data on prices and costs are required. These have been collected and are presented and analyzed below.

TRADE STATUS OF THE PRODUCTS

Given the negligible amounts traded, sorghum is considered as a non traded commodity, however as official statistics show a slight prevalence of imported volumes over exported ones Ghana was set as an importing country for the market incentives and disincentives analysis.

It is also worth mentioning that as far as the brewery industry is concerned barley is still imported as malting sorghum supply in Ghana is not sufficient to satisfy demand by brewery industries.

BENCHMARK PRICES

Observed

The unit values of imported sorghum could not be considered as the benchmark in the analysis given the presence of a significant number of outliers. On the other hand, FOB sorghum prices could not be considered given the negligible quantities exported to Ghana by the main exporters, USA or Canada.

Nigeria is also a large importer of sorghum grain. However, the international flows of sorghum in Nigeria are also very limited and reliable data for CIF prices is not available for most of the years under analysis.

As a consequence, an average CIF price for Kenya, Ethiopia, and Sudan, the main sorghum importers in Africa (IGC, 2012), was used to calculate the benchmark price. CIF prices were obtained from UNCOMTRADE.

Table 4: Average CIF prices for sorghum at Kenya, Sudan, and Ethiopia borders (USD/MT), 2005-2010,

	2005	2006	2007	2008	2009	2010
Average CIF price in Kenya, Sudan, and Ethiopia USD/MT	260.3	327	223.7	334.4	373.8	359.7

Source: UNCOMTRADE, 2012

No adjustment to the benchmark price was made

DOMESTIC PRICES

Given the scarcity of information on the sorghum value chain other than the description of interventions aimed at developing the production and commercialization of malting sorghum varieties, prices considered for the analysis refer to one of the main producing regions, the Northern region that together with the Upper West region is also one of the main suppliers of sorghum to the brewery industry located in Kumasi in the Ashanti Region. Kumasi is one of the main wholesale

markets in Ghana and was chosen as the point of competition given the proximity to major wholesale markets and the brewing industries.

Farm gate prices for Sorghum in Tamale were provided by the Ministry of Food and Agriculture. However, only farm gate prices in years 2009 and 2010 were made available. Farm gate prices for years 2005, 2006, 2007, 2008 had to be estimated.

Wholesale prices for Sorghum were not available for Kumasi market and national average rural wholesale prices, obtained from the Ministry of Food and Agriculture, were used for the analysis.

Farm Gate prices

Farm gate prices for Tamale were only available for two years, 2009 and 2010. In view of obtaining observed farm gate prices from the Ministry of Food and Agriculture and/or the Ghana Statistical Office, farm gate prices for the period 2005-2008 were estimated by subtracting the average spread between wholesale and farm gate prices observed in 2009 and 2010. The average difference between farm gate and wholesale prices in those years was 15%.

Table 5: Farm gate prices used for the analysis (GHCs/Ton)

	2005	2006	2007	2008	2009	2010
Sorghum farm gate prices in Tamale (GHCs/Ton)	330.2*	285.2*	280.1*	464.5*	614.6	526.2

Source: MOFA and own calculations

*Estimate

Wholesale prices

Wholesale prices of sorghum at the Kumasi wholesale market were not available and national average rural wholesale prices for sorghum provided by the Ministry of Agriculture were used for the calculations of market incentives and disincentives.

Table 6: Sorghum wholesale prices used for the analysis (GHCs/Ton)

	2005	2006	2007	2008	2009	2010
SORGHUM National average wholesale prices (GHCs/Ton)	385.0	332.5	326.6	541.5	657.3	674.4

Source: MOFA, 2012

EXCHANGE RATES

Observed

Ghana has a floating exchange rate regime for its currency, the Ghana cedi. With the 2006 Foreign Exchange Act Ghana shifted away from exchange controls. In July 2007, the national currency was re-denominated by setting 10 000 Cedis to 1 new Ghana cedi. Therefore no adjustment was made to the nominal exchange rate.

