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Analysis of price incentives for rice in Ghana 2005-2013

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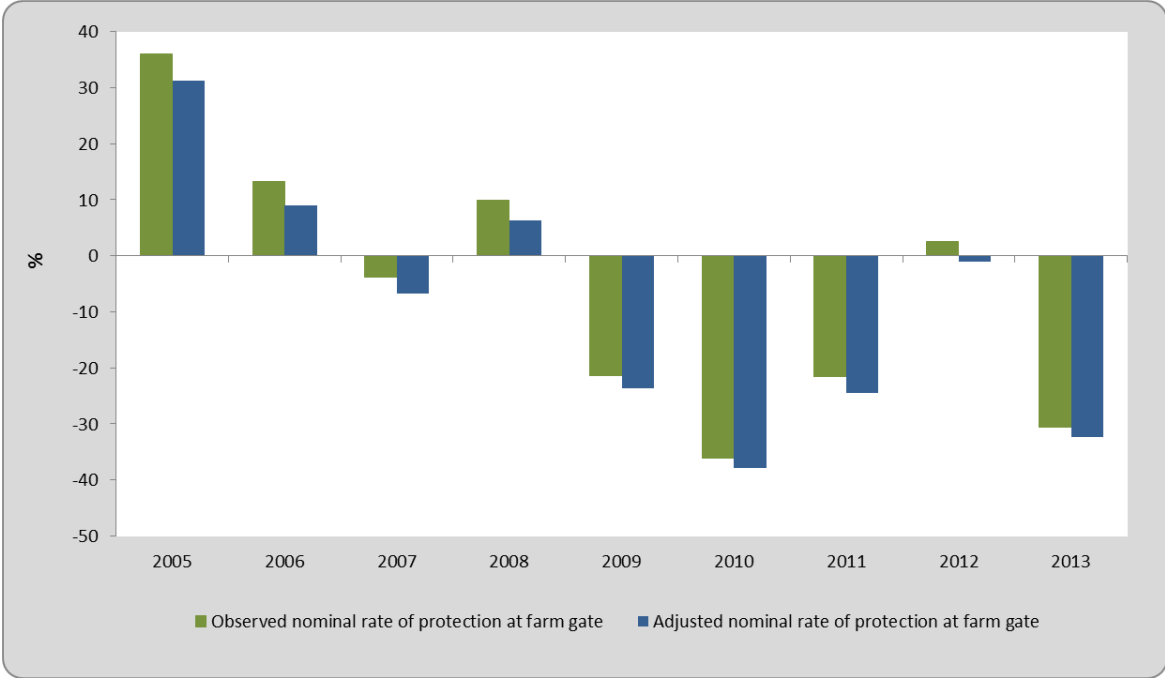
Executive summary

Product: Rice
Period analysed: 2005-2013
Trade status: Imported commodity
Two analyses were undertaken: price incentives using open market data (Figure 1) and price incentives using data on prices and access costs related to the National Buffer Stock Company (NAFCO) operations (Figure 2)

Commodity context

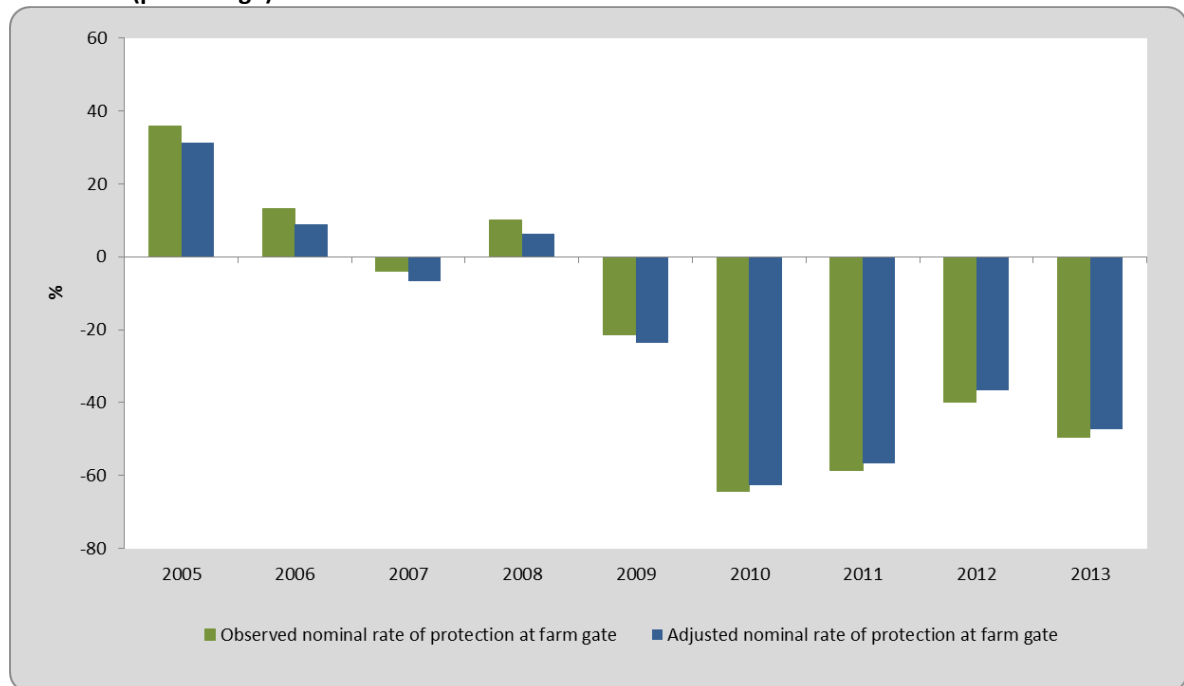
- First most important import crop;
- Total production from 142 000 tonnes in 2005 to almost 289 000 tonnes (milled equivalent) in 2012;
- Main type of rice imported is broken rice with Thailand and Viet Nam being the leading suppliers;
- Rice imports are subject to an import duty of 20 percent (temporarily removed in 2008 and reinstated during the course of 2009) as well as other taxes and levies;
- Rice is one of the commodities, purchased by NAFCO, operating since 2010, to stabilize rice prices and build emergency stocks;
- Policy interventions by the Government also include input subsidies (fertilizer, and seeds), irrigation schemes and improvement of processing techniques.

Figure 1. Observed and Adjusted Nominal Rate of Protection at Farm Gate for Rice in Ghana, [2005-2013] (percentage)



Source: Author’s calculations, 2014

Figure 2. Observed and Adjusted Nominal Rate of Protection at Farm Gate for Rice in Ghana (NAFCO), 2005-2013 (percentage)



Source: Author's calculations, 2014

The observed Nominal Rate of Protection (NRP, green bar) in the graph above measures the effect of policy distortions and overall market performance on price incentives for producers. The adjusted NRP (blue bar) 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.

Driving factors

The observed Nominal Rate of Protection (NRP, green bar) indicates that rice farmers receive prices which are quite aligned with the reference price at the farm gate up to year 2008 and experience price disincentives for the following years except for 2012 (Figure 1). The adjusted NRP (blue bar) captures the effects of market inefficiencies on farmers, namely the high transport costs. Price disincentives also occur for farmers selling to the national buffer stock for all years in which the buffer stock is operational (2010-2013) (Figure 2).

Our results show that disincentives, when they exist, arise from 1) price dynamics, 2) transport and handling costs.

Despite the significant increase of domestic rice production, starting from 2008, due to favorable weather conditions and higher accessibility to inputs and technical assistance (input and mechanization subsidies), rice producers face disincentives.

Population and income growth, especially in urban areas are the main determinants for the dramatic increase in per capita consumption levels; however domestic demand is oriented toward imported rice which is still considered of higher quality than the local rice.

The import tariff of 20 percent, suspended only during 2008 and 2009, is not effective in protecting farmers, as the NRP result above 20 percent only in year 2005 (Figure 1 and 2); High transport and

handling costs contribute to exacerbate farmers disconnection with wholesale markets in Ghana and international price dynamics. In particular, the removal of the fuel subsidy determined a dramatic increase in transport costs in 2013. Rice producers selling to NAFCO face even higher disincentives than farmers operating on the open market as pan-territorial farm gate prices are lower than prices farmers would receive on the open market.

Recommendations

- Carry out a review of all costs affecting transport and handling for both imported and domestic rice
- In-depth assessment of existing programmes supporting rice and coherence with policy objectives.
- Review of the import tariff
- Review of the National Buffer Stock and its operational features
- Improve post-harvest and processing techniques for domestic rice

Purpose of the note

This technical note is an attempt to measure, analyse and interpret price incentives for Rice in Ghana over the period 2005-2013. It is based on the previous MAFAP analysis of price price incentives for the period 2005-2012.¹

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.

¹ See Angelucci *et al.*, 2013.

1. Commodity context

Rice is considered to be the second most important grain food staple in Ghana, next to maize (MOFA, 2009). Rice consumption continues to increase with the country's population growth, urbanization, and changing consumer preferences. However, national production only meets 30 percent of demand and about US\$ 450 million every year are spent on rice imports (FAOSTAT, 2014)

It should be noted that rice is only one of the sources of carbohydrates available in Ghana. Root crops such as cassava, yam, cocoyam as well as plantains and maize are also relevant food crops in terms of domestic production. Rice is the 5th most important source of energy in the diet accounting for 9 percent of total caloric intake (FAOSTAT, 2012).

On average, over the period 2005-2012 paddy rice was the 8th agricultural commodity in Ghana by value of production (FAOSTAT, 2014). It occupies roughly 5.5 percent of the total crop harvested area and accounts for about 12 percent of the total area planted to cereals (MOFA-SRID, 2013).² In addition to being a staple food mainly for high income urban populations, rice is also an important cash crop in the communities in which it is produced.

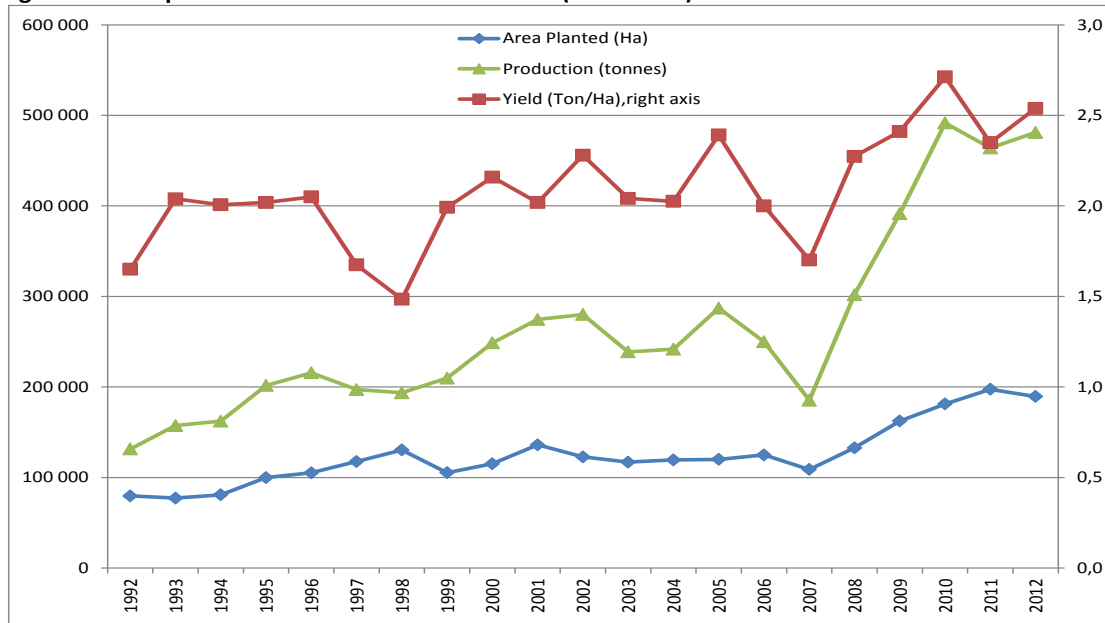
The dependency on rice imports is common to many West African countries. The massive dependency on rice imports has always been a concern for Ghanaian policy makers especially after food prices soared in 2008. Indeed, in May 2008 Ghana was one of the first countries within the Coalition for African Rice Development (CARD) to launch its National Rice Development Strategy (NRDS) for the decade 2009-2018. The main objective of the NRDS is to double domestic production by 2018, implying a 10 percent annual production growth rate, and enhance quality to stimulate demand for domestically produced rice. However, so far, import duties and other taxes as well as interventions to boost productivity and quality of local rice do not seem to produce any substantial impact on Ghana import bill.

Production

The main rice varieties produced in Ghana are *Oryza Sativa* and *Oryza Glaberima* (ODI, 2003). The Figure 3 shows the evolution of production, area and yield for rice in Ghana for the period 1992-2012. Paddy rice production increased from 1.3 and 4.8 hundred thousand tonnes, while yields fluctuated between 1.7 and 2.5 tonnes per hectare. Paddy rice production has increased exponentially starting from year 2007 to remain unchanged for the last two years (2011 and 2012). The rise in Ghanaian production goes in parallel with a sharp increase of the area planted which doubled during the same period 2007-2012. The production increase is a result of the growth in area planted as well as slightly higher but still very variable yields per hectare. The high variability of yields reveals how productivity is influenced by a combination of factors including rain patterns as well as the introduction of the Fertilizer subsidy programme in 2008, the Block Farm programme in 2009 contemplated in the Ghana Rice Strategy (see section on policy decisions and measures).

² Namely, maize, rice, sorghum and millet.

Figure 3. Main production trends for rice in Ghana (1992-2012)



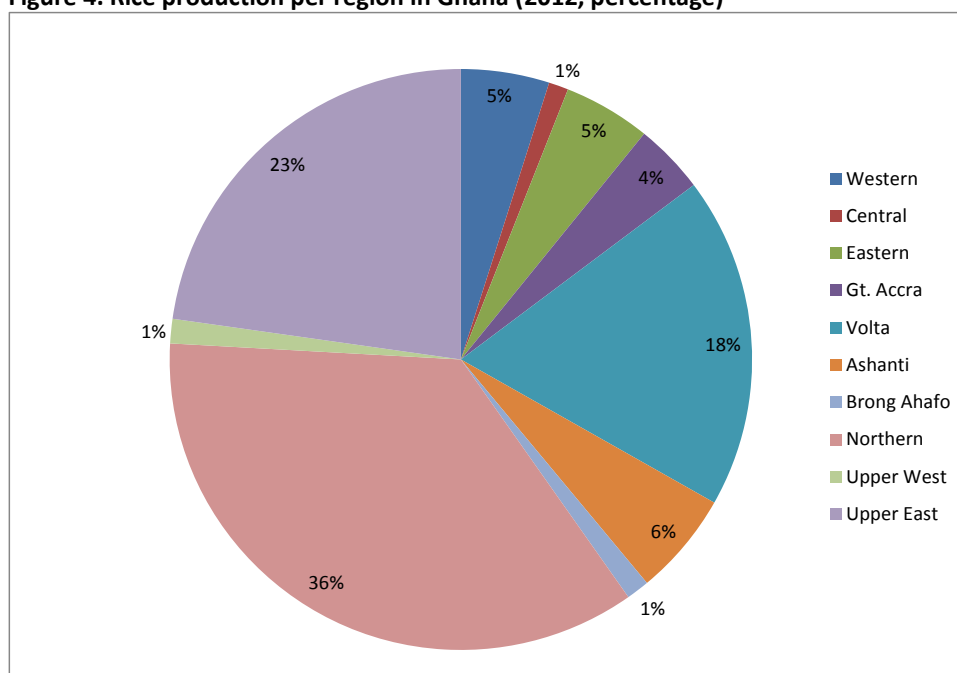
Source: data on production and area planted are from MOFA- SRID (2013); yield data is from FAOSTAT(2014)

Rice production takes place in all the ten regions of Ghana; which also cover all the major ecological-climatic areas including the interior savannah area, the high rain forest zone, the semi-deciduous rain forest area and the coastal savannah area with peak production occurring in the Northern, Upper East, Western, Brong Ahafo and Volta Regions (ODI, 2003).

