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Technical note: Analysis of price incentives for maize in Kenya for the time period 2005–2013

September 2014

Monitoring and Analysing Food and Agricultural Policies (MAFAP)

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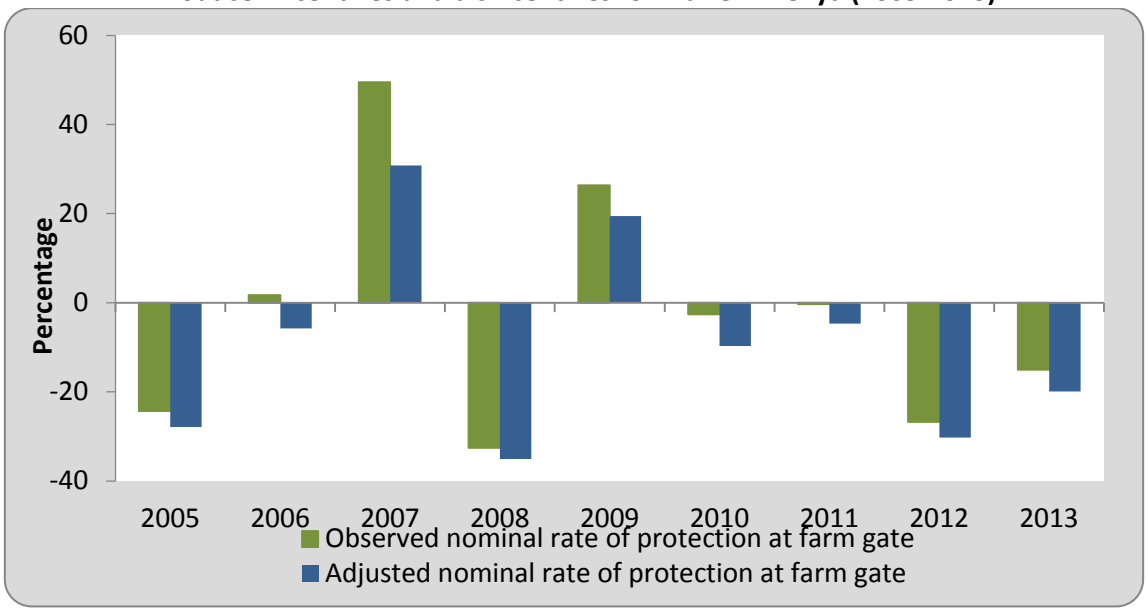
SUMMARY OF THE NOTE

Product : Maize
Period analyzed : 2005-2013
Trade status : Import

COMMODITY CONTEXT

- Maize is the main staple food crop and the most important cereal grain contributing significantly to food security by providing roughly a third of the caloric intake for Kenya's population.
- Maize is grown by 98percent of Kenya's 3.5 million smallholder farmers and in 2012 Kenya produced 3.8 million tons of maize on 2.2million ha's. Small and medium scale farmers produce about 75percent of the nation's maize crop, while large-scale farmers (farms over 25 acres) produce the remaining 25percent.
- In normal years, 25-35percent of total marketed maize is sold directly to the National Cereals and Produce Board (NCPB) by medium and large producers. Smallholder producers sell 96percent of their maize to private traders/brokers or consuming households. NCPB is a government tool used to regulate the market by purchasing maize (mainly from medium and large farms) and selling it below the cost of procurement to incentivize production, while keeping prices low for consumers.
- In Kenya, maize is somewhat an inferior good as its share in staple food expenditures is highest among the poor. Maize accounts for nearly 20percent of total food expenditures among the poorest 20percent of urban households and declines to 1percent of total food expenditures among the wealthiest 20percent.
- Kenya faces a growing structural deficit in maize production and this is normally met through duty free imports from the East African Community (EAC) countries of Uganda and Tanzania but when these are insufficient the government lowers import duty and imports are made from Malawi and South Africa.