Table 7: Exchange rate Ghana Cedis/USD

	2005	2006	2007	2008	2009	2010
National Currency per US Dollar (principal rate, period average)	0.91	0.92	0.94	1.06	1.41	1.43

Source: IMF

MARKET ACCESS COSTS

Access costs considered in the analysis are those from farm gate to the point of competition which in the case of sorghum refer to the costs incurred to take sorghum from one of the main producing areas, Tamale in the Northern Region, to the point of competition, Kumasi in the Ashanti region, which is one of the main wholesale markets in Ghana and also the area where brewery industries are located.

As far as access costs from the border to the point of competition are concerned these have been considered with reference to the costs incurred between the Port of Tema (Accra) and the point of competition, Kumasi.

Observed access costs from Farm Gate to Point of Competition

Access costs inherent to the sorghum value chain were not available. Hence access costs relative to the maize value chain were used and adapted for the analysis.

Table 8: Typical Marketing Costs in the Ghanaian Maize Value Chain

	USD per 100kg bag	%	Transaction costs and agents' margins per value chain segment (%)
Farmgate price	17.3	55.8	55.8
Handling and other costs	1.7	5.5	17.7
Transport	0.6	1.9	
Commission and Mktg Fee	0.3	1	
Storage, Interest, Losses	1.1	3.5	
Wholesale Agent Fee	0.3	1	
Wholesale Profit	1.5	4.8	
Techiman Wholesale Price	22.8	73.5	73.5
Handling, Marketing Fee, other	0.8	2.6	13.3
Transport	1.7	5.5	
Storage, interest, losses	0.9	2.9	
Wholesale Profit	0.7	2.3	
Accra wholesale price	27	87.1	87.1
Transport, Handling Marketing Fee	1.2	3.9	12.9
Storage Interest and losses	0.9	2.9	
Retailer Profit	1.9	6.1	
Accra Retail price	31	100	100

Source: NRI, IFPRI and World Bank 2007, own calculations

As maize access costs are computed in USD these have been converted in local currency, using the IMF exchange rate information, and expressed in tons. In addition, the transport costs were adapted to the distance between Tamale and Kumasi, 377 km. The remaining cost items such as handling, commissions and marketing fees were left unchanged.

Table 9: Estimated access costs for Sorghum from farm gate to point of competition (GHCs/Ton)

	2005	2006	2007	2008	2009	2010
Handling and other costs	15.41	15.58	15.90	17.98	23.95	24.33
Transport	6.90	6.98	7.12	8.06	10.73	10.90
Commission and Mktg Fee	2.72	2.75	2.81	3.17	4.23	4.29
Storage, Interest, Losses	9.97	10.08	10.29	11.64	15.50	15.74
Wholesale Agent Fee	2.72	2.75	2.81	3.17	4.23	4.29
Wholesale Profit	13.59	13.75	14.03	15.87	21.13	21.47
Total access costs	51.31	51.89	52.95	59.89	79.76	81.02

Source: own calculations using data from IFPRI maize value chain analysis, 2007.

Adjusted access costs from farm gate to point of competition

No value chain information was available to allow for adjustments.

Observed access costs from border to point of competition

The information on observed access costs from border to point of competition is partial. No information on for example port handling is available for sorghum. The data used for the calculation of access costs to take imported sorghum from the border to Kumasi, the point of competition, refers to average transport costs for sorghum per ton per Km which have been then multiplied by the distance that separates the port of Tema Accra to Kumasi, 250 km. Sorghum transport costs were provided by the Ghana Statistical Services and are available on a monthly basis, however some data is missing and this might have affected averages in some years. Moreover, data on transport costs for year 2005 was not available. The figure was obtained by deflating 2006 transport data using the GDP deflator for Ghana extracted from IMF. Transport costs appear very high relatively to Africa's averages. This might be due to the still extremely high transport costs in rural areas in Ghana. Concerning port charges, data on port charges for maize recently estimated by IFPRI (2011) were inputted.

Table 10: Observed access costs from border to point of competition (GHCs/Ton)

	2005	2006	2007	2008	2009	2010
Port charges	69.4	76.6	122.8	122.7	115.2	200.4
Sorghum transport costs (GHCs/Ton/Km)	0.65*	0.71	0.54	0.34	0.30	0.56
Sorghum transport costs (GHCs/Ton) from Tema to Kumasi (250 km)	163.01*	178.21	136.11	85.28	74.06	139.29
Total access costs (GHC/MT)	232.41	254.81	258.91	207.98	189.26	339.69

Source: MOFA and own calculations

*Estimate

Adjusted access costs from farm gate to point of competition

No value chain information was available to allow for adjustments.