The main rice producing regions are the Northern, Upper East and Volta regions (Figure 4), which altogether account for 77 percent of production volume in 2012. The Northern region is the main producer with about 173 000 tonnes in 2012 (MOFA-SRID, 2013).

In Ghana, a large share of rice production (more than 80 percent), similarly to other crops, is undertaken by smallholder farmers, with farms of less than one hectare in size. Most of the rice is cultivated from low-quality seed with mixed varieties, which brings about uneven maturity at harvest and wide variations in the size and shape of rice grains. Generally, this results in a gap between the quality of local and imported rice.

Figure 4. Rice production per region in Ghana (2012, percentage)



Source: MOFA, SRID (2013)

Consumption/Utilization

According to the most recent estimates on the food balance sheet (Table 1) rice in Ghana goes mainly to food consumption with an average waste of 6 percent. Less than 1 percent of rice in Ghana is processed. Rice is also not reported to be used as feed in the country.

Table 1. Provisional Food Balance Sheet for Rice in Ghana (2012/2013)

| | Rice (Paddy) | Rice (Milled) |
|---|--------------|-----------------|
| Gross Biological Production (MT) | 481 010 | 288 606 |
| Available Domestic Production for Human Consumption* (MT) | | 251 087 |
| Total Imports (MT) | | 111 617 |
| Carry Over Stock (MT) | | 24 200 |
| Total Exports (MT) | | 200 |
| Total Supply (MT) | | 386 704 |
| Per Capita Consumption (Kg/Annum) | | 24 |
| Closing Stock (MT) | | 38 670 |
| Total Needs (MT) | | 660 510 |
| Net Deficit/ Surplus (MT) | | -273 806 |

Note** Milled rice production is 60 percent of paddy rice production; *Estimated Population for 2012, based on 2010 provisional census figure = 25.91 m.

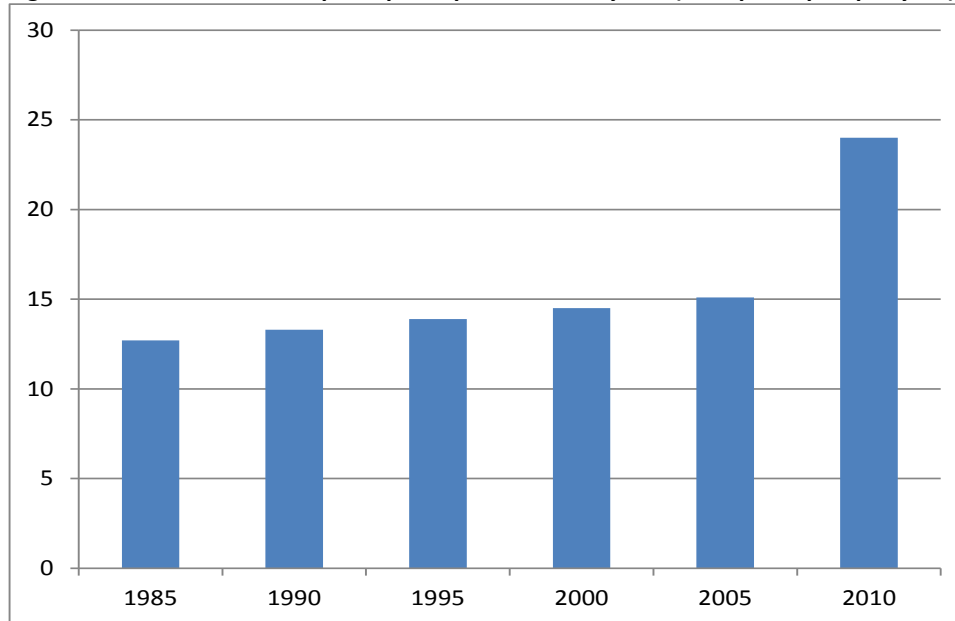
Source: MOFA-SRID, 2013

In Ghana, rice is considered to be among the main staples with consumption in 2012/13 estimated to reach 621 000 tonnes (MOFA-SRID, 2013). Per capita consumption of rice in 2012/2013 is pegged at about 24 kg (Figure 5) with urban areas accounting for about 76 percent of total rice consumption (CARD, 2010).

Although rice displays a high income elasticity of demand, over the last ten years, per capita rice consumption has doubled over the last 15 years due to changes in food consumption patterns driven

by urbanization. In urban areas, rice is preferred over other staples as it is easy and convenient to prepare and it allows for a wide variety of dishes. In addition, the rising number of fast food joints, restaurants and vendors in the major cities has increased the demand for rice. Rice consumption in rural areas is much lower than in urban areas and as such less vulnerable to price fluctuations.

Figure 5. Ghana rice consumption per capita, selected years (kilos per capita per year)



Source: MOFA-SRID, 2013.

High quality white rice is consumed on a regular basis in urban areas where the concentration of people with a stable income is higher. According to the Ministry of Food and Agriculture just about 20 percent of locally cultivated rice is consumed in urban areas due to consumer preferences for long grain aromatic rice which is principally imported from Vietnam and Thailand. There is anecdotal evidence that traders buy the local paddy, mill it and put them in foreign bags for sale. Also increase in per capita consumption is due to the convenience and ease in preparing rice based meals

Furthermore, in Ghana, the milling techniques applied to locally produced rice vary considerably. Most of the processing is done manually especially by small rice producers (USAID, 2009), which in turn results in high heterogeneity of quality standards in end products. For instance in Tamale, in the Northern region of Ghana, the whole stem is cut and is only roughly separated from the grain. This results in milled rice which is brown in colour given the presence of particles. In regions where the panicle is accurately removed less extraneous matter gets into the processed product. The resulting rice is white and very similar to the imported produce (Winrock International, 2011).

Quality improvement has been promoted but almost exclusively at the production and on-farm processing levels still significant investment in larger scale processing facilities would be needed to produce rice that could compete with imported rice in terms of quality (USAID, 2009).

Marketing and trade

Both local and imported rice are sold on urban markets, however due to the irregularity in supply of local rice, imported rice dominates the scene. A 2003 study conducted by the ODI in 32 rice producing villages in Ghana revealed that most farmers receive price information on rice from traders or “market

women” who dictate the prices.³ The market women, who often offer access to capital and credit for input purchase as well as transportation for farmers, operate an oligopolistic system, which constrains the market and limits innovation (ODI, 2003). Market women also present another challenge to farmers; this pertains to weighing of rice. Paddy rice is sold in sacks of 82 kg, however, due to a lack of a standardized weighing system, market women provide larger sacks than the standard 82kilos to collect the paddy from farmers at harvest time (ODI, 2003).

Imported rice on the other hand is sold either to wholesalers, retailers, or directly to consumers for instance at the local ports in Tema and Takoradi where consumers can directly purchase goods from importers, although middle men are often used to link wholesalers to consumers. In comparison to locally produced rice, imported rice is packaged in smaller packs of 50 kg, 25 kg, 10 kg and 5kg bags. Marketing of imported rice (in particular rice from the US) is done through television, radio and print media advertisement all over the country (ODI, 2003). Estimates on the type of rice available for human consumption assessed that grade 1 rice accounts for about 6 percent of total imports while grade 2 holds a share of 51 percent of total imports. There is no grade 1 rice produced in Ghana, while grade 2 rice represents only 4 percent of total production. Most of the domestic production (83 percent) is of grade 5 (USAID, 2009).

Table 2. Total rice trade balance in Ghana (2005-2013, tonnes)

| | 2005 | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 |
|-------------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|
| Import | 430 927 | 389 660 | 440 475 | 425 356 | 383 985 | 320 152 | 543 465 | 520 845 | 644 334 |
| Export | 4 | 2 | 0 | 3 | 128 | 6 | 1 238 | 3 | 1 |
| Net trade* | -430 923 | -389 659 | -440 475 | -425 353 | -383 857 | -320 146 | -542 227 | -520 842 | 644 333 |

Source: Ministry of Trade and Industry (2013) and UNComtrade (2014)

*Imports minus exports

The fall in imports in 2010 (Table 2) could be explained with the restoration of the 20 percent import duty at the end of 2009 and the high price of rice on the international market in 2010 which may have discouraged imports. However, the demand for rice is increasing due to population growth especially in urban areas where rice is mostly consumed. This phenomenon is the main explanation for the missed objective of reducing rice imports dependency for Ghana despite domestic production is increasing quite steadily starting from year 2007.

³ Market women are female traders who sell on local markets. These women often dominate local agricultural trade and have been said to manipulate prices and local trade in Ghana (Owusu-Ansah, 1994).

Table 3. Main figures on milled and broken rice trade in Ghana (2005-2013, tonnes, GHC)

| Rice broken | 2005 | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 |
|--------------------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|
| Import quantity (tonnes) | 357 251 | 354 864 | 371 017 | 304 364 | 290 487 | 243 238 | 354 878 | 376 806 | 464 844 |
| Export quantity (tonnes) | 0 | 0 | 0 | 2 | 5 | 0 | 0 | 1 | 0 |
| Net trade (tonnes) | -357 721 | -354 864 | -371 017 | -304 362 | -290 482 | -243 238 | -354 878 | -376 805 | -464 844 |
| Import value (GHC) | 110 791 | 93 667 | 115 951 | 168 534 | 221 676 | 197 133 | 314 649 | 398 885 | 510 949 |
| Export value (GHC) | 0 | 0 | 0 | 2 | 1 | 0 | 0 | 1 | 1 |
| Net trade (GHC) | -110 791 | -93 667 | -115 951 | -168 532 | -221 674 | -197 132 | -314 649 | -398 884 | -510 949 |
| Rice milled | | | | | | | | | |
| Import quantity (tonnes) | 35 323 | 35 007 | 69 427 | 119 854 | 93 337 | 76 888 | 188 664 | 143 880 | 179 455 |
| Export quantity (tonnes) | 0 | 0 | 0 | 0 | 123 | 6 | 1 237 | 2 | 0 |
| Net trade (tonnes) | -35 323 | -35 006 | -69 427 | -119 854 | -93 214 | -76 883 | -187 427 | -143 878 | -179 455 |
| Import value (GHC) | 18 830 | 14 866 | 31 061 | 86 149 | 94 900 | 91 116 | 275 959 | 241 756 | 312 701 |
| Export value (GHC) | 0 | 0 | 0 | 0 | 147 | 11 | 955 | 0 | 1 |
| Net trade (GHC) | -18 830 | -14 866 | -31 061 | -86 148 | -94 753 | -91 105 | -275 004 | -241 756 | -312 701 |

Source: Ministry of Trade and Industry (2013) and UNComtrade (2014)

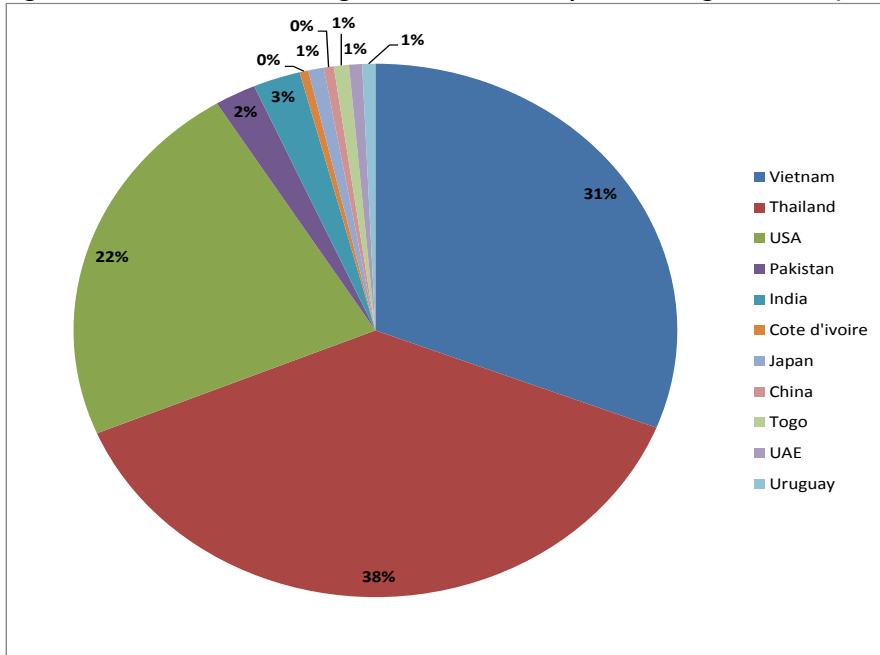
As shown in Table 2 and 3 above, Ghana is clearly an importing country, primarily of milled and broken rice, given the negligible export figures. Over the period of analysis, Thailand, Vietnam and USA were the main supplying countries for rice in Ghana. On average in terms of quantities, 38 percent of imported rice was from Thailand, 31 percent from Viet Nam and 22 percent from the USA (Figure 6).

However, it should be noted that figures on imports do not include the significant quantities of rice smuggled through neighboring countries to evade the high import tariffs and fees. Namely, the border with Côte d'Ivoire reveals the presence of cartels that operate smuggling activities and haul rice into Ghana free of tax, free of quality control checks and free of VAT although illicit payments are made. It is estimated that on average over 100 000 metric tonnes (about 4 million bags) of rice is smuggled into Ghana from Cote d'Ivoire annually (IRRI, 2014).

Consumers' preference for long grain perfumed rice from Vietnam and Thailand is evident in urban areas where very few locally produced rice is marketed. The costs of taking local rice from producing areas to mills on to the urban areas are very high and discourage importers or large traders to market local rice which, also because of inefficient processing has often a price which is higher than the imported rice.⁴

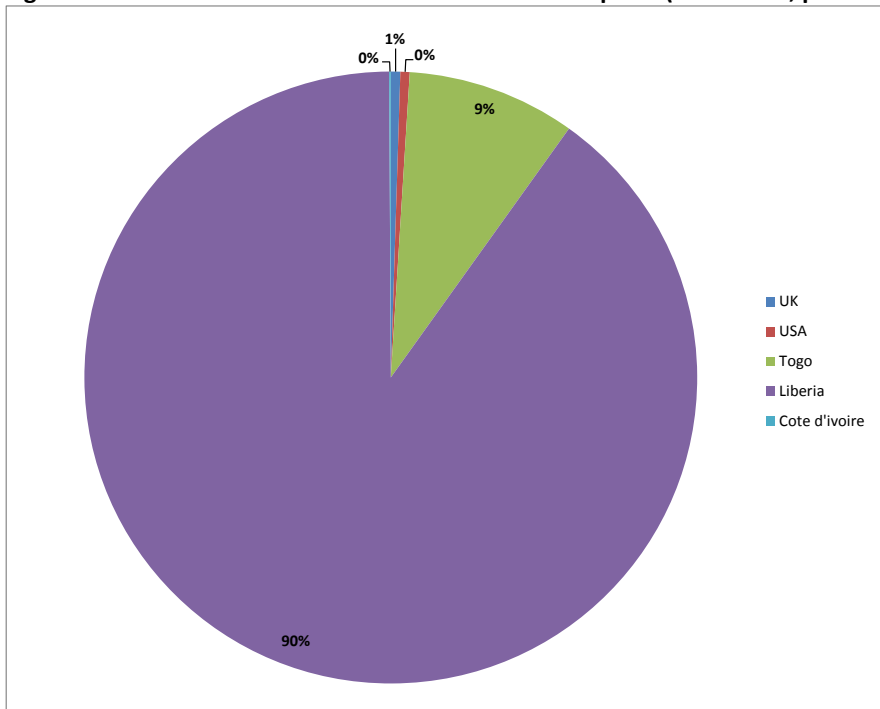
⁴ Some large traders such as Finatrade have started marketing local rice in the urban areas. They source domestic produce from one of the nucleus farms, GADCO, and market the rice in urban wholesale markets.

Figure 6. Main countries of origin for Ghana rice imports, average volumes (2005-2012, percentage)



Source: UNCOMTRADE, 2014

Figure 7. Main destination countries for Ghana rice exports (2005-2012, percentage)



Source: UNCOMTRADE, 2014

Description of the value chain

Local and imported rice are characterized by very different value chains' structures. Although both value chains are fairly simple, the import value chain is shorter and more efficient than the local rice value chain which includes various stages and actors (Figure 8) (CARD, 2009).