Producer incentives and disincentives for maize in Kenya (2005-2013)



The observed Nominal Rate of Protection (NRP, green line) in the graph above measures the effect of policy distortions and overall market performance on maize price incentives for producers. The adjusted NRP (blue line) captures the same elements as the observed NRP in addition to any market distortions resulting from

inefficiencies in the commodity's value chain and exchange rate misalignment. The area in red reflects the estimated cost that value chain inefficiencies impose on producers. Despite the complexity of maize value chain in Kenya, this cost is rather small.

The analysis indicates that the incentives/disincentives are quite variable over time with domestic producer price above the reference price in 2007 which is characterized by high world market price, in 2009 which was a drought year and in 2012-13 characterized by high domestic prices and low imports. In other years, maize prices at the farmgate tend to be below the reference prices. The variability of the nominal rates of protection was the result of the variability in production, particularly in 2007-2009 and the short-term adjustment of the trade policy.

DRIVING FACTORS

The main policy instrument used to affect market prices of maize and consequently the price incentives to producers in Kenya is the trading activities of the NCPB. It does this through purchasing grain and selling it to millers often at a subsidized price. Combined with the short-term adjustment of the tariff to increase imports during years of shortage, the purchase pricing of NCPB manifested itself as a maize price ceiling. Since the NCPB purchase price is not based on import parity of maize, the domestic price of maize in Kenya is isolated to some degree from aligning with world market price.

RECOMMENDATIONS

The Government of Kenya needs to consider a maize policy that will allow for free alignment of domestic prices with world markets and thus reducing producers' disincentives and provide an enabling environment for an efficient resource allocation. To achieve this goal, NCPB purchase pricing which influence domestic market prices should be based on import price parity. Moreover, the discretionary use of the tariff should be avoided to reduce market uncertainty. Finally, to protect consumers from surging prices, the government may rely on alternative targeted mechanisms such as food stamps.

Other measures to reduce disincentives could include:

i. As an alternative to the use of stock purchase and release strategy, NCPB needs to consider improving farmers' access to adequate storage facilities to stabilize prices and enable farmers to gain from high price opportunities in the world markets.
ii. Shift Kenya's policy approach from reactive to proactive to better prepare for food shortages and reduce market uncertainty about short-term government actions.
iii. Further investigate the effects of the NCPB's activities on various agents of the supply chain.

1. PURPOSE OF THE NOTE

This technical note is an attempt to measure, analyse and interpret price incentives for Maize in Kenya over the period 2005 - 2013.

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 and key policy recommendations were formulated on the basis of this interpretation (Chapter 4). Finally, the note concludes with a few main messages, limitations of the analysis and areas identified for further research to improve the analysis (Chapter 5).

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

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

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

2. COMMODITY CONTEXT

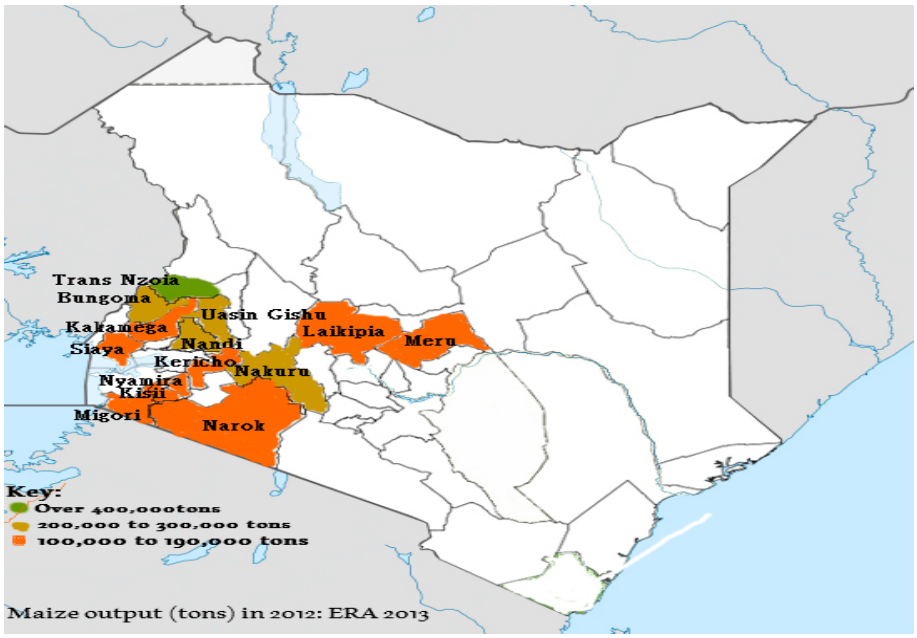
Maize is the primary staple food for most Kenyans, accounting for 36 percent of all calories consumed and 65 percent of staple food calories consumed. It is the most valued cereal crop in Kenya and it is an indispensable crop that plays a pivotal role in the food and feed system, and contributes significantly to income generation for rural households. It is a key ingredient in animal feeds and it accounts for over 80percent of feed rations.