EXTERNALITIES

No externalities were considered in our analysis at this stage.

BUDGET AND OTHER TRANSFERS

Sorghum producers are not benefiting from any specific budget transfer. The fertilizer subsidy programme is irrelevant to sorghum as inorganic fertilizer is not applied on this crop.

Some credit facility is provided within the Guinness Ghana Technoserve project to help the farmer face high input costs. However, more detailed information will have to be gathered concerning this aspect.

QUALITY AND QUANTITY ADJUSTMENTS

No quality and quantity adjustment was considered relevant at this stage given the unavailability of information on the different prices of malting and non malting sorghum in Ghana.

DATA OVERVIEW

Following the discussions above, here is a summary of the main sources and methodological decisions taken for the analysis of price incentives and disincentives for Sorghum in Ghana.

		Description	
Concept		***Observed***	***Adjusted***
Benchmark price		▪ Average CIF unit value of sorghum in Kenya, Ethiopia, and Sudan (UNComtrade)	*N.A.*
Domestic price at point of competition		▪ National average wholesale price of sorghum, from MOFA	*N.A.*
Domestic price at farm gate		▪ Farm gate prices for sorghum in Tamale were only available for years 2009 and 2010. Farm gate prices for the period 2005-2008 estimated by subtracting the average spread between the wholesale and the farm gate prices in those years for which farm gate prices were available (2009 and 2010)	*N.A.*
Exchange rate		▪ Annual average of exchange rate as reported by IMF	*N.A.*
Access cost from border to point of competition		▪ Estimated as the average cost of transport per ton per km of sorghum within Ghana as the transport costs of sorghum for the route Tema (Accra)-Kumasi were not available. Port handling costs for maize (IFPRI 2011) were also included in the calculations	*N.A.*
Access costs to farm gate		▪ Estimated for the route from the producing area of Tamale to Kumasi using maize access costs calculated by IFPRI (2007)	*N.A.*
QT adjustment	Bor-Wh	*N.A.*	*N.A.*
	Wh-FG	*N.A.*	*N.A.*
QL adjustment	Bor-Wh	*N.A.*	*N.A.*
	Wh-FG	*N.A.*	*N.A.*

The data used for the analysis is summarized in the following table:

		Year	*2005*	*2006*	*2007*	*2008*	*2009*	*2010*
		trade status	*m*	*m*	*m*	*m*	*m*	*m*
DATA	*Unit*	*Symbol*						
Benchmark Price								
Observed	USD/TONNE	$P_{b(int\$)}$	**260.30**	**327.00**	**223.70**	**334.40**	**373.80**	**359.70**
Adjusted	USD/TONNE	P_{ba}						
Exchange Rate								
Observed	GHC/USD	ER_o	0.91	0.92	0.94	1.06	1.41	1.43
Adjusted	GHC /USD	ER_a						
Access costs border - point of competition								
Observed	GHC /TONNE	AC_{owh}	232.41	254.81	258.91	207.98	189.26	339.69
Adjusted	GHC /TONNE	AC_{awh}						
Domestic price at point of competition	GHC /TONNE	P_{dwh}	**385.01**	**332.54**	**326.61**	**541.59**	**657.35**	**674.41**
Access costs point of competition - farm gate								
Observed	GHC /TONNE	AC_{ofg}	51.31	51.89	52.95	59.89	79.76	81.02
Adjusted	GHC /TONNE	AC_{afg}						
Farm gate price	GHC /TONNE	P_{dfg}	**330.23**	**285.22**	**280.14**	**464.53**	**614.68**	**526.27**
Externalities associated with production	GHC /TONNE	E						
Budget and other product related transfers	GHC /TONNE	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}						

CALCULATION OF INDICATORS

The indicators and the calculation methodology used is described in Box 1. A detailed description of the calculations and data requirements is available on the MAFAP website or by clicking here.