The local rice value chain

The local rice value chain consists of a number of actors: input suppliers, producers, bulkers, processors/millers, wholesalers and retailers.

Input suppliers consist mainly of agrochemical dealers and seedling producers while producers consist mainly of smallholder farmers (about 80 percent of production) and a few large scale farm producers (AGRA, 2012). As rice production is done mainly by smallholders, bulkers act as an intermediary between individual producers and processors by collecting the rice from smallholder farmers and supplying them to the processors. A number of bulkers are also involved in milling. While some processors simply perform a commercial processing function for bulkers, others also sell to rice importers who repackage the rice for wholesale commercial activities. Some local processors who have established distribution networks also act as small-scale wholesalers. Retailers buy rice either from importers, bulkers or processors and sell directly to consumers. The locally produced rice is popularly called brown rice.

There is a small percentage of locally produced improved aromatic rice which is sold through Accra and Kumasi and competes with imported rice. This rice is grade 2 rice and represents about 4 percent of Ghana rice production (USAID, 2009).

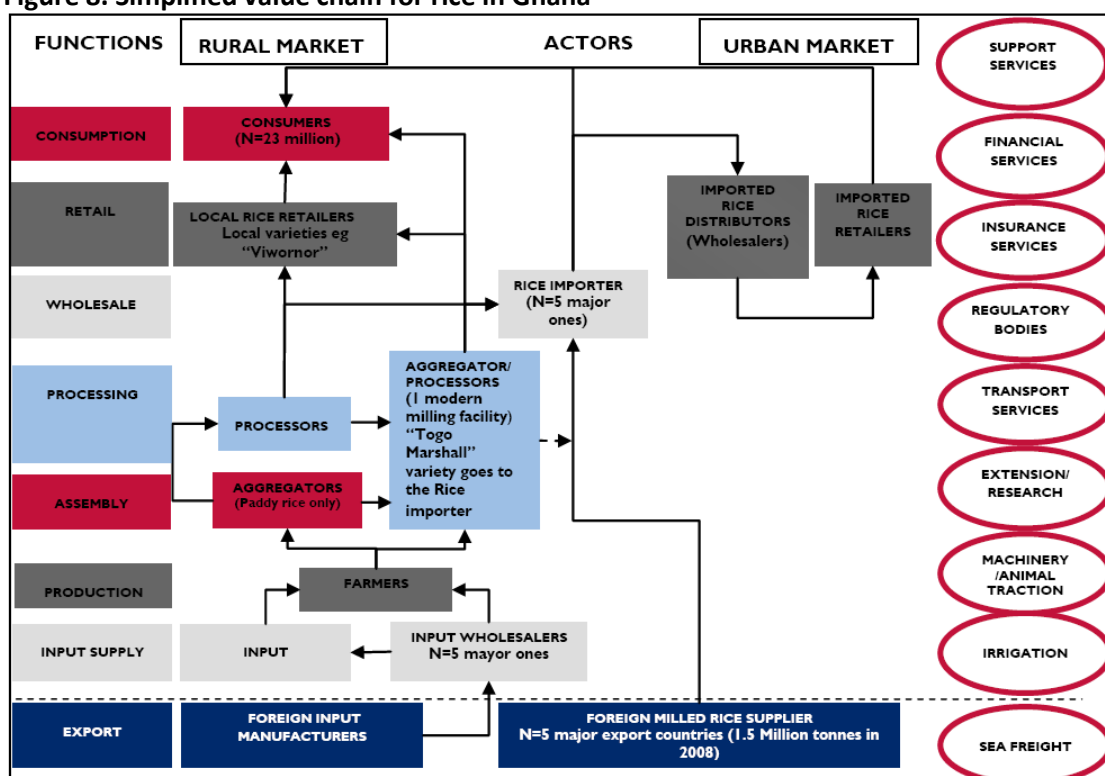
In spite of Ghana's high potential to improve its production, several constraints limit the value chain effectiveness. Firstly, in spite of increased research efforts to improve the value chain, focus is on production, high yielding varieties and post-harvest and storage technologies at the cost of market and demand-driven research. High input costs have also severely limited production potential as they make the overall production process uncompetitive. Smallholders therefore resort to cheaper methods, which in the long run produce lower yields and a higher impact of costs per hectare. Climatic unpredictability and a large dependence on rainfall for rice cultivation also make rice production expensive on per unit of output basis. The high number of intermediaries is an additional element of inefficiency as it generates additional costs and takes advantages of information asymmetries between farmers and traders/middle-men. Processing of rice is also of low quality and parboiling techniques which are applied in Northern Ghana produce undesired characteristics in rice such as the rice being harder, glassier (longer cooking time required) and firmer when cooked, which leaves the final product unappealing to a wide section of consumers (ODI, 2003). The current financial system in Ghana is also unfavourable for farmers due to the high costs of borrowing and lack of support to agriculture given its risky nature if compared to other sectors (ODI, 2003).

The import rice value chain

Ghana imports rice from 5 major suppliers (Vietnam, Thailand, USA, Pakistan, and Togo). As indicated in figure 6 above, for the period 2005 to 2013, Thailand was the largest rice exporter to Ghana by quantity, followed by Viet Nam (UNCOMTRADE, 2012).

There are five main wholesale rice importers in Ghana. These are: Royal Bow Company Ltd., CCTC, Cereal Investment Co. Gh. Ltd, Olam, and Ezal Trading Gh. Ltd. Importers directly distribute to wholesalers all over the country and often sell rice on a credit basis. Wholesalers have a distribution network of retailers who in turn sell to consumers in either large bags of 50kg or in accepted units known as olonka or margarine tins (CARD, 2010).

Figure 8. Simplified value chain for rice in Ghana



Source: USAID, GFSR (2009)

Policy decisions and measures

General agricultural policies to boost the rice sector

The first **Food and Agricultural Sector Development Policy (FASDEP I)**, formulated in 2002, was designed to provide a policy framework for modernizing agriculture and promoting rural growth. FASDEP I especially sought to decrease rice imports of 30 percent by 2004 through boosting domestic production levels to 370,000 tonnes. This target was however not reached. The second **Food and Agricultural Sector Development Policy (FASDEP II)** was then developed in 2007 but implemented from 2009 (CARD, 2010).

FASDEP II intends to achieve food security via the promotion of five staple food crops (cassava, cowpea, maize, rice and yam). Pertaining to rice production, FASDEP II pays particular attention to developments along the rice value chain. As part of FASDEP II, four initiatives were put forward. These are:

- ✓ subsidization of agricultural mechanization services by supporting the establishment and operation of Agricultural Mechanization Service Centers (AMSEC);
- ✓ subsidization of fertilizers through the National Fertilizer Subsidy Programme;
- ✓ establishment and management of "Block Farms" (large farms established in suitable areas to achieve economies of scale thanks to the provision of technical assistance and input subsidies, such as: subsidies for mechanization services and inputs (fertilizers, improved seed, and pesticides) as well as extension services. The block farms programme also serves the objective to create additional employment opportunities in rural areas;

- ✓ stabilization of output prices and management of staple food reserves via the establishment and operation of the National Food Buffer Stock Company (NAFCO).

Fertilizer Subsidy Programme

In 2008, in response to the sharp increases in food and fertilizer prices, the Government of Ghana introduced a fertilizer subsidy programme. The programme sought to return the price farmers paid for fertilizer to pre-crisis levels, create a pan-territorial pricing for fertilizer in the country, and to ultimately encourage fertilizer use so as to prevent a fall in food production below the levels experienced in 2007. The government also realized that Ghana had one of the lowest fertilizer use rates in the Sub-Saharan African region (8 kg per hectare), which could be one of the reasons for low crop production and productivity, high food prices, low incomes and increasing poverty rates among small scale farmers (MOFA 2007). As such, a target was put forward to increase the national average rate of fertilizer use from 8 kg per hectare to 20 kg per hectare. The programme targeted four types of inorganic fertilizers. The fertilizer subsidy was distributed to farmers in the form of vouchers. It is also important to mention that Ghana's fertilizer market is liberalized with prices set by fertilizer retailers however, for the subsidy programme, the government negotiated fertilizer prices per 50 kg bag with private fertilizer importers. The vouchers have a face value of about 50 percent of these negotiated prices (IFPRI, 2009).

To make the scheme more accessible for small scale farmers and to ensure fertilizer price equality in all regions, the voucher system was replaced by a waybill receipt system in 2010. The waybill system eliminates vouchers and expands subsidy access to all farmers, regardless of farm size or crops produced (IFDC, 2012). The waybill system also envisages that the government pays for actual costs of imported fertilizer including: port handling, loading and transport costs as well as agents' commission and margins. Under the waybill system in 2010, a total of 91,244 MT of subsidized fertilizer was sold, with nearly 80 percent reaching farmers directly through market purchases while another 18 percent was made available through the block farm programme, and the remaining 2 percent sold to cotton farmers (IFPRI, 2011).

However, as with the voucher system, farmers and retailers were dissatisfied with the timeliness of the subsidy (IFPRI, 2011). There was an overall perception that the subsidy prices were announced late and as such subsidized fertilizer was unavailable at the onset of the cropping season when it was needed most. Thus, the system typically benefitted farmers in the northern and middle belt of the country where the season commenced later (Banful, 2009).

Seed subsidy

In spite of Ghana's low seed prices, the government has established a subsidy on seed for hybrid maize, rice, and soybean. The subsidy reduces the price of maize and soybean seed by about 50 percent and rice seed by about 10 percent.

The Block Farm Programme (BFP)

Launched in 2009 in six regions of Ghana, the Block Farm Program (BFP) aims at providing large quantities of arable land in blocks for the production of a number of selected commodities as well as to generate employment among the poor in rural areas, improve farm incomes by a minimum of 50 percent, enhance food security via the use of science and technology and improve marketing opportunities. The block farms receive a bundle of subsidized mechanization services and inputs (including improved seed varieties, chemical inputs and credit), in addition to extension services.

Together with agricultural extension services, farmers are expected to increase yields. Following harvesting, the programme aims at recovering its cost from farmers in kind (IFPRI, 2011).

The Ashanti, Brong-Ahafo, Central, Northern, Upper East and Upper West were initially selected for pilot phase in 2009, although by 2010, all ten regions of Ghana joined. Crops included in the programme are maize seed and grain, rice seed and grain, soybean sorghum, tomato, and onions (IFPRI, 2011).

While overall the programme has been rated as successful with rice farmers appearing to benefit most from the programme, a number of challenges such as the timeliness of inputs and adequacy of land as well as engagement of youth were cited. Other challenges mentioned include cost recovery, increased demand for post-harvest technologies and services, and lack of commensurate support by agricultural extension officers (IFPRI, 2011).

The National Buffer Stock Company (NAFCO) Programme

The National Buffer Stock Company was established upon a recommendation of the National Post Harvest Committee. The rationale for the creation of NAFCO was the anticipated increase in crop production as a consequence of the introduction of the block farm and the fertilizer subsidy programmes described in the previous paragraphs, for funding post-harvest management of the Youth in Employment Block Farm Programme in 2009.

Essentially, NAFCO operations consist in buying cereals from farmers during harvest when prices are at their lowest levels and store them for sale in the lean season when prices are at their highest levels. During the harvest NAFCO would ensure farmers a minimum price for their produce while during the lean season, NAFCO releases stocks on the market in order to depress prices and prevent price spikes which could hinder food security and consumers real incomes.

The company was mandated, or authorized, to carry out the following activities:

- ✓ to guarantee farmers an assured income by offering a minimum guaranteed price and market access;
- ✓ to absorb excess produce so as to reduce post-harvest losses and hence protect farm incomes;
- ✓ to purchase, sell, preserve and distribute food stuff;
- ✓ to ensure stability in demand and supply via the use of a buffer stock mechanism;
- ✓ to increase demand for food grown in Ghana by selling to state institutions such as the military, schools, hospitals, prisons, among others;
- ✓ to manage government's emergency food security;
- ✓ to facilitate the export of excess stock.

As one of the key aims of NAFCO was to buy and sell grains, rice, maize and soya bean, all over the country, it was also expected that NAFCO would set a standard for marketing agricultural commodities and control food quality. Licensed Buying Companies (LBCs) (private sector entities) are commissioned by NAFCO to purchase maize, rice and soya beans from farmers at a minimum purchasing price (i.e. floor price) determined by NAFCO (IFPRI, 2011).

NAFCO floor (minimum) price

The purchasing prices are set by considering the total cost of production, established by the post harvest committee, plus a determined profit margin for farmers, which is 15 percent in the case of maize (IFPRI, 2011). In spite of the fact that spatial differences in the cost of production may exist due to differences in the local production and market conditions, spatial differentiation in the floor prices is not foreseen.

NAFCO ceiling price (selling price)

For the ceiling price, NAFCO considers its cost of operations plus some profit margin. Profit margins in 2011 were 3.8 and 25 percent of the total cost of maize and rice, respectively. Table 4 below shows NAFCO cost items and margins in 2011.

Table 4. Determination of NAFCO ceiling price (GhC)

| Cost item | Maize | Rice |
|----------------------------------|-------------------|----------------------|
| | GHC per 100 kilos | GHC per 50 Kilos bag |
| Purchase from LBCs | 48 | 35 |
| Handling and administrative cost | 3 | 6.5 |
| Warehousing and insurance | 2 | 1 |
| Parboiling and milling | n.a. | 13 |
| Total cost | 53 | 55.5 |
| Profit margin | 2 | 13.88 |
| Ceiling price | 55 | 70 |

Source: IFPRI (2013) using NAFCO data (2011)

Agricultural Mechanization Services Enterprise Centers (AMSECs) programme

In an effort to promote sustainable agricultural production and to reduce entry barriers into the mechanized services sector, the Agricultural Mechanization Services Enterprise Centres (AMSECs) programme was set up as a credit facility to assist the private sector players purchase agricultural machinery and set up commercially viable AMSECs in key locations. The private sector is in turn expected to help farmers, who historically relied on labour intensive methods of production, and agro-processors have widespread access to mechanization services at affordable prices and to increase effectiveness and efficiency in farming and processing operations.

AMSEC was initially set up in twelve centres in eight regions. The two key objectives of AMSEC are to increase the ratio of tractors to farmers and to gradually reduce the number of out-dated tractors (over 15 years old). Other objectives include: timely access to mechanized services; better usage of agricultural machinery; reduction in drudgery and tedium linked with agriculture; increased yield and production; increased rural employment opportunities; and overall reduction in post-harvest losses.

The credit facility is open to all registered companies in the private sector (with the ability to pay-back) through an application process in response to an expression of interest by the government that is published in the national daily newspapers. Interested parties are also expected to have the technical requirements for operating a mechanization centre.

Overall, the repayment of the loans taken by the AMSECs was lower than expected especially in 2007. However, recovery rates improved with those for 2009 and 2010 exceeding the target while the expected rate for 2011 being pegged at 68 percent. The project has encountered challenges related to

the lack of skilled tractor operators and mechanics and in transporting operators to required locations in some farming areas (IFPRI, 2011).

Specific measures for the rice sub-sector

As part of FASDEP II, the Ghana's Medium Term Agriculture Sector Investment Plan (METASIP) 2009/-2015 (MOFA, 2009), and the Food Security and Emergency Preparedness Programme, have been initiated to increase agricultural productivity (including increasing rice yields) by 50 percent.

The productivity of irrigation schemes as well as the intensification of irrigation is to be increased by 25 percent and 50 percent respectively by the end of 2012 (MOFA, 2007). In support of FASDEP II, over 20 rice-related projects have been implemented or are in process of being implemented.

Trade policy

In 2005, Ghana adopted a new trade policy. This policy was defined in the framework of "Ghana's long-term strategic vision of achieving middle-income status by 2012 and becoming a leading agro-industrial country in Africa (GoG, 2005)". This policy has two parallel strategies: an export led industrialisation strategy and a domestic market led industrialization strategy to achieve import substitution. These two strategies are supported through measures to enhance competitiveness of national producers and through the introduction of an import and domestic trade regime (OECD, 2012).