The importance of maize availability in Kenya is underscored by imports being facilitated by the lowering of duty whenever the Country's 3 month stocks falls below the 1 million tons required to feed the Country in that period. The civil unrest that followed the December 2007 election and the subsequent drought in 2009 resulted in a spike in maize imports and prices; and increased interest in maize policies to assure national supplies. In terms of value, maize accounts for only about 8 percent of the total value of agricultural production, while other commodities (e.g. cattle, milk and tea) are more important by value.

PRODUCTION

Maize dominants crop production as it is grown by 98percent of Kenya's 3.5 million smallholder farmers with the country's annual production averaging three million Tonnes between 2008 and 2012 (ERA 2013). Maize is grown through the length and breadth of the Country under differing production conditions. It is grown in the high potential areas of the rift valley; in the medium potential areas in central province and western province; in the marginal areas of Eastern province and South Nyanza; in the arid areas of North Eastern and in the coastal lowlands of Kenya. The main production Counties are shown in Figure 1. Parts of the Rift Valley Province especially the Counties of Trans Nzoia and Uasin Gishu, produce a large maize surplus, primarily on medium and large farms. Most other regions are self-sufficient or face a maize deficit on an annual basis.

Figure 1.Key Maize producing counties



Source: ERA 2013

Small and medium scale farmers with less than 25 acres of land produce three-quarters of maize production in Kenya. Large-scale farmers with more than 25 acres of land produce the remaining 25percent. During land preparation, farmers in some areas commonly use tractors and/or oxen and then plant maize as a mono-crop (pure stand); but most small farmers prepare their land using hand implements like the hoe and they intercrop the maize with other crops (predominantly beans). Labor is generally a mix of family and hired labor and the maize crop is usually grown on the producers own land although some farmers grow it on rented land. According to Kibaara and Kavoi (2012), most (59 percent) maize farmers purchased hybrid seed while the rest used retained hybrid or local seeds recycled for a number of years; 42percent used manure and 23percent used tractors in production. They also found that about 51percent of maize yield is lost because of inefficiency.