Box 1 : MAFAP POLICY INDICATORS

MAFAP analysis uses four measures of market price incentives or disincentives. *First*, are the two observed nominal rates of protection one each at the wholesale and farm level. These compare observed prices to reference prices free from domestic policy interventions.

Reference prices are calculated from a benchmark price such as an import or export price expressed in local currency and brought to the wholesale and farm levels with adjustments for quality, shrinkage and loss, and market access costs.

The ***Nominal Rates of Protection - observed (NRPo)*** is the price gap between the domestic market price and the reference price divided by the reference price at both the farm and wholesale levels:

$$NRPo_{fg} = (P_{fg} - RPo_{fg})/RPo_{fg}; \quad NRPo_{wh} = (P_{wh} - RPo_{wh})/RPo_{wh};$$

The $NRPo_{fg}$ captures all trade and domestic policies, as well as other factors which impact on the incentive or disincentive for the farmer. The $NRPo_{wh}$ helps identify where incentives and disincentives may be distributed in the commodity market chain.

Second are the ***Nominal Rates of Protection - adjusted (NRPa)*** in which the reference prices are adjusted to eliminate distortions found in developing country market supply chains. The equations to estimate the adjusted rates of protection, however, follow the same general pattern:

$$NRPa_{fg} = (P_{fg} - RPa_{fg})/RPa_{fg}; \quad NRPa_{wh} = (P_{wh} - RPa_{wh})/RPa_{wh};$$

MAFAP analyzes market development gaps caused by market power, exchange rate misalignments, and excessive domestic market costs which added to the NRP*o* generate the NRP*a* indicators. Comparison of the different rates of protection identifies where market development gaps can be found and reduced.

With the data described above we obtain the price gaps summarized in Table 11, nominal rates of protection in Table 12. Observed and adjusted price gaps and Nominal rates of protection do not differ as no adjustment was made to access costs. Calculations of the NRA were not possible given the absence of information on the amount of budget transfers to sorghum producers throughout the period of analysis.

Table 11: MAFAP price gaps for Sorghum in Ghana (GHCs per Mt) 2005-2010

	2005	2006	2007	2008	2009	2010
Trade status for the year	m	m	m	m	m	m
Observed price gap at wholesale	(84.28)	(223.12)	(142.58)	(20.85)	(58.97)	(179.65)
Adjusted price gap at wholesale	(84.28)	(223.12)	(142.58)	(20.85)	(58.97)	(179.65)
Observed price gap at farm gate	(87.75)	(218.55)	(136.10)	(38.02)	(21.88)	(246.77)
Adjusted price gap at farm gate	(87.75)	(218.55)	(136.10)	(38.02)	(21.88)	(246.77)

Source: Own calculations using data as described above.

Table 12: MAFAP nominal rates of protection (NRP) for Sorghum in Ghana (%) 2005-2010

	2005	2006	2007	2008	2009	2010
Trade status for the year	m	m	m	m	m	m
Observed NRP at wholesale	-17.96%	-40.15%	-30.39%	-3.71%	-8.23%	-21.03%
Adjusted NRP at wholesale	-17.96%	-40.15%	-30.39%	-3.71%	-8.23%	-21.03%
Observed NRP at farm gate	-20.99%	-43.38%	-32.70%	-7.57%	-3.44%	-31.92%
Adjusted NRP at farm gate	-20.99%	-43.38%	-32.70%	-7.57%	-3.44%	-31.92%

Source: Own calculations using data as described above.

INTERPRETATION OF THE INDICATORS

The observed price gaps are based on observed access costs while adjusted price gaps are based on adjusted access costs net of Government taxes and fees as well as excessive logistic costs. In the case of sorghum in Ghana it was not possible to adjust observed access costs as information on taxes and duties applied on sorghum are not available at this stage. The international reference price has been converted in the local currency under the assumption of no exchange rate misalignement during the period of analysis. Therefore, in the case of sorghum it was possible to calculate the observed price gaps which are affected by both market imperfections/failures and Government interventions. Hence a positive price gap indicates positive support to the farmer while negative price gap represents a "tax"or a disincentive for the agent. Price gaps can also be expressed as a percentage of the reference parity, i.e. the nominal rate of protection (NRP) presented in figure 9 below.