Presently in Ghana, rice imports attract the following duties and levies: 20 percent import duty; 12.5 percent Value Added Tax (VAT); 2.5 percent National Health Insurance Levy (NHIL) to be collected by the Ghana Revenue Authority (GRA); 0.5 percent Export Development and Investment Fund Levy (EDIF); 1 percent Inspection fee; 0.5 percent ECOWAS Levy; and 0.4 percent Ghana Customs Network (CARD, 2010). These add to a total 37.4 percent, a substantial barrier considering that domestic firms do not face part of these charges (WTO, 2014).

In June 2008, the Government of Ghana removed the 20 percent import duty on food imports to minimize the impact of the global food crisis. This was however restored in December 2009 (WTO, 2014).

A range of import duties are applied on rice by the majority of Western Africa countries. Duties are also considered as one of the causes for import prices variability and hence one of the determinants of informal cross border trade occurring between surplus areas in the North-east Ghana which export rice to the neighboring countries, Togo and Burkina Faso as well as rice smuggling from Côte d'Ivoire into Ghana (USAID, 2009).

2. 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 (RP_{ofg}) 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 chain⁵ 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 (RP_{ofg}) 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 (PG_{ofg}) are as follows:

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

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

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.

⁵ 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.

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.⁶ Mathematically, the Nominal Rate of Assistance is defined by the following equation:

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

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

⁶ 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.

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:

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

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

3. 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

Ghana is a net importer of rice over the whole period of analysis.

Table 5. Import and export of rice in Ghana (2005-2013, tonnes)

| | 2005 | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 |
|-------------------|----------|----------|----------|----------|----------|----------|----------|----------|---------|
| Import | 430 927 | 389 660 | 440 475 | 425 356 | 383 985 | 320 152 | 543 465 | 520 845 | 644 334 |
| Export | 4 | 2 | 0 | 3 | 128 | 6 | 1 238 | 3 | 1 |
| Net trade* | -430 923 | -389 659 | -440 475 | -425 353 | -383 857 | -320 146 | -542 227 | -520 842 | 644 333 |

Source: Trade statistics accessed through the Ministry of Trade and Industry of Ghana, 2013 and UNComtrade, 2014 at <http://comtrade.un.org/data>

*Imports minus exports

Market pathway analysed

Ghana has several wholesale market channels, from the south to the northern part of the country. In this context and for the purpose of this study, Accra was selected as the point of competition as it is considered the main consuming area where domestic rice competes with imported rice.

Farm gate prices used for the calculations refer to producing areas in the region around Tamale (Northern Region) as it is most likely that the local rice marketed in Accra originates from the surplus producing areas in the Northern region of Ghana. However, in Accra very little local rice is actually flowing from the two main producing areas, Northern and Western region. Overall, it is estimated that only 20 percent of rice consumed in urban areas in Ghana is local rice.

The port of entry considered for this analysis is Tema which is 25 km away from Accra.

Figure 9. Selected market pathway for rice in Ghana



Source: http://www.lonelyplanet.com/maps/africa/ghana/map_of_ghana.jpg

The Tamale - Accra pathway is also representative in terms of purchases of rice by the National Buffer Stock Company (NAFCO) as Licensed Buying Companies (LBCs) operating on behalf of NAFCO source part of their rice reserves in the Northern region of Ghana. This made it possible to undertake an analysis of the price incentives structure by using farm gate, access costs (which reflect the costs of taking rice from the producing areas to NAFCO warehouses in Tamale and finally to Accra) and wholesale prices referring to NAFCO operations.

Benchmark prices

Observed

The basis for calculating a reference price to determine whether rice producers receive market incentives or disincentives is to establish a benchmark price, which represents the price for rice free of domestic policy and market distortions. Since Ghana is a net importer of rice during the 2005-2013 time period, the benchmark price considered is the Ghana CIF price for broken rice.

Broken rice imports represent 65 percent of total rice imports on average over the period 2005-2013 (HS code: 1006400000). Data on imports of broken rice for Ghana is available from various sources including UN Comtrade. UN Comtrade data were used for the analysis covering the time period 2005-2010. Since trade data was provided by the Ghana Ministry of Trade and Industries, UN Comtrade was replaced with data from national sources until year 2011. Data on imported values and volumes for year 2012 could not be used as the CIF price for this year is extremely high as compared to UN Comtrade data. Hence, the CIF price used for 2012 was extracted from UNComtrade database (Table 6).

Table 6. Benchmark prices for rice (broken) in Ghana, 2005-2013

| | 2005 | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 |
|---------------------------------------|------|------|------|------|------|------|------|------|------|
| CIF price of Broken Rice (US\$/tonne) | 257 | 288 | 334 | 523 | 542 | 566 | 587 | 590 | 563 |
| CIF price of Broken Rice (US\$/tonne) | 233 | 264 | 312 | 554 | 763 | 810 | 887 | 1060 | 1099 |

Source: Ministry of Trade and Industries (MOTI), International Grains Council (2014), UNComtrade (2014)

Adjusted

No adjustment was needed.

Domestic prices

Observed prices at point of competition

The price data refers to the wholesale market in Accra, where national and imported rice compete. Price data was obtained from the Statistics and Research and Information Directorate of the Ministry of Food and Agriculture (MOFA-SRID) and refers to “Local rice” without further specification on the type of rice sold. The lack of further details on the type of rice sold is to be attributed to the many different types of milled rice produced and marketed in Ghana (ODI, 2003). Price data is available on a monthly basis and has been used to calculate the average annual price for rice in Accra for the period 2005-2013.

Table 7. Wholesale price of local rice in Accra (annual average 2005/2012)

| | 2005 | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 |
|--|-------|-------|-------|-------|---------|---------|---------|---------|----------|
| Wholesale price in Accra (local rice, GHC per tonne) | 486.1 | 586.1 | 599.5 | 913.8 | 1 187.9 | 1 308.9 | 1 460.0 | 1 565.5 | 1 311.15 |

Source: MOFA-SRID, 2013

NAFCO wholesale prices

NAFCO selling price, considered as the wholesale price for this analysis, is also determined by considering the cost of operations plus some profit margin.

The table below shows prices at the wholesale level in Accra until year 2009. Starting from 2010 open market prices were replaced with pan-territorial selling prices by NAFCO to show how the incentives structure changes in the years before (2005-2009) and during (2010-2013) buffer stock operations.

Table 8. Wholesale price of rice in Accra (2005-2007) and pan-territorial NAFCO wholesale price for paddy rice (2008-2013)

| | 2005 | 2006 | 2007 | 2008 | 2009 | 2010* | 2011* | 2012* | 2013* |
|--|-------|-------|-------|-------|---------|-------|-------|-------|-------|
| Wholesale prices of rice (GhC per tonne) | 486.1 | 586.1 | 599.5 | 913.8 | 1 187.9 | 411.8 | 470.6 | 764.7 | 735.9 |

Note: *NAFCO ceiling prices cover the period 2010-2013. Prices before 2010 refer to the open market as NAFCO was not yet operational in those years.

Source: MOFA-SRID, 2013 and NAFCO

Observed prices at farm gate

Farm gate prices for the period 2005-2013 were obtained from the MOFA-SRID. Farm gate prices used for the calculations refer to producing areas in the region around Tamale as it is most likely that the local rice marketed in Accra originates from the surplus producing areas in the Northern region. The farm gate price for 2013 was estimated by applying the average share of the farm gate price on the wholesale price over the period 2005-2012.

Table 9. Farm gate price of rice in Tamale (annual average 2005/2013)

| | 2005 | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 |
|---|------|------|------|------|------|------|------|-------|------|
| Farm gate price of rice in Tamale (GHC per Tonne) | 473 | 456 | 454 | 746 | 705 | 663 | 891 | 1 310 | 957 |

Source: MOFA, SRID

NAFCO farm gate prices

NAFCO floor prices, the prices paid by NAFCO to producers, are determined on the basis of the cost of production for different crops provided by the National Post Harvest Committee (NAFCO 2011). The purchasing prices at the farm gate are thus the result of total cost of production plus a profit margin for farmers. Despite potential spatial differences in the cost of production across different producing areas due to local production and market conditions, the floor price is determined at the national level.

Table 10. Farm gate price of rice in Tamale (2005-2007) and pan-territorial NAFCO farm gate price for paddy rice (2008-2013)

| | 2005 | 2006 | 2007 | 2008 | 2009 | 2010* | 2011* | 2012* | 2013* |
|---|------|------|------|------|------|-------|-------|-------|-------|
| Farm gate prices for rice (GHC per tonne) | 473 | 456 | 454 | 746 | 705 | 318 | 412 | 647 | 588 |

Note: *NAFCO ceiling prices cover the period 2010-2013. Prices before 2010 refer to the open market as NAFCO was not yet operational in those years.

Source: MOFA, SRID and NAFCO

NAFCO prices (2010-2013) are significantly lower than open market prices at both the farm gate and wholesale levels. While the low wholesale prices can be attributed to the objective to make food more affordable for consumers when prices reach high levels during the lean season, it is not clear why prices paid to farmers are so low compared to open market ones. From NAFCO official figures it is very hard to understand how farmers are benefitting from NAFCO operations considering that they are not only consumers but also producers of rice as a cash crop. Unofficial sources of information also mentioned that NAFCO pays higher prices than the official ones, however we would need further information on these real prices to re-calculate price incentives. Actual data highlight how farmers lose part of their profit when selling to NAFCO.

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 restrictions on payments and transfers for current international transactions.

In July 2007, the national currency was re-denominated by setting 10 000 cedis to 1 new Ghana cedi.

Data on the exchange rate between the national currency and the United States Dollar was extracted from the IMF database.

Table 11. Nominal exchange rate

| | 2005 | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 |
|---|------|------|------|------|------|------|------|------|------|
| Official exchange rate (GHC per US\$, period average) | 0.91 | 0.92 | 0.94 | 1.06 | 1.41 | 1.43 | 1.51 | 1.80 | 1.95 |

Source: IMF, 2014

Table 11 above shows a relatively stable Cedi over the period 2005-2007. Between 2008 and 2010, it depreciated by over 50 percent against the dollar. According to the IMF country report (IMF, 2011),

the aftermath of the global crises led to a decelerated GDP growth and the inflow from portfolio capital and remittance also declined. This eventually led to the depreciation in the exchange rate. Nevertheless, since 2009, strengthened confidence and cautious interventions in the foreign exchange market under the floating exchange rate regime have helped reduce volatility and maintain broad stability of the cedi. Another important factor that led to the appreciation of the Cedi is oil exports which begun in December 2010. Moreover, oil displaced cocoa as Ghana's second-most valuable export in 2012, with shipments worth \$3 billion, according to the central bank.

The value of the Ghana cedi rose in 2013 due to increased oil revenues. This could produce a negative impact on rice importers and consumers as their demand would become increasingly inelastic relative to the high price of imported rice.

Adjusted

No exchange rate adjustment was needed.

Access costs

All time series on access costs were changed, compared to the previous version of this technical note, as it was more appropriate to deflate data generated through field surveys than keep outdated and incomplete information from literature which was used for the previous price incentives analysis.

Observed

Border to point of competition

Information on access costs refers to all costs incurred by imported rice from the Port of Tema (which is 25 Km far from Accra) up to the wholesale market in Accra. The access costs used for the analysis are the ones collected through a field survey undertaken by the staff of the Ministry of Food and Agriculture which was complemented by data collected by IFPRI on the costs of importing rice in Ghana (IFPRI, 2012). The decision to complement data from MOFA with IFPRI data is because the IFPRI analysis provides further details on fees and taxes as well as port charges. IFPRI data refers to year 2011 and was inflated and deflated to obtain the whole time series for the period under analysis 2005-2013. MOFA data, which includes transport and port charges, was collected for the years 2012-2013 and was deflated to obtain data for the previous years. Traders' margins were estimated as 10 percent of the CIF price consistently with the MAFAP methodological guidelines on price incentives that suggest considering a 10 percent profit margin in the case where no information is available and when there is an oligopoly amongst traders or importers.⁷ Costs were adjusted to account for the excessive traders margins and reduced at 5 percent of the CIF price, consistently with MAFAP methodological guidelines (Table 12).

The access costs from the border to the point of competition are the same for price incentives analyses, NAFCO and open market.

⁷ MAFAP methodological guidelines on price incentives analysis are available at: <http://www.fao.org/3/a-at163e.pdf>

Table 12. Observed and adjusted access costs from the border to the point of competition for rice in Ghana (2005-2013, GHC per tonne)

| | 2005 | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 |
|--|------------|------------|------------|------------|------------|------------|------------|------------|------------|
| CIF price | 233 | 264 | 312 | 554 | 763 | 810 | 887 | 1 060 | 1 099 |
| Ecowas Levy | 2 | 2 | 2 | 2 | 3 | 4 | 4 | 4 | 5 |
| EDFL (Export development and Investment levy) | 2 | 2 | 2 | 2 | 3 | 4 | 4 | 4 | 5 |
| Processing fee (1%) | 3 | 4 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| VAT | 48 | 56 | 62 | 70 | 84 | 105 | 119 | 130 | 148 |
| NHIL (National Health Insurance Levy) | 10 | 11 | 12 | 14 | 17 | 21 | 24 | 26 | 26 |
| Port Charges (Includes inspection fees, service charges, and fees to the Ghana Shippers Council) | 131 | 154 | 172 | 192 | 230 | 290 | 328 | 358 | 358 |
| Transport to market | 52 | 61 | 68 | 76 | 91 | 115 | 130 | 105 | 138 |
| Traders margins (10% of CIF) | 23 | 26 | 31 | 55 | 76 | 81 | 89 | 106 | 110 |
| Total Observed access costs | 269 | 316 | 354 | 417 | 509 | 626 | 706 | 743 | 800 |
| Traders margins (5% of CIF) | 11.7 | 13.2 | 15.6 | 27.7 | 38.2 | 40.5 | 44.4 | 53,0 | 55,0 |
| Total Adjusted Access costs | 258 | 303 | 338 | 389 | 471 | 586 | 662 | 690 | 745 |

Source: MOFA and IFPRI

Farm gate to point of competition

Data on access costs was provided by MOFA-SRID based on a field survey to assess costs to bring the commodity from the producing area Tamale (Northern Ghana) to Accra. Data was collected for the years 2012 and 2013 and deflated to obtain estimated access costs for the previous years. Data on margins was not available hence these were estimated as a percentage of the wholesale price.

Table 13. Observed access costs from the farm gate to the point of competition for rice in Ghana (2005-2013; GHC per tonne)

| | 2005 | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 |
|------------------------------------|-----------|------------|------------|------------|------------|------------|------------|------------|------------|
| Wholesale price | 486 | 586 | 600 | 914 | 1 188 | 1 309 | 1 460 | 1 566 | 1 311 |
| Transport | 30 | 35 | 35 | 40 | 40 | 40 | 50 | 55 | 55 |
| District Assembly Levy | 2 | 2 | 2 | 2 | 2 | 2 | 4 | 5 | 5 |
| Loading | 1 | 1 | 1 | 2 | 2 | 2 | 2 | 2 | 2 |
| Off-Loading | 1 | 1 | 1 | 2 | 2 | 2 | 2 | 2 | 2 |
| Cost of Sack | 2 | 2 | 5 | 5 | 5 | 5 | 10 | 20 | 20 |
| Cost of Storage | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 |
| Cost of Labour for sewing Sack | 2 | 2 | 2 | 2 | 5 | 5 | 10 | 10 | 10 |
| Trader's margins (10% of WH price) | 49 | 59 | 60 | 91 | 119 | 131 | 146 | 157 | 131 |
| Total observed access costs | 97 | 112 | 116 | 154 | 185 | 197 | 234 | 261 | 235 |

Source: MOFA-SRID, 2013

Farm gate to point of competition

The only items adjusted are transport costs which have been kept constant at 35 GHC/tonne to control for the sharp increase that observed transport costs (table 14) have registered starting from 2008 onwards, due to the removal of the fuel subsidy, and profit margins which were reduced to 5 percent of the wholesale selling price.