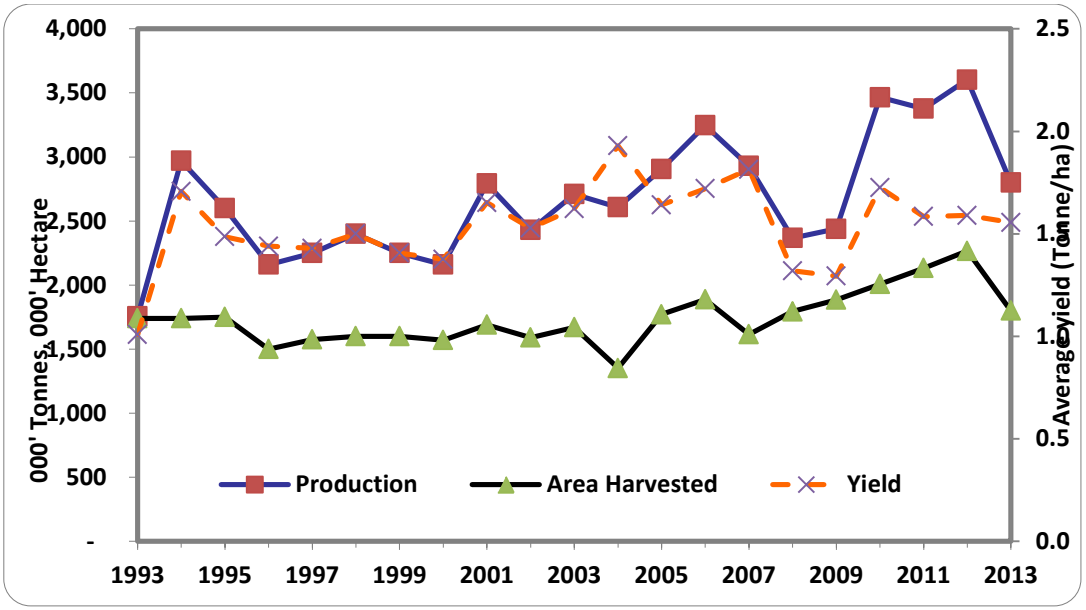
Most small holders produce for home consumption and sell small quantities. Kirimi et al (2012) found that 2percent of small holder farms account for 50percent of the overall marketed maize surplus from the smallholder sector. Smallholder farmers in the aggregate sell 96percent of their maize to either private traders/brokers or to consuming households.

Since maize production in Kenya depends largely on amount and distribution of rainfall within any given season, maize production is quite variable over time following the yield trends (Figure 2). National maize production increased significantly from 1.75 million tonnes in 1993 to 3.6 million tonnes in 2012 before declining to 2.8 million tonnes in 2013. Over the same period (1993-2005), cultivated maize remain relative staple ranging from 1.74 million ha to about 2.3 million ha. Significant improvement in productivity has been achieved during the period of 2007-2012. The higher maize productivity was attributed to access to subsidized fertilizers, improved utilization of certified seeds, good and well distributed rains and inputs support through the National Accelerated Agricultural Inputs Access Programme (**NAAIAP**) project[1].

Beside rainfall, maize production was affected by the political instability in 2007, which resulted in the destruction of 0.3 million tonnes of maize (African Centre for Open Governance) and a 20 percent reduction in the total area planted to maize during the long rains in 2008 (World Bank, 2009b). The situation was worsened by a drought that affected the next two harvests. As a result, total production fell 19 percent in 2008 and did not recover to normal levels until 2010, according to official estimates (Table 1; Figure 2).

[1] The National Accelerated Agricultural Inputs Access Program (NAAIAP) was started by the Kenyan government in 2007. The program was designed to act as a safety net for poor farmers who did not have adequate resources to purchase farm inputs and as part of the governments' response to the 2006 Fertilizer conference in Nigeria that came up with the "Abuja Declaration on Fertilizer for the African Green Revolution".

Figure 2. Kenya Maize production; 1993 to 2013



Source: Index Mundi: http://www.indexmundi.com/agriculture/?country=ke&commodity=corn

CONSUMPTION/UTILIZATION

Maize is the main staple food in Kenya, accounting for 65 percent of total staple food caloric intake. Maize is the source of more than 30 percent of both calories and protein in the Kenyan diet come (De Groote and Kimenju 2012). In 2003 maize accounted for 59 percent and 38 percent of the staple carbohydrate consumption among the 20 percent poorest and richest households, respectively (Kirimi et al., 2011). Maize is an important source of carbohydrate, protein, iron, vitamin B, and minerals.