Wholesale indicators

Observed price gaps at wholesale are negative ranging from -20 to -223. Estimated nominal rates of protection at the wholesale level are quite variable over the years. These rates range from -3.71% to -40%. The lowest levels for both indicators are registered during the biennium 2008 and 2009 when wholesale prices for sorghum increased.

Import duties seem to contribute to a reduction in the negative price gaps and thus increase protection of the sorghum sub-sector from international competition at least in those years for which those are in place, 2007, 2008 and 2009. This is more evident when looking at the Nominal Rates of Protection.

Farm Gate indicators

Unfortunately, the lack of analysis on the sorghum value chain does not allow for a clear cut interpretation of the results which is further hindered by the unavailability of farm gate prices information for the years 2005-2008 which had to be estimated.

The observed price gaps at farm gate are negative for all years under analysis ranging from -21 to -246 GHC/MT. These are similar in magnitude to the wholesale price gaps except for years 2009 and 2010 when there is a significant difference between the two gaps.

The equivalent observed nominal rate of protection ranges from -3.44% to -43.33%. Similarly to the nominal rate of protection at the wholesale level the most negative NRP at farm gate was reached in 2006.

As in the case of the NRP at wholesale, the farm gate NRP shows smaller negative values in the biennium when the import tariff on sorghum was in place.

Figure 8: Observed and Adjusted Price Gaps for Sorghum in Ghana (GHC/Ton)