Table 14. Adjusted access costs from the farm gate to the point of competition for rice in Ghana (2005-2013; GHC/tonne)

| | 2005 | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 |
|--------------------------------------|-----------|-----------|-----------|------------|------------|------------|------------|------------|------------|
| wholesale price | 486 | 586 | 600 | 914 | 1 188 | 1 309 | 1 460 | 1 566 | 1 311 |
| Transport | 30 | 35 | 35 | 35 | 35 | 35 | 35 | 35 | 35 |
| District Assembly Levy | 2 | 2 | 2 | 2 | 2 | 2 | 4 | 5 | 5 |
| Loading | 1 | 1 | 1 | 2 | 2 | 2 | 2 | 2 | 2 |
| Off-Loading | 1 | 1 | 1 | 2 | 2 | 2 | 2 | 2 | 2 |
| Cost of Sack | 2 | 2 | 5 | 5 | 5 | 5 | 10 | 20 | 20 |
| Cost of Storage | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 |
| Cost of Labour for sewing Sack | 2 | 2 | 2 | 2 | 5 | 5 | 10 | 10 | 10 |
| Trader`s margins (5% of WH price) | 24 | 29 | 30 | 46 | 59 | 65 | 73 | 78 | 66 |
| Total (adjusted access costs) | 72 | 82 | 86 | 104 | 120 | 126 | 146 | 162 | 150 |

Source: MOFA

Table 15 below shows access costs borne by NAFCO to collect rice from farmers and sell it to selected beneficiaries, such as schools, hospitals in Accra. Data refers to the period when NAFCO operates 2010-2013.

Table 15. NAFCO access costs from farm gate to point of competition for rice in Ghana (GHC per tonne)

| | 2010 | 2011 | 2012 | 2013 |
|--|--------------|--------------|--------------|--------------|
| Physical Movement | 14.2 | 16.1 | 17.6 | 15.3 |
| District Assembly Levy/Town Council Levy | 4.7 | 5.4 | 5.9 | 3.4 |
| Processing (Winnowing/Cleaning) | 9.5 | 10.7 | 11.8 | 7.6 |
| Loading | 1.9 | 2.1 | 2.4 | 1.5 |
| Off-Loading | 1.9 | 2.1 | 2.4 | 1.5 |
| Bagging | 2.8 | 3.2 | 3.5 | 2.3 |
| Cost of Sack | 4,7 | 5,4 | 5,9 | 3,8 |
| Cost of Storage | 3.8 | 4.3 | 4.7 | 3.8 |
| Cost of Labour for sewing Sack | 0.5 | 0.5 | 0.6 | 0.4 |
| Transport from Village | 19 | 21.5 | 23.5 | 19.1 |
| Assembling | 19 | 21,5 | 23,5 | 19,1 |
| Traders' margins (10% of the WH price) | 41,2 | 47,1 | 76,5 | 73,5 |
| Taxes and Fees | 4,7 | 5,4 | 5,9 | 7,6 |
| NAFCO observed access costs | 128,0 | 145,3 | 184,1 | 159,2 |
| Traders' margins (5% of the WH price) | 20,6 | 23,5 | 38,2 | 36,8 |
| NAFCO Adjusted access costs | 107,4 | 121,8 | 145,9 | 122,4 |

Source: MOFA-SRID, 2013 and NAFCO

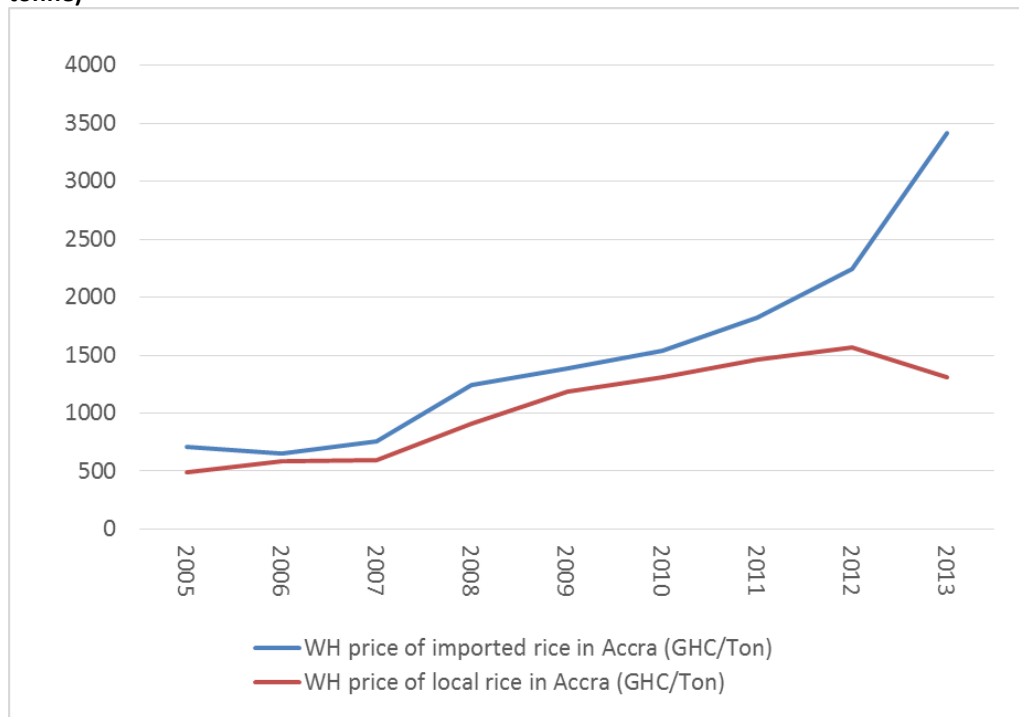
Budget and other transfers

Ghana has both a fertilizer and a seed subsidy programme which started in 2008 and 2012, respectively. The two programs do not target specific crops. Nevertheless, MOFA PPMED has provided estimates on amounts of fertilizer and seed support by crop. The total estimated fertilizer and seed support to the rice sector was then divided by the production quantity to obtain an estimate of the input support per tonne of rice produced for the years in which the two input subsidies schemes are in place.

Quality and quantity adjustments

A quality adjustment factor was applied between imported and locally produced rice and hence between the border and the point of competition. The quality adjustment factor is the result of the average price ratio over the period 2005-2013 between wholesale prices of local rice and imported rice which are both available from MOFA-SRID. The average ratio between the two prices is 0.75. Although the difference between the prices of the two types of rice, local and imported may not only be due to the higher quality of imported rice but also to all additional taxes and fees which make imported rice more expensive than it should be.

Figure 10. Average annual wholesale prices for imported and local rice in Accra, 2005-2013; (GHC per tonne)



Source: Author elaboration using MOFA SRID data (2013)

NAFCO quantity adjustment factor

NAFCO data refers to paddy rice, hence a quantity adjustment factor was applied from milled to paddy rice (0.65) between the border and the point of competition.

Data overview

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

Table 16. Data sources and methodological decisions (Open market price incentives analysis)

| | | Description | |
|---|----------|--|---|
| Concept | | Observed | Adjusted |
| Benchmark price | | Data from the Ghana Ministry of Trade and Industry, IGC and UNComtrade | |
| Domestic price at point of competition | | MOFA | N.A. |
| Domestic price at farm gate | | MOFA | N.A. |
| Exchange rate | | IMF | |
| Access cost from the point of competition to the border | | MOFA field survey; IFPRI; and deflated data using the CPI | Transport costs (starting from 2008) and margins were reduced from 10 to 5 percent of the CIF price |
| Access costs from the point of competition to farm gate | | MOFA field survey deflated data using the CPI. | Transport costs (starting from 2008) and margins were reduced from 10 to 5 percent of the CIF price |
| QT adjustment | Bor-PoC | N.A. | N.A. |
| | PoC -FG | N.A. | N.A. |
| QL adjustment | Bor- PoC | Ratio between local and imported wholesale prices for rice in Accra | N.A. |
| | PoC -FG | N.A. | N.A. |

Table 17. Data sources and methodological decisions (NAFCO price analysis)

| | | Description | |
|---|----------|---|--|
| Concept | | Observed | Adjusted |
| Benchmark price | | Data from the Ghana Ministry of Trade and Industry, IGC and UNComtrade | |
| Domestic price at point of competition | | MOFA and NAFCO | N.A. |
| Domestic price at farm gate | | MOFA and NAFCO | N.A. |
| Exchange rate | | IMF | |
| Access cost from the point of competition to the border | | MOFA field survey, IFPRI and deflated data using the CPI | Transport costs were reduced starting from 2008 and importers margins were reduced from 10 to 5 percent of the wholesale price |
| Access costs from the point of competition to farm gate | | MOFA field survey; deflated data using the CPI. NAFCO data | Transport costs were reduced starting from 2008 and traders margins were reduced from 10 to 5 percent of the wholesale price |
| QT adjustment | Bor-PoC | N.A. | N.A. |
| | PoC -FG | Since prices and access costs data for NAFCO refer to paddy rice, a quantity conversion factor of 0.65 from paddy to milled was applied (2010-2013) | N.A. |
| QL adjustment | Bor- PoC | Ratio between local and imported wholesale prices for rice in Accra(0.75) | N.A. |
| | PoC -FG | N.A. | N.A. |

Note: *NAFCO started to operate in 2010

Data used for this analysis is summarized below

Table 18. Data summary (open market price incentives analysis)

| | Year | 2005 | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 |
|---|----------------|-----------|--------|--------|--------|--------|--------|--------|--------|-------|
| | trade status | m | m | m | m | m | m | m | m | m |
| DATA | Unit | Symbol | | | | | | | | |
| Benchmark Price | | | | | | | | | | |
| Observed | $P_{b(int\$)}$ | 257.41 | 287.92 | 334.16 | 523.46 | 541.61 | 566.34 | 586.64 | 590.45 | 563 |
| Adjusted | P_{ba} | 257.41 | 287.92 | 334.16 | 523.46 | 541.61 | 566.34 | 586.64 | 590.45 | 563 |
| Exchange Rate | | | | | | | | | | |
| Observed | ER_o | 0.91 | 0.92 | 0.94 | 1.06 | 1.41 | 1.43 | 1.51 | 1.80 | 1.95 |
| Adjusted | ER_a | 0.91 | 0.92 | 0.94 | 1.06 | 1.41 | 1.43 | 1.51 | 1.80 | 1.95 |
| Access costs border - wholesale | | | | | | | | | | |
| Observed | AC_{owh} | 269 | 316 | 354 | 417 | 509 | 626 | 706 | 743 | 790 |
| Adjusted | AC_{awh} | 258 | 303 | 338 | 389 | 471 | 586 | 662 | 690 | 740 |
| Domestic price at wholesale | P_{dwh} | 486 | 586 | 600 | 914 | 1,188 | 1,309 | 1,460 | 1,566 | 1,311 |
| Access costs wholesale - farm gate | | | | | | | | | | |
| Observed | AC_{ofg} | 97 | 112 | 116 | 154 | 185 | 197 | 234 | 261 | 235 |
| Adjusted | AC_{afg} | 72 | 82 | 86 | 104 | 120 | 126 | 146 | 162 | 150 |
| Farm gate price | P_{dfg} | 472.86 | 455.91 | 453.96 | 745.58 | 704.74 | 663.13 | 891 | 1,310 | 957 |
| Externalities associated with production | E | | | | | | | | | |
| Budget and other product related transfers | BOT | - | - | - | 0.01 | 0.01 | 0.01 | 0.02 | 0.04 | n.a. |
| Quantity conversion factor (border - point of competition) | Fraction | QT_{wh} | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Quality conversion factor (border - point of competition) | Fraction | QL_{wh} | 0.75 | 0.75 | 0.75 | 0.75 | 0.75 | 0.75 | 0.75 | 0.75 |
| Quantity conversion factor (point of competition – farm gate) | Fraction | QT_{fg} | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Quality conversion factor (point of competition – farm gate) | Fraction | QL_{fg} | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |

Table 19. Data summary (includes NAFCO farm gate prices; NAFCO wholesale prices and access costs starting from 2010)

| | Year | 2005 | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 |
|---|----------------|-----------|--------|--------|--------|--------|------------|------------|------------|------------|
| DATA | trade status | m | m | m | m | m | m | m | m | m |
| | Unit | Symbol | | | | | | | | |
| Benchmark Price | | | | | | | | | | |
| Observed | $P_{b(int\$)}$ | 257.41 | 287.92 | 334.16 | 523.46 | 541.61 | 566.34 | 586.64 | 590.45 | 563 |
| Adjusted | P_{ba} | 257.41 | 287.92 | 334.16 | 523.46 | 541.61 | 566.34 | 586.64 | 590.45 | 563 |
| Exchange Rate | | | | | | | | | | |
| Observed | ER_o | 0.91 | 0.92 | 0.94 | 1.06 | 1.41 | 1.43 | 1.51 | 1.80 | 1.95 |
| Adjusted | ER_a | 0.91 | 0.92 | 0.94 | 1.06 | 1.41 | 1.43 | 1.51 | 1.80 | 1.95 |
| Access costs border - wholesale | | | | | | | | | | |
| Observed | AC_{owh} | 269 | 316 | 354 | 417 | 509 | 626 | 706 | 743 | 790 |
| Adjusted | AC_{awh} | 258 | 303 | 338 | 389 | 471 | 586 | 662 | 690 | 740 |
| Domestic price at wholesale | P_{dwh} | 486 | 586 | 600 | 914 | 1,188 | 412 | 471 | 765 | 735 |
| Access costs wholesale - farm gate | | | | | | | | | | |
| Observed | AC_{ofg} | 97 | 112 | 116 | 154 | 185 | 128 | 145 | 184 | 159 |
| Adjusted | AC_{afg} | 72 | 82 | 86 | 104 | 120 | | | | |
| Farm gate price | P_{dfg} | 472.86 | 455.91 | 453.96 | 745.58 | 704.74 | 318 | 412 | 647 | 588 |
| Externalities associated with production | E | | | | | | | | | |
| Budget and other product related transfers | BOT | - | - | - | 0.01 | 0.01 | 0.01 | 0.02 | 0.04 | n.a. |
| Quantity conversion factor (border - point of competition) | Fraction | QT_{wh} | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Quality conversion factor (border - point of competition) | Fraction | QL_{wh} | 0.75 | 0.75 | 0.75 | 0.75 | 0.75 | 0.75 | 0.75 | 0.75 |
| Quantity conversion factor (point of competition – farm gate) | Fraction | QT_{fg} | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 0.65 | 0.65 | 0.65 |
| Quality conversion factor (point of competition – farm gate) | Fraction | QL_{fg} | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |

Note: NAFCO started to operate in 2010

Summary of indicators

Table 20. MAFAP Price Gaps for Rice in Ghana (GHC/tonne), 2005-2013)

| | 2005 | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 |
|--|------|------|------|------|------|------|------|------|------|
| Trade status for the year | m | m | m | m | m | m | m | m | m |
| Observed price gap at point of competition | 42 | 72 | 11 | 82 | 106 | 75 | 89 | 27 | -303 |
| Adjusted price gap at point of competition | 53 | 85 | 27 | 109 | 144 | 115 | 133 | 81 | -253 |
| Observed price gap at farm gate | 125 | 53 | -18 | 68 | -192 | -374 | -246 | 32 | -422 |
| Adjusted price gap at farm gate | 112 | 37 | -33 | 45 | -218 | -404 | -289 | -13 | -457 |

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

Table 21: MAFAP Price Gaps for Rice in Ghana incl. NAFCO* operations (GHC/tonne), 2005-2013)

| | 2005 | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 |
|--|------|------|------|------|------|-------------|-------------|-------------|-------------|
| Trade status for the year | m | m | m | m | m | m | m | m | m |
| Observed price gap at point of competition | 42 | 72 | 11 | 82 | 106 | -610 | -668 | -495 | -590 |
| Adjusted price gap at point of competition | 53 | 85 | 27 | 109 | 144 | -569 | -623 | -442 | -540 |
| Observed price gap at farm gate | 125 | 53 | -18 | 68 | -192 | -576 | -581 | -428 | -578 |
| Adjusted price gap at farm gate | 112 | 37 | -33 | 45 | -218 | -535 | -537 | -375 | -528 |