Kenyans consume maize as either flour or grain. Maize flour is consumed as ugali, porridges and beer; with ugali (stiff porridge made by mixing maize flour with boiling water) being the most widely eaten. Whole maize grain is eaten fresh on the cob or boiled separately or mixed with beans (and sometimes with available vegetables) to form *githeri/muthokoi*. Maize is also an important livestock feed both as silage and as crop residue and the grain is also used industrially for starch and oil extraction. Kenyans consume white maize principally as yellow maize in most parts of the Country is seen as inferior and it is associated with food aid and animal feed. But colored traditional varieties are still popular, especially at the coast where they are appreciated for their storage qualities, and around Lake Victoria where the Nyamula variety is highly appreciated for roasting (Kirimi et al 2012).

Kirimi et al. (2011) estimate per capita maize consumption at about 88 kg/capita/year. In recent years, total national consumption of maize increased from about 2.89 million tonnes in 2005 to over 4 million tonnes by 2013 (Table 2). During normal to good years, Kenya's national production may cover as high as 98.5 percent of the estimated consumption (self-sufficiency ratio) (Table 1). Self-sufficiency ratio may decrease to as low as 62 percent in drought years as was the case in 2009. However, such years are not frequent.

Table 1. Estimated Kenya Maize supply 2005 to 2013

	2005	2006	2007	2008	2009	2010	2011	2012	2013*
	000' Tonnes / Percent								
Production	2,916	3,249	2,930	2,367	2,439	3,465	3,377	3,603	2,800
Imports	49.6	73.0	100.4	1,100.0	1,508.4	229.6	359.2	324.6	93.5
Exports	10.9	22.3	27.8	9.0	4.1	2.6	1.2	0.5	1.2
Available supply	3,002	3,266	2,986	3,448	3,239	3,562	3,776	4,016	4,118
Self-sufficiency ratio	97.1	99.5	97.9	68.6	75.4	97.3	89.4	93.8	80.6
Estimated consumption	2,8901	2,980	3,069	3,240	3,330	3,420	3,600	4,040	4,085

* Provisional data (not yet validated)

Source: KNBS, Economic survey 2008, 2010 and 2014; Index Mundi (2014)

MARKETING AND TRADE

Kenya is a net importer of maize (Table 1). Imports ranged from 1.7 percent to 38 percent of the total supply of maize in the country over the period of 2005-13. Kenya imports maize as grain. The major suppliers of maize to Kenya include Tanzania, Malawi and Zambia. For the period of 2011-13, Tanzania was the source for 34 percent of imported maize followed by Malawi with 30 percent (Figure 3). In contrast, maize from Uganda accounts for only 1 percent of the formal imports. However, these estimates reflect the formal imports as significant cross-border informal trade is usually not recorded especially through the eastern borders of Uganda. According to the Regional Agricultural Trade Intelligence Network (RATIN) which monitors regional agricultural commodity trade flows at selected border crossings between countries, the average amount of maize export from Uganda to Kenya was about 160,000 tons in the three-year period of 2005 to 2007 (Benson et al., 2008). As a result, Kenya imported about 5 percent of its maize consumption from Uganda during this period. Similarly, Bank of Uganda (2011) estimates the value of informal maize grain and flour exports to neighboring countries in 2009 and 2010 at USD 36.67 and 45.83 million, respectively.