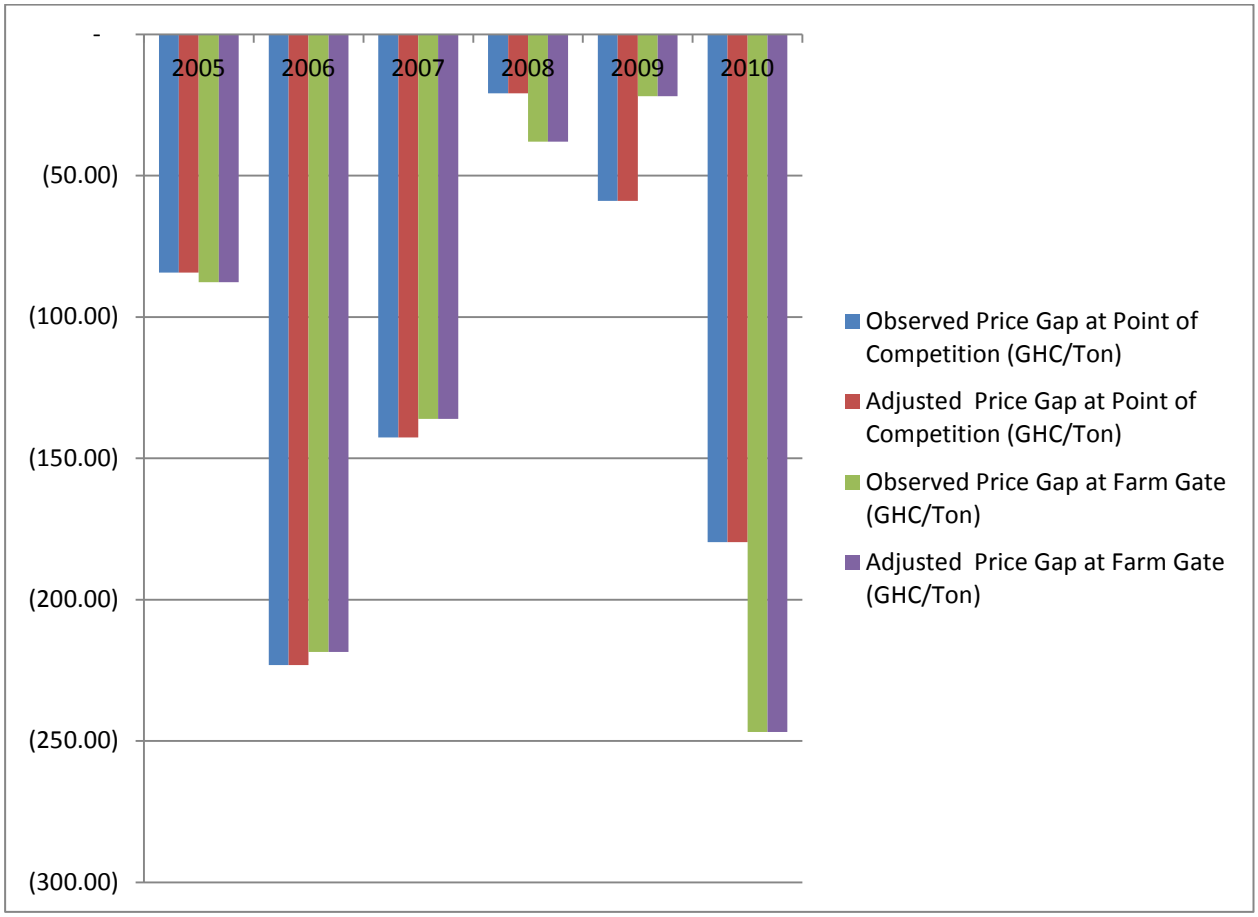
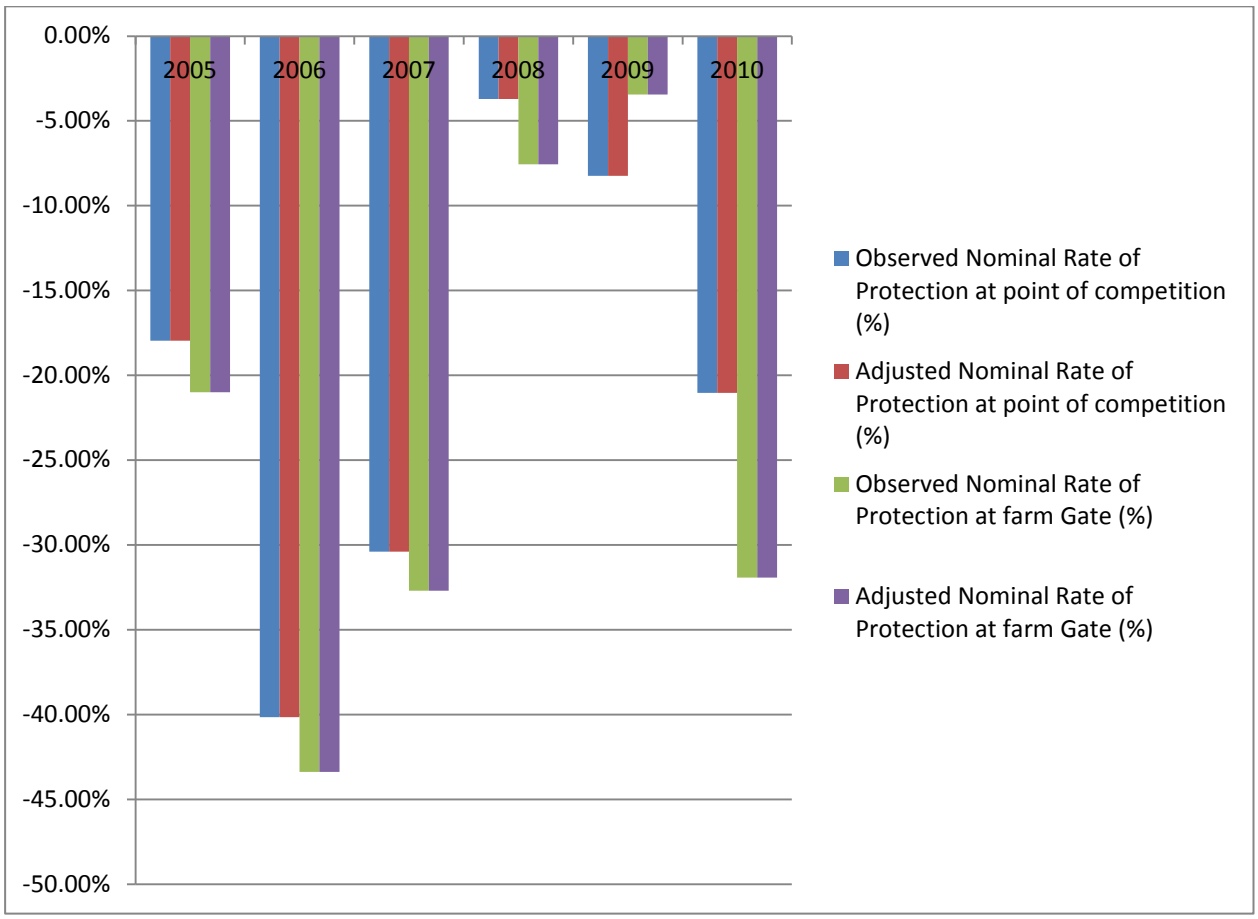