Note: *NAFCO started to operate in 2010

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

Table 22: MAFAP Nominal Rates of Protection and Assistance for Rice in Ghana, (%), 2005-2013)

| | 2005 | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 |
|--------------------------------------|------|------|------|------|------|------|------|------|------|
| Trade status for the year | m | m | m | m | m | m | m | m | m |
| Observed NRP at point of competition | 9% | 14% | 2% | 10% | 10% | 6% | 6% | 2% | -19% |
| Adjusted NRP at point of competition | 12% | 17% | 5% | 14% | 14% | 10% | 10% | 5% | -16% |
| Observed NRP at farm gate | 36% | 13% | -4% | 10% | -21% | -36% | -22% | 3% | -31% |
| Adjusted NRP at farm gate | 31% | 9% | -7% | 6% | -24% | -38% | -25% | -1% | -32% |
| Observed NRA at farm gate | 36% | 13% | -4% | 10% | -21% | -36% | -22% | 3% | -31% |
| Adjusted NRA at farm gate | 31% | 9% | -7% | 6% | -24% | -38% | -25% | -1% | -32% |

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

Table 23bis: MAFAP Nominal Rates of Protection and Assistance for Rice in Ghana, including NAFCO operations (%), 2005-2013

| | 2005 | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 |
|--------------------------------------|------|------|------|------|------|------|------|------|------|
| Trade status for the year | m | m | m | m | m | m | m | m | m |
| Observed NRP at point of competition | 9% | 14% | 2% | 10% | 10% | -60% | -59% | -39% | -45% |
| Adjusted NRP at point of competition | 12% | 17% | 5% | 14% | 14% | -58% | -57% | -37% | -42% |
| Observed NRP at farm gate | 36% | 13% | -4% | 10% | -21% | -64% | -59% | -40% | -50% |
| Adjusted NRP at farm gate | 31% | 9% | -7% | 6% | -24% | -63% | -57% | -37% | -47% |
| Observed NRA at farm gate | 36% | 13% | -4% | 10% | -21% | -64% | -59% | -40% | -50% |
| Adjusted NRA at farm gate | 31% | 9% | -7% | 6% | -24% | -63% | -57% | -37% | -47% |

Note: *NAFCO started to operate in 2010

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

Table 24. MAFAP Market Development Gaps for Rice in Ghana, (%), 2005-2013

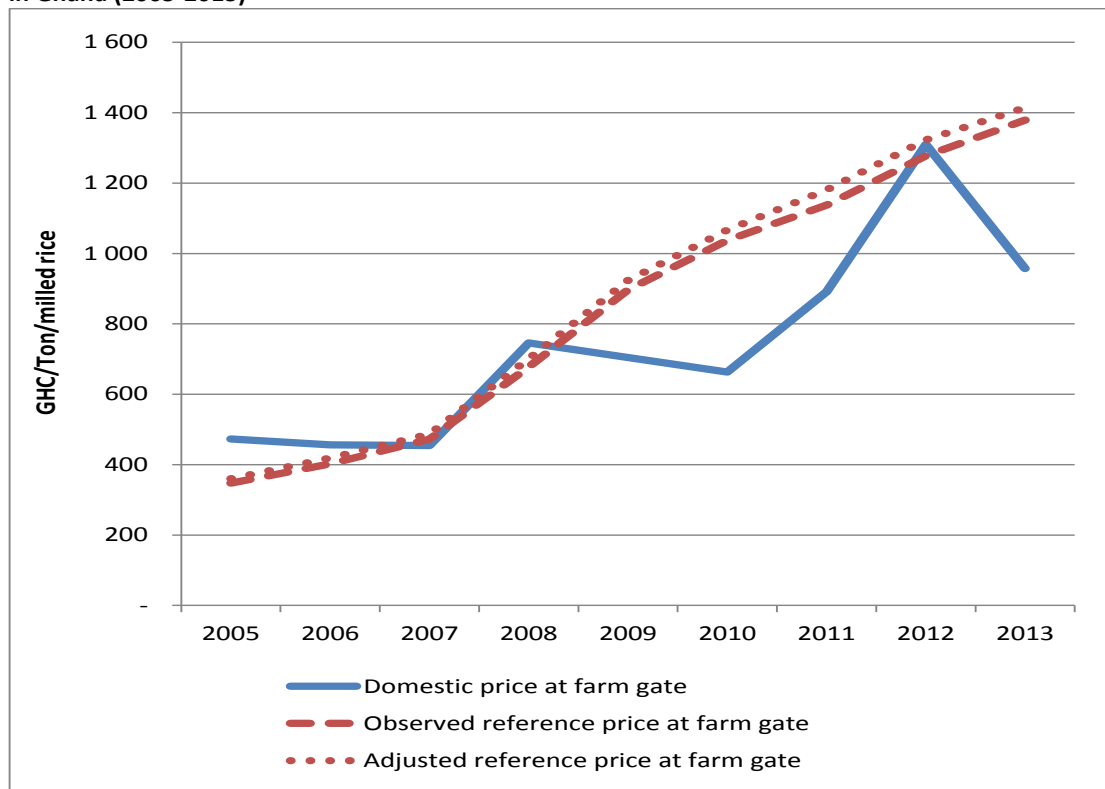
| | 2005 | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 |
|---|------|------|------|------|------|------|------|------|------|
| Trade status for the year | m | m | m | m | m | m | m | m | m |
| Access costs gap to competition point (ACGwh) | 12 | 13 | 16 | 28 | 38 | 41 | 44 | 53 | 50 |
| Access costs gap to farm gate (ACGfg) | -24 | -29 | -30 | -51 | -64 | -70 | -88 | -98 | -86 |

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

4. Results and interpretation

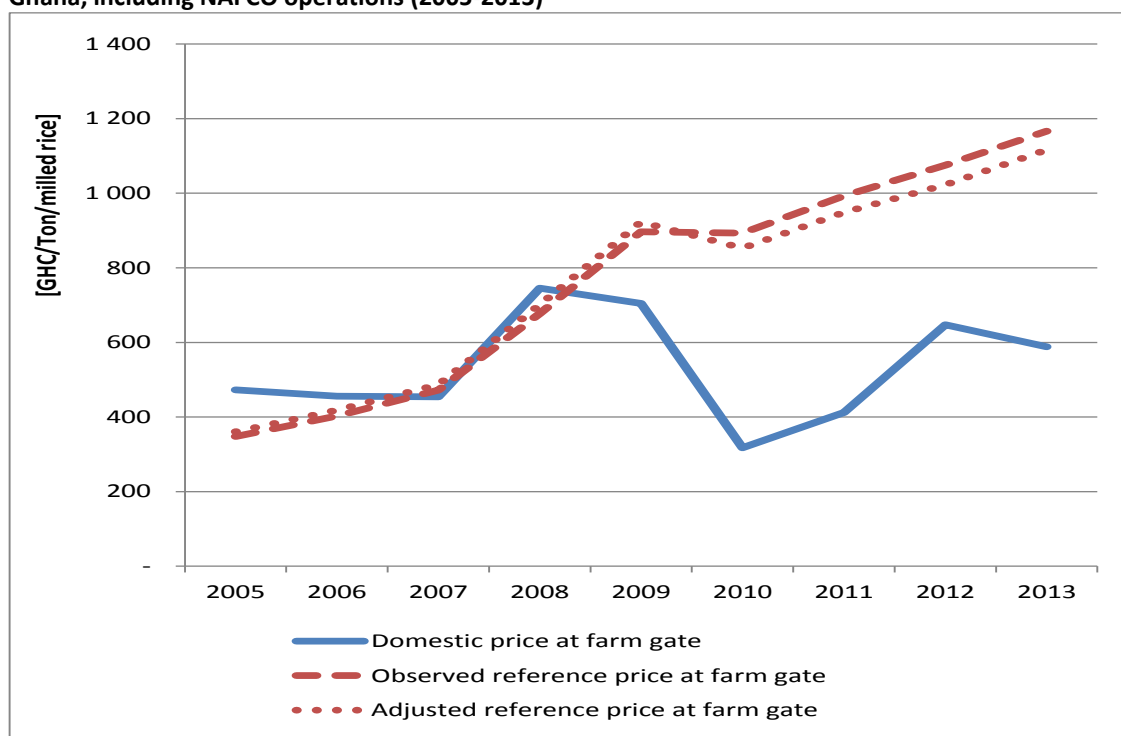
Figure 11 shows that after four years of alignment with the international price (2005-2008) the domestic price of rice at farm gate in Ghana is increasing sharply especially starting from year 2010 and converging towards its equivalent in the international market, the observed reference price at farm gate, to then drop significantly below the reference price in 2013. On the other hand, if prices paid to farmers by the national buffer stock are taken into account (Figure 12) during the period 2010-2013, observed prices seem to be more variable and divergent from the observed reference price at farm gate. This trend reveals that the disconnection between domestic prices in Ghana and the international market is exacerbated when farm gate pan-territorial prices set by NAFCO are considered. It thus appears that, at least for the first four years of operation, the buffer stock served more in keeping prices low for consumers rather than as a price stabilization tool given the trend fluctuations that we observe (Figure 12).

Figure 11. Actual price, observed reference price and adjusted reference price at farm gate for Rice in Ghana (2005-2013)



Source: Author's calculations, 2014

Figure 12. Actual price, observed reference price and adjusted reference price at farm gate for rice in Ghana, including NAFCO operations (2005-2013)



Source: Author's calculations, 2014

Although the time series is very short since NAFCO is operational starting from 2010, both the standard deviation and the coefficient of variation were calculated (Table 25). Price variability and volatility, when using yearly averages, were not reduced by the buffer stock which generates higher coefficient of variation as compared with open market prices and for both the farm gate and wholesale levels.

Table 25. Standard deviation and Coefficient of variation, NAFCO and open market prices (2010-2014)

| | NAFCO (2010-2013) | | OPEN MARKET (2010-2013) | |
|------------------------------------|-------------------|-----------|-------------------------|-----------|
| | WH prices | FG prices | WH prices | FG prices |
| Standard deviation (GHC per tonne) | 180 | 153 | 125 | 268 |
| Coefficient of variation (%) | 30% | 31% | 9% | 28% |

Source: Author elaboration based on data from MOFA-SRID and NAFCO

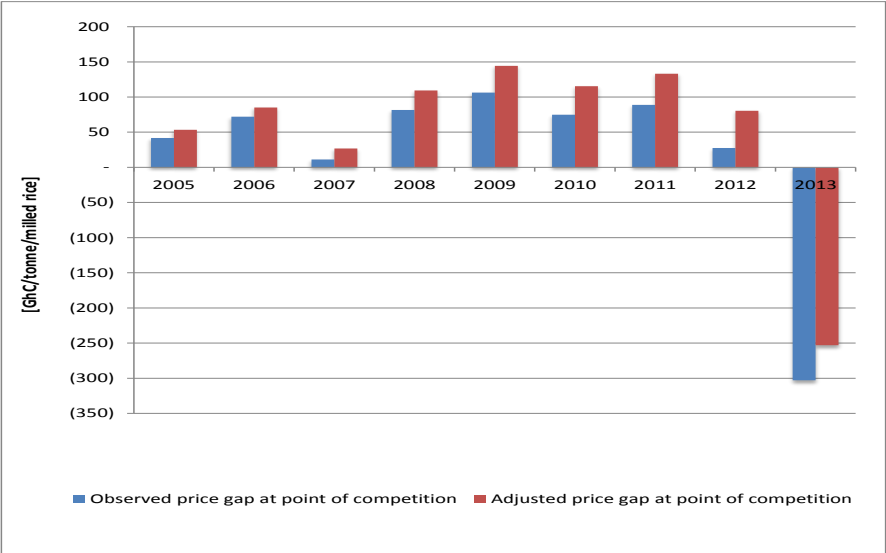
Observed price gaps at point of competition (Figure 13) are positive for all years except 2013 when the price gap becomes negative by -303 GHC/tonne. This negative pick seems mainly due to price dynamics and the dramatic increase in the benchmark price which was not transmitted at the wholesale and national level.

Compared to the prevailing open market prices, NAFCO seemed to be subsidizing the operations or consumption of those to whom it was selling rice (Figure 14). For example, the average open market price of rice was well above NAFCO ceiling prices during all years. The main beneficiaries of NAFCO selling prices for rice were schools, and other public institutions (IFPRI, 2013). Furthermore, the implicit

subsidy passed on is much higher for rice than for maize also in consideration of the high price of imported rice as compared to local rice.⁸

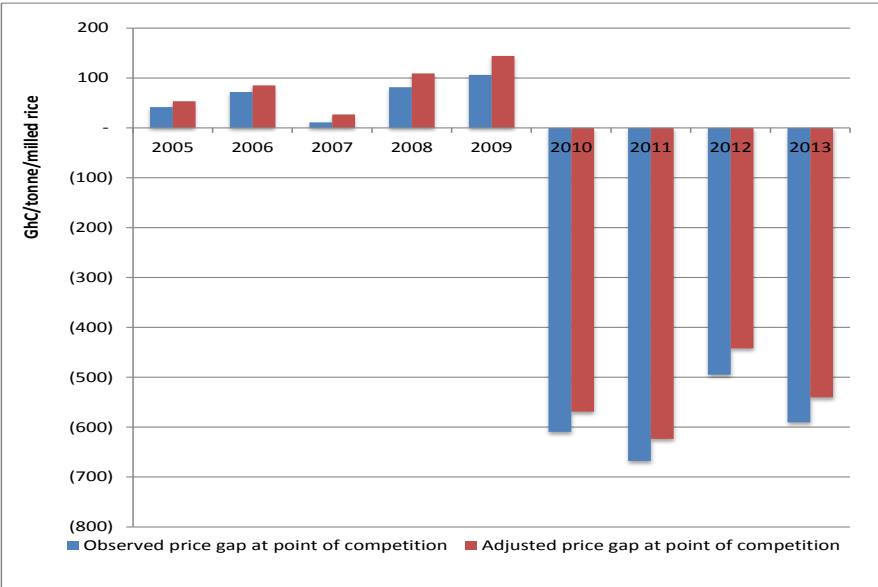
Adjusted price gaps only reflect the existence of excessive margins among the few rice importers in Ghana. Adjusted values reveal what price gaps would be in the case where markets were more efficient hence they are higher than observed price gaps when these are above zero while they are lower than the observed price gaps when observed price gaps are negative.

Figure 13. Observed and adjusted price gaps at point of competition for rice in Ghana, 2005-2013



Source: Author’s calculations, 2014

Figure 14. Observed and adjusted price gaps at point of competition for rice in Ghana (NAFCO), 2005-2013



Source: Author’s calculations, 2014

Observed price gaps at farm gate (Figure 15) are positive but very close to zero during the period 2005-2008 and then drop, up to reaching – 422 GhC/tonne in 2013. From 2010 onwards disincentives show

⁸ As for rice, maize price incentives were analysed both in the open market and buffer stock context.

an increasing convergence with the reference price until 2012 and then become significantly negative in 2013. In Figure 16 where NAFCO pan-territorial prices are used starting from 2010, farmers start to receive disincentives in 2009 which become increasingly negative in years 2010-2013.

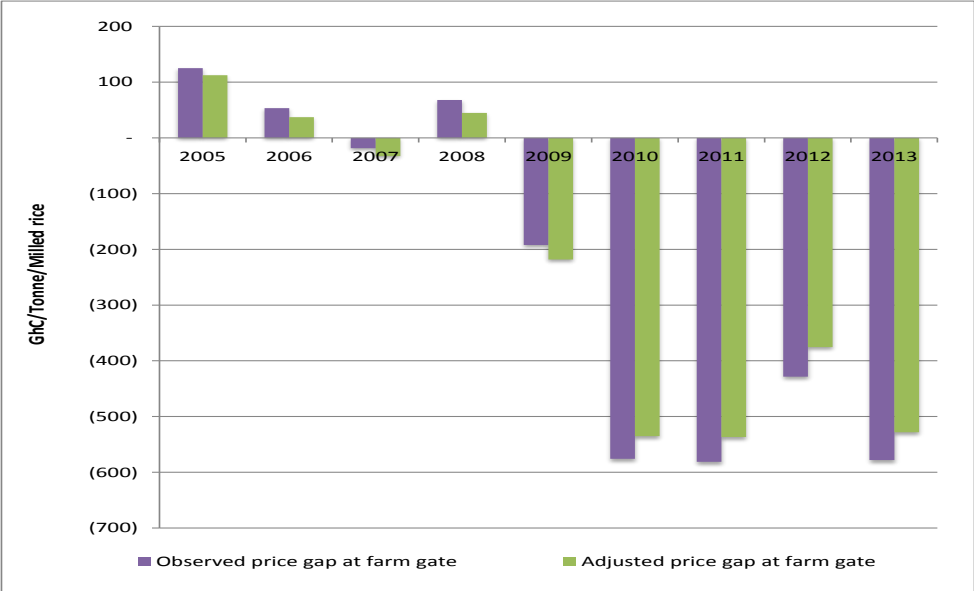
Adjusted price gaps reveal the impact of excessive traders' margins and transport costs starting from year 2008 which created lower incentives or higher disincentives for farmers.