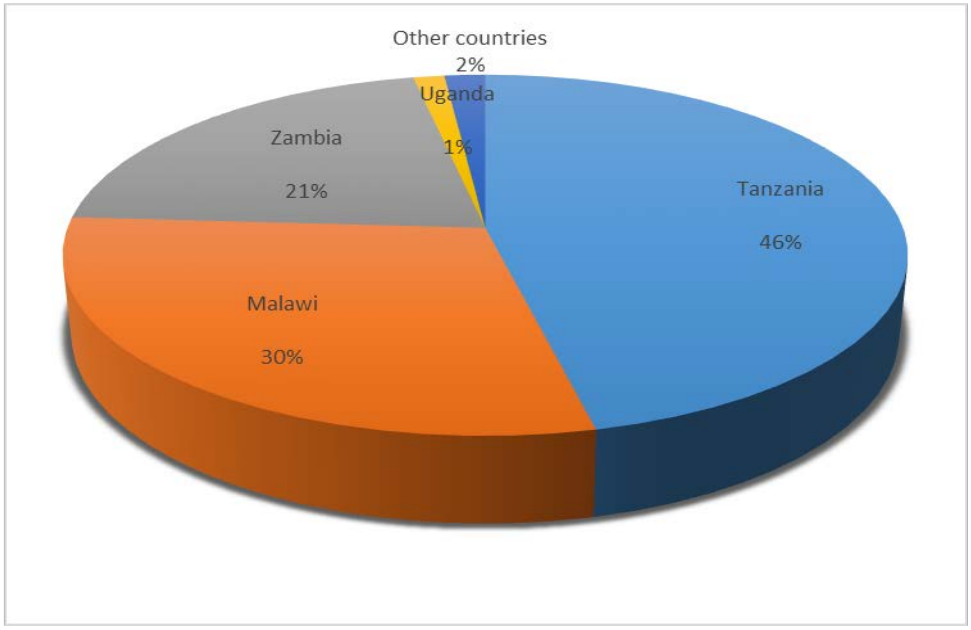
Imports from the world market are usually enabled by a reduction in import duty creating market inefficiencies and risk. Sales to the NCPB and large millers fell even more dramatically from 17 percent in 2007 to 9 percent in 2013 (Table 2). The impact of NCPB purchases is perhaps is not due to the significance of its share of production but rather to its impact on market prices as will be explained below. Smallholder producers retained a larger share of their crop in the face of shortages and steeply rising food prices while large scale producers appears to depend more on the open market for their maize sale. Medium- and large-scale producers may be more motivated by income earned from maize production. In this case, the expected price is an important consideration in the decisions on crop choice.

Table 2: Kenya Maize Production, 2005-2010

	2005	2006	2007	2008	2009	2010	2011	2012	2013
Production (000' Tonnes)	2,916	3,249	2,925	2,367	2,443	3,465	3,377	3,766	3,391
Sales to NCPB and large millers (000' Tonnes)	416	471	509	341	191	295	405.8	387.3	316.4
Share of sales to NCPB and large millers (percent)	14	14	17	14	8	9	12	10	9
Sales to others (000' Tonnes)	2,500	2,778	2,416	2,027	2,248	2,927	2,971	3,379	3075

Sources: KNBS, *Economic Survey, 2008, 2011* and 2014

Figure 3. Source of maize imports in last 3 years (2011-13)



Source: Global Trade Atlas (2014).

DESCRIPTION OF THE VALUE CHAIN

The maize value chain in Kenya is quite complex with numerous intermediaries (actors) with varying relative importance over the years depending on the season. There are seven major categories of actors in the maize value chain namely, farmers, primary assemblers (village traders and brokers), wholesalers, the NCPB, *posho* millers, large-scale millers and retailers. In a normal or good year with small national deficit, domestic production from small- and large-scale farmers forms the major source of domestic supply (Figure 4). In contrast, imports from neighboring countries account for 25-30percent of total domestic supply in an average or poor harvest year, while the world market supplies relatively little, especially when import tariff rates are high. Moreover, the value chain for large-scale producers is a distinct sub-chain where maize sales are mainly to NCPB and to a lesser extent to wholesale traders.