Figure 9. Observed and Adjusted Nominal Rate of protection for sorghum in Ghana (%)



PRELIMINARY CONCLUSIONS AND RECOMMENDATIONS

MAIN MESSAGE

Although sorghum was for many years one of the most important and widely cultivated cereals for farmers in Northern Ghana, the few studies on the sorghum sub-sector and general information on area harvested and national production provide some indication on its decreasing importance as a food crop. Nevertheless, sorghum is still important as a substitute food staple and a cash crop, even if its potential has not been fully exploited. The massive introduction of maize – which after millet has the advantage of being a short-duration crop contributing to coping with seasonal hunger in the area – is seen as one of the factors responsible for this shift in importance.

On the other hand the results of the market incentives and disincentives analysis and in particular the negative price gaps and NRPs for sorghum also reveal that despite the absence of incentives to produce and market sorghum this is still an important crop from a social and religious point of view.

Indeed the estimated price wedges and relative nominal rates of protection for sorghum in Ghana indicate substantial disincentives to producers and wholesalers. This disincentive is mainly due to the inefficiency of the market and in particular to transport costs in rural areas which are well above the continent's average.

PRELIMINARY RECOMMENDATIONS

In some countries, such as Côte d'Ivoire, Nigeria or Zimbabwe, the industrial use of sorghum for brewing alcoholic beverages is increasing. Consequently, it is quite likely that a gradual shift of sorghum from its traditional role as a mere staple crop toward virtually becoming both a cash and industrial crop will occur if the economic demand and other related conditions prevail enough to warrant such a change. We do not have sufficient and reliable information on if and to what extent this transformation within the sorghum value chain is actually occurring or can occur in the future in Ghana. The decision to intensify technological and agronomic research in terms of development of improved varieties and malting techniques to make sorghum more suitable for industrial and commercial use is one of the options to be pursued. This would imply a thorough analysis of the sector and the profitability of sorghum with respect to its industrial uses.

Essentially, sorghum utilization by the brewery industry seems to have a potential which seems to be untapped. Unfortunately due to significant data limitations encountered in this analysis it is difficult to assess how far existing market structure and policy is affecting production. However, if the Government wishes to stimulate sorghum production for processing the following measures should be considered: support to sorghum producers, better integration of value chain with brewing sector, R&D for new varieties. There were some attempts in this direction but never on a large scale basis.

LIMITATIONS

The analysis of market incentives and disincentives for sorghum in Ghana faced the following constraints:

- Lack of value chain analysis on sorghum;

- Lack of regional farm gate prices for selected years;
- Lack of wholesale prices at the regional level;
- Lack of information on malting varieties for sorghum and their prices;
- Lack of information on access costs.

FURTHER INVESTIGATION AND RESEARCH

An updated analysis on the sorghum sector would help understand more on the commodity pathways, the uses and main actors in the sector as well as prices at the regional level.

Given the major price and access cost data problem the need to cross-check the various assumptions and estimates made through small surveys among to traders or associations of traders in Kumasi becomes essential.

Furthermore, it would be very interesting to find out more evidence on existing price differences between those paid to farmers on the wholesale market and those paid by industrial breweries.

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ANNEX I: Methodology Used

A guide to the methodology used by MAFAP can be downloaded from the MAFAP website or by clicking here.