Figure 15. Observed and adjusted price gaps at farm gate for rice in Ghana, 2005-2013



Source: Author's calculations, 2014

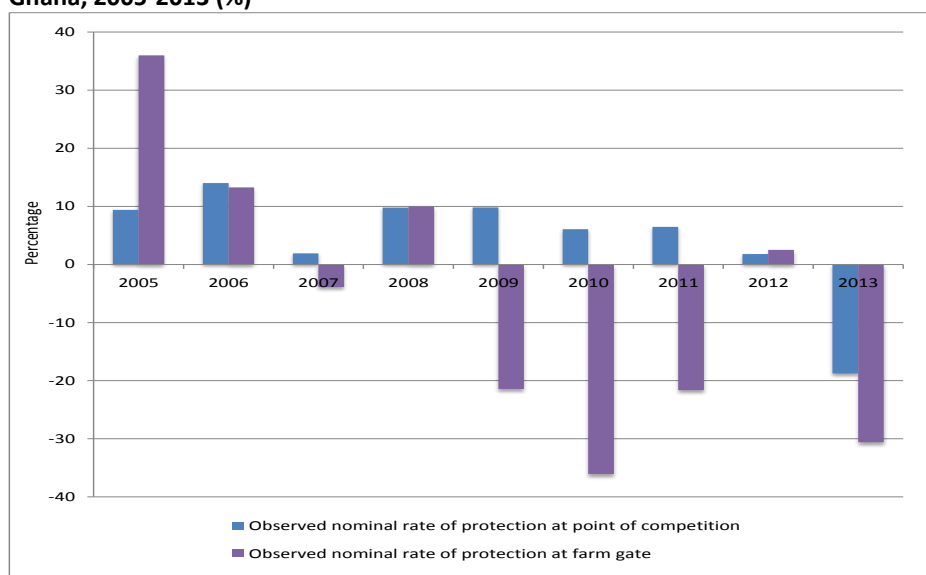
Figure 16. Observed and adjusted price gaps at farm gate for rice in Ghana (NAFCO), 2005-2013



Source: Author's calculations, 2014

Observed NRPs at point of competition show a decreasing trend between 2006 and 2013 with the lowest negative value registered in 2013. Despite an import tariff of 20 percent in place in all years except 2008 and 2009, price incentives at the point of competition are below 20 percent if not negative revealing the inefficiency of the trade policy in creating incentives for traders and/or wholesalers.

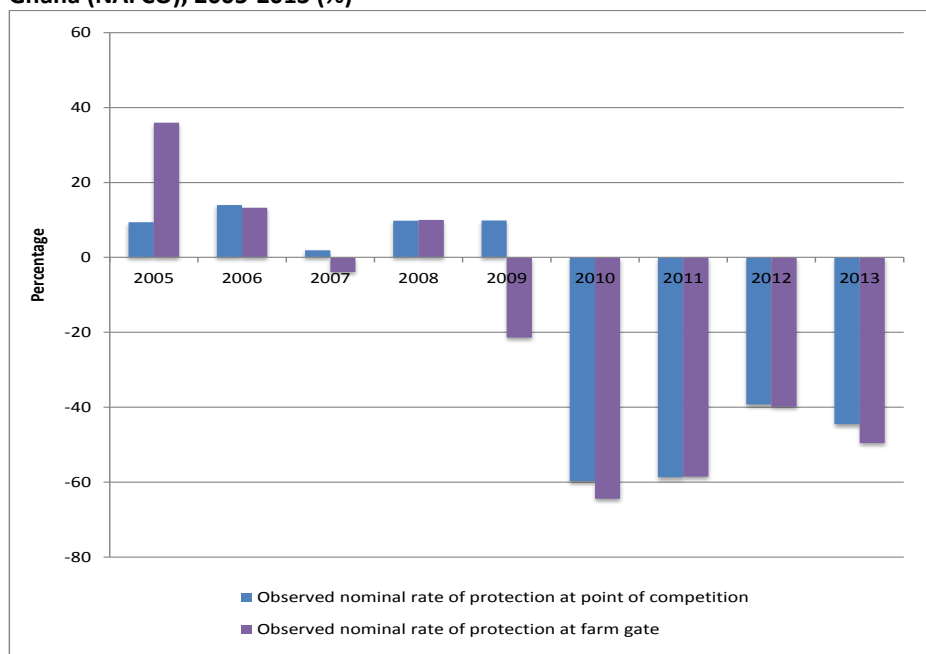
Figure 17. Observed Nominal Rate of Protection at point of competition and farm gate for rice in Ghana, 2005-2013 (%)



Source: Author's calculations, 2014

NAFCO operations during the period 2010-2013 show how the lower ceiling price generates disincentives for NAFCO itself as the institution sells below open market prices and buys from farmers at prices below what farmers get on the open market and generates higher disincentives for farmers if compared to the disincentives they receive on the open market.

Figure 18. Observed Nominal Rate of Protection at point of competition and farm gate for rice in Ghana (NAFCO), 2005-2013 (%)

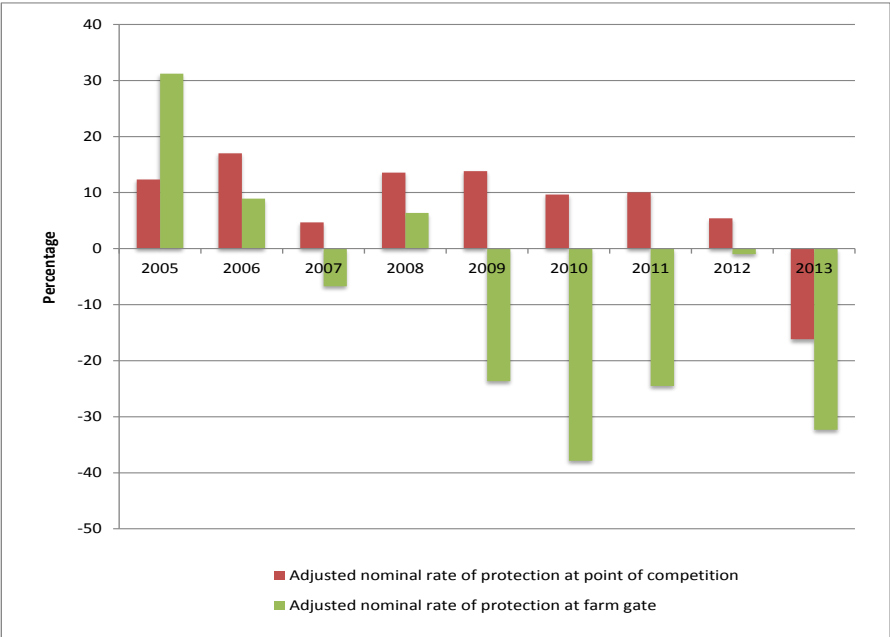


Source: Author's calculations, 2014

Farm gate NRPs show significant negative values over the period 2009-2012 with the import tariff not producing the expected incentives except year 2005. Although there is a progressive convergence of NRPs towards the equilibrium level, it is clear that this is the result of a compensation effect between the import tariff of 20 percent whose impact is attenuated by other factors such as the excessive

transport costs in rural areas mainly borne by farmers as well as the high cost of importing rice which hinders consumers affordability.

Figure 19. Adjusted Nominal Rate of Protection at point of competition and farm gate for rice in Ghana, 2005-2013



Source: Author’s calculations, 2014

Starting from 2010, both open market and NAFCO disincentives at the farm gate level show a decreasing trend which does not appear to be generated by the set of policies targeting the rice sector such as: fertilizer subsidy, seed subsidy block farms programme but rather by price dynamics which show a progressive convergence between international and domestic prices (Figure 20).

Figure 20. Adjusted Nominal Rate of Protection at point of competition and farm gate for rice in Ghana (NAFCO), 2005-2013

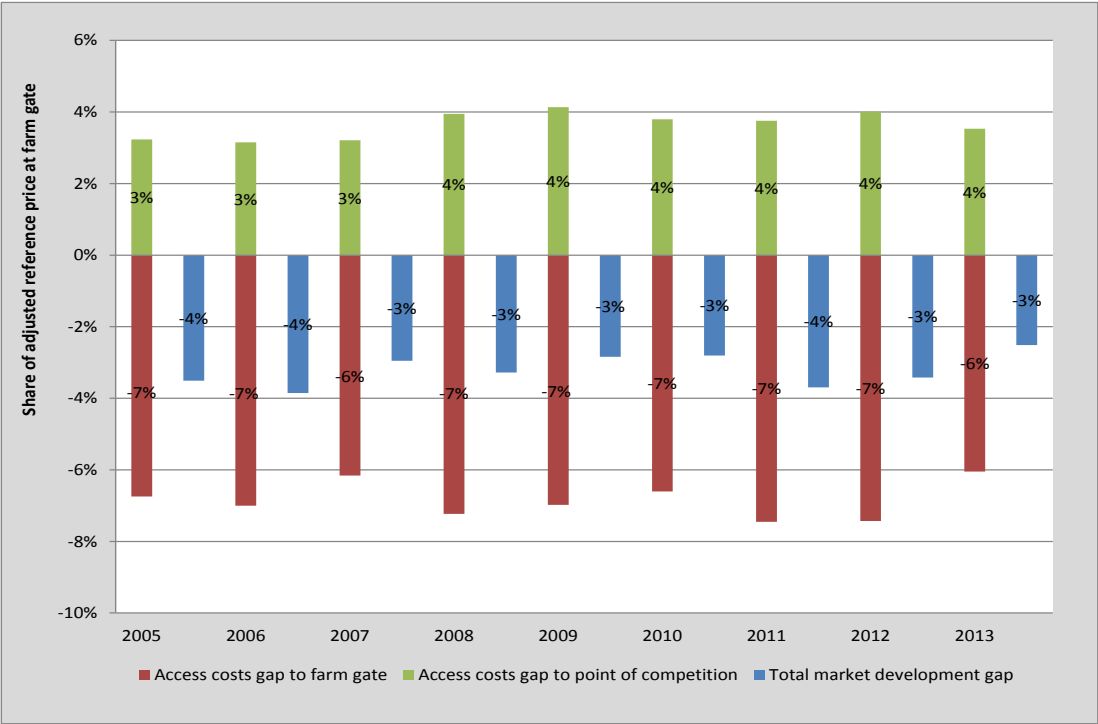


Source: Author’s calculations, 2014

This conclusion is further corroborated by the very small value of the NRA (Table 3 and 3bis) which was calculated using estimated budget transfers as described on page 21.

Figure 21 highlights that market inefficiencies occurring between the farm gate and the point of composition are the main elements influencing the total market development gap given the high transport costs in rural areas and the market power that traders exert over farmers, resulting in excessive margins for traders/wholesalers.

Figure 21. Composition of Market Development Gap for Rice in Ghana, 2005-2013 (as percentage of adjusted reference price at farm gate)



Source: Author’s calculations, 2014

5. Conclusions

Main message

The indicators obtained from the analysis on incentives and disincentives for the rice sector in Ghana are mainly determined by price dynamics rather than policies targeting rice. Although, a set of measures are in place such as import tariffs and input subsidies these are not influencing results as we would expect. The progressive convergence, in recent years, of both NRPs at point of competition and farm gate towards zero shows the lack of impact of the rice trade policy as in the presence of a 20 percent import tariff, expected NRPs should register an incentive which is equivalent to the tariff at least for the years in which it is in place (2005-2007 and 2010-2013). The disincentives at farm gate level, although progressively reducing, are more the result of the inefficiencies that characterize the local rice value chain which experiences extremely high access costs especially transport costs. These have been increasing significantly starting from 2008. Trade restrictions and the plethora of taxes and fees applied on imported rice are more effective in protecting traders, who experienced incentives except for year 2013, than farmers.

The opportunity to analyse the structure of price incentives at the producer level in the framework of the buffer stock provided additional insights on the detrimental effect that NAFCO has on production incentives. Although, incentives at the farm gate and wholesale level are converging towards zero which implies an alignment with international prices, NAFCO operations generate disincentives as the floor and ceiling prices are far from being aligned with the reference prices at the farm gate and the point of competition.

As prices at the point of competition are considered as the closest approximation of how incentives would look like at the consumer level, it can be concluded that consumers are slightly penalized by higher prices of rice when looking at the open market while they pay significantly lower prices than those they would pay if no policy distortions were in place in the case where NAFCO operations are considered.

Recommendations

The Government of Ghana, through its fertilizer and seed subsidy programmes, block farm programme, national buffer stock company and its import restrictions is committed to supporting domestic rice production (among other staple crops) by implementing strategies that address many of the issues highlighted in this analysis. In general, these strategies include providing financial and technical support to farmers, increasing the adoption of yield enhancing technologies, investing in irrigation and improved seeds, seeking private investment to improve mills and removing tariffs levied on agricultural inputs.

Aside from the government's input subsidy program, which was introduced in 2008, there is little evidence that the expected progress has been made in implementing and achieving tangible results through these strategies. This is particularly visible in the negative trend that incentives to farmers have assumed in 2009. Therefore, to stimulate domestic rice production, the government will need to follow through with its stated commitments. It is also recommended that the government commits to investing in its roadways in order to reduce excessive access costs, which currently limit the marketability of domestic rice.

Furthermore, while considering the effects and benefits for the society of protection for farmers, the government should also measure the effects of such a policy environment on food security and poverty for consumers especially in urban areas. Indeed, if we consider the open market context consumers pay higher prices than they would if policy distortions and market inefficiencies were removed, except year 2013.

The Northern region is also the area where buffer stock operations have been more intensive hence this region was also considered representative for the analysis of price incentives using data about NAFCO operations. If we refer to the NAFCO scenario, we see a different situation where disincentives are in place for both producers and traders (NAFCO) while consumers are benefitting from prices below their international equivalents. The analysis confirms the need to review the NAFCO as it is serving more as a price ceiling for consumers but not generating incentives for farmers which are not viewed as cash crop producers. Furthermore, if compared with open market conditions we do not observe a dramatic improvement in price stabilization which would justify the existence of the buffer stock. Essentially, NAFCO manages to keep ceiling prices low as the agency buys at lower prices from producers and has lower access costs thanks to the economies of scale it can reach by moving larger quantities of rice. Benefits appear evident for consumers, however it would be advisable to understand if NAFCO sales are targeted to those consumers more in need and the cost implications that the maintenance of a buffer stock has considering it is not producing the expected benefits for producers.

The conflicting impact of the import tariff does not justify its application. As with regards to open market price analysis, it is protecting traders but not farmers. The main argument put forward by the Government of Ghana is that the import tariff on rice is a foreign currency earner, however we cannot assess if the benefits from the import tax are passed on to the consumers and more in general tax payers given the scope of the present analysis.

More support to the agricultural sector through market-oriented training, favourable policies and the introduction of better processing methods as well as market-favoured aromatic rice varieties will go a long way to improve the competitiveness and demand for locally produced rice. Should Ghana strive to increase the competitiveness of rice, the efficiency of production of locally produced rice has to improve via productivity enhancement, so as to be able to compete with imported rice. A tariff on imported rice could also help in increasing the competitiveness of locally produced rice, although a high tariff without an increase in the quality of locally produced rice would only increase the price burden on consumers at the detriment of food security.

In summary, the present study and analysis of price incentives at both the farm gate and wholesale level for both contexts, open market and buffer stock has contributed to identify the following priority areas for reform:

- The need to review NAFCO price structure as this is currently producing price disincentives for farmers and is not serving as a price stabilization tool;
- The impellent need for the Government of Ghana to undertake rural infrastructural improvements, especially for what concerns feeder roads, given the high costs of transport between producing areas and main wholesale markets;
- Abolish or reduce the current trade restrictions and all taxes and fees applied on imported rice as these are harming consumers access to food and are not producing the expected price incentives for farmers;

- Upgrade processing techniques for local rice in order to capture consumers in urban areas who still express a marked preference for the imported product

Limitations

Data and value chain information gaps:

The complexity in accessing and obtaining the right data from the Port of Tema to Accra, considered as the point of competition led to the adoption of a non optimal solution where a combination of different sources of data (IFPRI and MOFA) had to be used to cover all access costs from the border to the point of competition;

The calculation is based on a single wholesale market in Ghana; perhaps the analysis could be further extended to include alternative points of competition to also assess the different levels of price transmission between the farm gate and the wholesale market as well as the border and the wholesale market

Quantities purchased and sold by NAFCO each year and main beneficiaries of NAFCO ceiling price would help in framing the influence that NAFCO operations have in terms of price signals and distortions on the domestic market

Data on the benchmark price and the farm gate price for 2013 were estimated in view of obtaining the actual price data from national partners

The analysis has also highlighted some difficulties in understanding what types of rice are included in the “local rice” category and to what extent this reflects the different processing techniques at the farm level to increase value addition

Information on traders’ margins could not be retrieved

Further investigation and research

The analysis focuses on Accra Market (Ghana) which has linkages to the rest of the country. However, Accra consumes little local rice and therefore might not be the best point of competition. There are other important markets in Ghana such as the Kumasi Market as second consumption market consuming both imported and local rice, or Techiman market (Northern than Kumasi) being a real exchange market serving as another wholesale for the northern parts of the country. A similar analysis could be carried out considering Techiman as our wholesale market instead of Accra since imported rice sometimes is transported directly to Techiman.

The analysis of price incentives generated by NAFCO should be complemented with an analysis of the expenditure that the buffer stock implies including storage facilities, buying and selling operations so to come up with a full policy coherence analysis.

A serious assessment of the benefits of the fertilizer and seed subsidy programmes also in the light of the objectives set by the METASIP in terms of productivity growth for selected crops including rice.

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Annex I: Data and calculations used in the analysis

| Name of product | | Rice | | Local currency | | Gh¢ | | | | | | |
|---|----------|----------|---------------------|----------------|--------|--------|--------|--------|--------|--------|--------|--------|
| International currency | | USD | | | | | | | | | | |
| DATA | Unit | Symbol | Year trade status | 2005 | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 |
| | | | | m | m | m | m | m | m | m | m | m |
| Benchmark price | Observed | USD/TON | P _{b(int)} | 257.41 | 287.92 | 334.16 | 523.46 | 541.61 | 566.34 | 586.64 | 590.45 | 562.53 |
| | Adjusted | USD/TON | P _{ba} | 257.41 | 287.92 | 334.16 | 523.46 | 541.61 | 566.34 | 586.64 | 590.45 | 562.53 |
| Exchange rate | Observed | Gh¢/USD | ER _o | 0.91 | 0.92 | 0.94 | 1.06 | 1.41 | 1.43 | 1.51 | 1.80 | 1.95 |
| | Adjusted | Gh¢/USD | ER _a | 0.91 | 0.92 | 0.94 | 1.06 | 1.41 | 1.43 | 1.51 | 1.80 | 1.95 |
| Access costs border - point of competition | Observed | Gh¢/TON | ACG _{wh} | 269 | 316 | 354 | 417 | 509 | 626 | 706 | 743 | 790 |
| | Adjusted | Gh¢/TON | ACG _{wh} | 258 | 303 | 338 | 389 | 471 | 586 | 662 | 690 | 740 |
| Domestic price at point of competition | | Gh¢/TON | P _{wh} | 486 | 586 | 600 | 914 | 1 188 | 1 309 | 1 460 | 1 566 | 1 311 |
| Access costs point of competition - farm gate | Observed | Gh¢/TON | ACG _{fg} | 97 | 112 | 116 | 154 | 185 | 197 | 234 | 261 | 235 |
| | Adjusted | Gh¢/TON | ACG _{fg} | 72 | 82 | 86 | 104 | 120 | 126 | 146 | 162 | 150 |
| Domestic price at farm gate | | Gh¢/TON | P _{atg} | 472.86 | 455.91 | 453.96 | 745.58 | 704.74 | 663.13 | 891 | 1 310 | 957 |
| Externalities associated with production | | Gh¢/TON | E | - | - | - | - | - | - | - | - | - |
| Budget and other product related transfers | | Gh¢/TON | BOT | - | - | - | 0.01 | 0.01 | 0.01 | 0.02 | 0.04 | - |
| Quantity conversion factor (border - point of competition) | | Fraction | QT _{wh} | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Quality conversion factor (border - point of competition) | | Fraction | QL _{wh} | 0.75 | 0.75 | 0.75 | 0.75 | 0.75 | 0.75 | 0.75 | 0.75 | 0.75 |
| Quantity conversion factor (point of competition - farm gate) | | Fraction | QT _{fg} | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Quality conversion factor (point of competition - farm gate) | | Fraction | QL _{fg} | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |

| CALCULATED PRICES | | Unit | Symbol | 2005 | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 |
|--|----------|---------|----------------------|------|------|------|------|-------|-------|-------|-------|-------|
| Benchmark price in local currency | Observed | Gh¢/TON | P _{b(occ)} | 233 | 264 | 312 | 554 | 763 | 810 | 887 | 1 060 | 1 099 |
| | Adjusted | Gh¢/TON | P _{b(occ)a} | 233 | 264 | 312 | 554 | 763 | 810 | 887 | 1 060 | 1 099 |
| Reference price at point of competition | Observed | Gh¢/TON | RP _{wh} | 444 | 514 | 588 | 832 | 1 082 | 1 234 | 1 371 | 1 538 | 1 614 |
| | Adjusted | Gh¢/TON | RP _a | 433 | 501 | 573 | 805 | 1 044 | 1 194 | 1 327 | 1 485 | 1 564 |
| Reference price at farm gate | Observed | Gh¢/TON | RP _{fg} | 348 | 402 | 472 | 678 | 897 | 1 037 | 1 137 | 1 277 | 1 379 |
| | Adjusted | Gh¢/TON | RP _a | 360 | 419 | 487 | 701 | 923 | 1 067 | 1 181 | 1 323 | 1 414 |

| INDICATORS | | Unit | Symbol | 2005 | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 |
|---|----------|---------|--------------------|------|------|------|------|------|------|------|------|------|
| Price gap at point of competition | Observed | Gh¢/TON | PG _{wh} | 42 | 72 | 11 | 82 | 106 | 75 | 89 | 27 | -303 |
| | Adjusted | Gh¢/TON | PG _a | 53 | 85 | 27 | 109 | 144 | 115 | 133 | 81 | -253 |
| Price gap at farm gate | Observed | Gh¢/TON | PG _{fg} | 125 | 53 | -18 | 68 | -192 | -374 | -246 | 32 | -422 |
| | Adjusted | Gh¢/TON | PG _a | 112 | 37 | -33 | 45 | -218 | -404 | -289 | -13 | -457 |
| Nominal rate of protection at point of competition | Observed | % | NRPO _{wh} | 9% | 14% | 2% | 10% | 10% | 6% | 6% | 2% | -19% |
| | Adjusted | % | NRPA _{wh} | 12% | 17% | 5% | 14% | 14% | 10% | 10% | 5% | -16% |
| Nominal rate of protection at farm gate | Observed | % | NRPO _{fg} | 36% | 13% | -4% | 10% | -21% | -36% | -22% | 3% | -31% |
| | Adjusted | % | NRPA _{fg} | 31% | 9% | -7% | 6% | -24% | -38% | -25% | -1% | -32% |
| Nominal rate of assistance | Observed | % | NRA _o | 36% | 13% | -4% | 10% | -21% | -36% | -22% | 3% | -31% |
| | Adjusted | % | NRA _a | 31% | 9% | -7% | 6% | -24% | -38% | -25% | -1% | -32% |

| DECOMPOSITION OF MDG | | Unit | Symbol | 2005 | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 |
|--|--|---------|-------------------|------|------|------|------|------|------|------|------|------|
| International markets gap | | Gh¢/TON | IRG | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Exchange policy gap | | Gh¢/TON | ERPG | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Access costs gap to point of competition | | Gh¢/TON | ACG _{wh} | 12 | 13 | 16 | 28 | 38 | 41 | 44 | 53 | 50 |
| Access costs gap to farm gate | | Gh¢/TON | ACG _{fg} | -24 | -29 | -30 | -51 | -64 | -70 | -88 | -98 | -86 |
| Externality gap | | Gh¢/TON | EG | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Total market development gap | | Gh¢/TON | MDG | -13 | -16 | -14 | -23 | -26 | -30 | -44 | -45 | -36 |
| Market development gap as share of farm gate price | | % | MDG | -3% | -4% | -3% | -3% | -4% | -5% | -5% | -3% | -4% |
| Market development gap as share of adjusted reference price at | | % | MDG | -4% | -4% | -3% | -3% | -3% | -3% | -4% | -3% | -3% |

| | |
|-------------------------------|---------------------|
| Name of product | Rice (NAFCO) |
| International currency | USD |

| | |
|-----------------------|------------|
| Local currency | Gh¢ |
|-----------------------|------------|

| DATA | | Unit | Symbol | Year trade status | 2005 | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 |
|---|----------|----------|---------------------|-------------------|--------|--------|--------|--------|--------|--------|--------|--------|------|
| | | | | | m | m | m | m | m | m | m | m | m |
| Benchmark price | Observed | USD/TON | P _{bi(us)} | | 257.41 | 287.92 | 334.16 | 523.46 | 541.61 | 566.34 | 586.64 | 590.45 | 563 |
| | Adjusted | USD/TON | P _{ba} | | 257.41 | 287.92 | 334.16 | 523.46 | 541.61 | 566.34 | 586.64 | 590.45 | 563 |
| Exchange rate | Observed | Gh¢/USD | ER _o | | 0.91 | 0.92 | 0.94 | 1.06 | 1.41 | 1.43 | 1.51 | 1.80 | 1.95 |
| | Adjusted | Gh¢/USD | ER _a | | 0.91 | 0.92 | 0.94 | 1.06 | 1.41 | 1.43 | 1.51 | 1.80 | 1.95 |
| Access costs border - point of competition | Observed | Gh¢/TON | ACo _{wh} | | 269 | 316 | 354 | 417 | 509 | 626 | 706 | 743 | 790 |
| | Adjusted | Gh¢/TON | ACa _{wh} | | 258 | 303 | 338 | 389 | 471 | 586 | 662 | 690 | 740 |
| Domestic price at point of competition | | Gh¢/TON | P _{dwh} | | 486 | 586 | 600 | 914 | 1,188 | 412 | 471 | 765 | 735 |
| Access costs point of competition - farm gate | Observed | Gh¢/TON | ACo _{fg} | | 97 | 112 | 116 | 154 | 185 | 128 | 145 | 184 | 159 |
| | Adjusted | Gh¢/TON | ACa _{fg} | | 72 | 82 | 86 | 104 | 120 | 128 | 145 | 184 | 159 |
| Domestic price at farm gate | | Gh¢/TON | P _{dfg} | | 473 | 456 | 454 | 746 | 705 | 318 | 412 | 647 | 588 |
| Externalities associated with production | | Gh¢/TON | E | | | | | | | | | | |
| Budget and other product related transfers | | Gh¢/TON | BOT | | | | | 0.01 | 0.01 | 0.01 | 0.02 | 0.03 | |
| Quantity conversion factor (border - point of competition) | | Fraction | QT _{wh} | | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 0.65 | 0.65 | 0.65 | 0.65 |
| Quality conversion factor (border - point of competition) | | Fraction | QL _{wh} | | 0.75 | 0.75 | 0.75 | 0.75 | 0.75 | 0.75 | 0.75 | 0.75 | 0.75 |
| Quantity conversion factor (point of competition - farm gate) | | Fraction | QT _{fg} | | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Quality conversion factor (point of competition - farm gate) | | Fraction | QL _{fg} | | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |

| CALCULATED PRICES | | Unit | Symbol | 2005 | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 |
|--|----------|---------|----------------------|------|------|------|------|-------|-------|-------|-------|-------|
| Benchmark price in local currency | Observed | Gh¢/TON | P _{bi(oc)} | 233 | 264 | 313 | 554 | 763 | 810 | 887 | 1,060 | 1,099 |
| | Adjusted | Gh¢/TON | P _{bi(oc)a} | 233 | 264 | 313 | 554 | 763 | 810 | 887 | 1,060 | 1,099 |
| Reference price at point of competition | Observed | Gh¢/TON | RPo _{wh} | 444 | 514 | 588 | 832 | 1,082 | 1,021 | 1,138 | 1,260 | 1,326 |
| | Adjusted | Gh¢/TON | RPa _{wh} | 433 | 501 | 573 | 804 | 1,043 | 981 | 1,094 | 1,207 | 1,275 |
| Reference price at farm gate | Observed | Gh¢/TON | RPo _{fg} | 348 | 403 | 472 | 678 | 897 | 893 | 993 | 1,075 | 1,166 |
| | Adjusted | Gh¢/TON | RPa _{fg} | 360 | 419 | 487 | 701 | 923 | 853 | 949 | 1,022 | 1,116 |

| INDICATORS | | Unit | Symbol | 2005 | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 |
|---|----------|---------|--------------------|------|------|------|------|------|------|------|------|------|
| Price gap at point of competition | Observed | Gh¢/TON | PGo _{wh} | 42 | 72 | 11 | 82 | 106 | -610 | -668 | -495 | -590 |
| | Adjusted | Gh¢/TON | PGa _{wh} | 53 | 85 | 27 | 109 | 144 | -569 | -623 | -442 | -540 |
| Price gap at farm gate | Observed | Gh¢/TON | PGo _{fg} | 125 | 53 | -18 | 68 | -192 | -576 | -581 | -428 | -578 |
| | Adjusted | Gh¢/TON | PGa _{fg} | 112 | 37 | -33 | 45 | -218 | -535 | -537 | -375 | -528 |
| Nominal rate of protection at point of competition | Observed | % | NRPo _{wh} | 9% | 14% | 2% | 10% | 10% | -60% | -59% | -39% | -45% |
| | Adjusted | % | NRPa _{wh} | 12% | 17% | 5% | 14% | 14% | -58% | -57% | -37% | -42% |
| Nominal rate of protection at farm gate | Observed | % | NRPo _{fg} | 36% | 13% | -4% | 10% | -21% | -64% | -59% | -40% | -50% |
| | Adjusted | % | NRPa _{fg} | 31% | 9% | -7% | 6% | -24% | -63% | -57% | -37% | -47% |
| Nominal rate of assistance | Observed | % | NRA _o | 36% | 13% | -4% | 10% | -21% | -64% | -59% | -40% | -50% |
| | Adjusted | % | NRA _a | 31% | 9% | -7% | 6% | -24% | -63% | -57% | -37% | -47% |

| DECOMPOSITION OF MDG | | Unit | Symbol | 2005 | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 |
|---|--|---------|-------------------|------|------|------|------|------|------|------|------|------|
| International markets gap | | Gh¢/TON | IRG | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Exchange policy gap | | Gh¢/TON | ERPG | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Access costs gap to point of competition | | Gh¢/TON | ACG _{wh} | 12 | 13 | 16 | 28 | 38 | 41 | 44 | 53 | 50 |
| Access costs gap to farm gate | | Gh¢/TON | ACG _{fg} | -24 | -29 | -30 | -51 | -64 | 0 | 0 | 0 | 0 |
| Externality gap | | Gh¢/TON | EG | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Total market development gap | | Gh¢/TON | MDG | -13 | -16 | -14 | -23 | -26 | 41 | 44 | 53 | 50 |
| Market development gap as share of farm gate price | | % | MDG | -3% | -4% | -3% | -3% | -4% | 13% | 11% | 8% | 9% |
| Market development gap as share of adjusted reference price a | | % | MDG | -4% | -4% | -3% | -3% | -3% | 5% | 5% | 5% | 4% |