ANNEX II: Data and calculations used in the analysis

Name of product	SORGHUM
International currency	USD

Local currency	GHC

	DATA		Unit	Symbol	Year trade status	2005 m	2006 m	2007 m	2008 m	2009 m	2010 m	Notes
	Benchmark Price											
1		*Observed*	USD/TON	$P_{b(int\$)}$		**260.30**	**327.00**	**223.70**	**334.40**	**373.80**	**359.70**	
1b		*Adjusted*	USD/TON	P_{ba}		**260.30**	**327.00**	**223.70**	**334.40**	**373.80**	**359.70**	
	Exchange Rate											
2		*Observed*	YYY/XXX	ER_o		0.91	0.92	0.94	1.06	1.41	1.43	
2b		*Adjusted*	YYY/XXX	ER_a		0.91	0.92	0.94	1.06	1.41	1.43	
	Access costs border - point of competition											
3		*Observed*	GHC/TON	ACo_{wh}		232.41	254.81	258.91	207.98	189.26	339.69	
3b		*Adjusted*	GHC/TON	ACa_{wh}								
4	**Domestic price at point of competition**		GHC/TON	P_{dwh}		385.01	332.54	326.61	541.59	657.35	674.41	
	Access costs point of competition - farm gate											
5		*Observed*	GHC/TON	ACo_{fg}		51.31	51.89	52.95	59.89	79.76	81.02	
5b		*Adjusted*	GHC/TON	ACa_{fg}								
6	**Farm gate price**		GHC/TON	P_{dfg}		330.23	285.22	280.14	464.53	614.68	526.27	
7	Externalities associated with production		GHC/TON	E								
8	Budget and other product related transfers		GHC/TON	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}								

	CALCULATED PRICES		Unit	Symbol	2005	2006	2007	2008	2009	2010	Formula
	Benchmark price in local currency										
9		*Observed*	GHC/TON	$P_{b(loc\$)}$	236.87	300.84	210.28	354.46	527.06	514.37	[1]*[2]
10		*Adjusted*	GHC/TON	$P_{b(loc\$)a}$	236.87	300.84	210.28	354.46	527.06	514.37	[1b]*[2b]
	Reference Price at point of competition										
11		*Observed*	GHC/TON	RPo_{wh}	469.29	555.65	469.19	562.44	716.32	854.06	[9]+[3]
12		*Adjusted*	GHC/TON	RPa_{wh}	469.29	555.65	469.19	562.44	716.32	854.06	[10]+[3]
	Reference Price at Farm Gate										
13		*Observed*	GHC/TON	RPo_{fg}	417.98	503.77	416.24	502.55	636.56	773.04	[11]-[5]
14		*Adjusted*	GHC/TON	RPa_{fg}	417.98	503.77	416.24	502.55	636.56	773.04	[12]-[5]

	INDICATORS		Unit	Symbol	2005	2006	2007	2008	2009	2010	Formula
	Price gap at point of competition										
15		*Observed*	GHC/TON	PGo_{wh}	(84.28)	(223.12)	(142.58)	(20.85)	(58.97)	(179.65)	[4]-[11]
16		*Adjusted*	GHC/TON	PGa_{wh}	(84.28)	(223.12)	(142.58)	(20.85)	(58.97)	(179.65)	[4]-[12]
	Price gap at farm gate										
17		*Observed*	GHC/TON	PGo_{fg}	(87.75)	(218.55)	(136.10)	(38.02)	(21.88)	(246.77)	[6]-[13]
18		*Adjusted*	GHC/TON	PGa_{fg}	(87.75)	(218.55)	(136.10)	(38.02)	(21.88)	(246.77)	[6]-[14]
	Nominal rate of protection at point of competition										
19		*Observed*	%	$NRPo_{wh}$	-17.96%	-40.15%	-30.39%	-3.71%	-8.23%	-21.03%	[15]/[11]
20		*Adjusted*	%	$NRPa_{wh}$	-17.96%	-40.15%	-30.39%	-3.71%	-8.23%	-21.03%	[16]/[12]
	Nominal rate of protection at farm gate										
21		*Observed*	%	$NRPo_{fg}$	-20.99%	-43.38%	-32.70%	-7.57%	-3.44%	-31.92%	[17]/[13]
22		*Adjusted*	%	$NRPa_{fg}$	-20.99%	-43.38%	-32.70%	-7.57%	-3.44%	-31.92%	[18]/[14]
	Nominal rate of assistance										
23		*Observed*	%	NRAo	-21%	-0.43382299	-0.32697233	-0.07565588	-0.03437172	-0.31921538	([17]+[8])/[13]

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