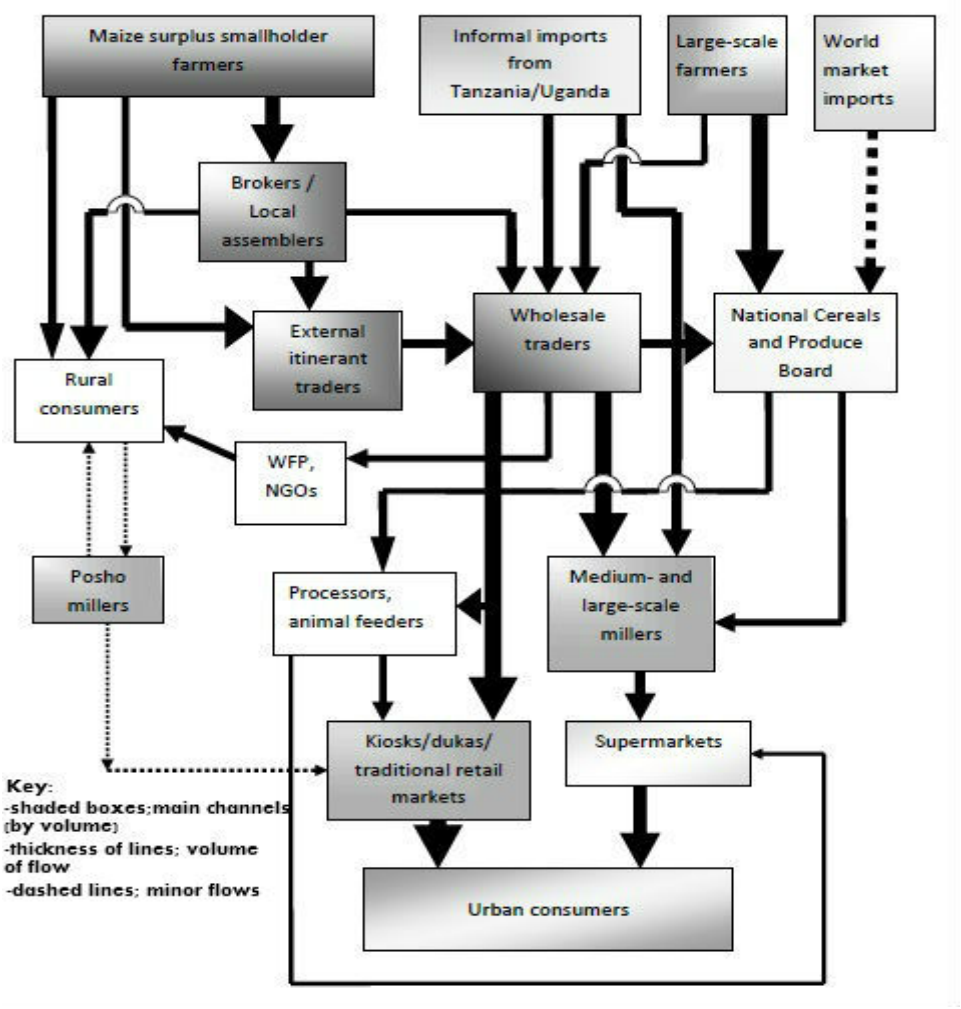
In this analysis, we focus on smallholder maize system. Smallholder maize sales go largely to small-scale assemblers or brokers, who collect and bulk for onward sale to large wholesalers with buying depots in the towns of major production areas. Large-scale farmers sell both to wholesale traders and to the NCPB. Large-scale millers buy grain primarily from the large wholesalers, the NCPB, and from smaller traders. The large millers sell mainly to a decentralized system of informal retailers (street kiosks, *dukas*, multipurpose retail shops, and traditional retail markets) and to a lesser extent to the more high-end consumers who shop at supermarkets. *Posho* millers who operate in retail markets are important players in some areas. Consumers buy grain and pay a fee to custom-mill their grain into posho meal. This option provides the means to produce maize meal relatively inexpensively and is preferred by the urban poor and most rural households, especially in the western parts of the country.

According to Kirimi et al. (2011), in a year when the main harvest in the major growing areas is poor, the country is more reliant on imports. If supplies can be imported from Uganda and Tanzania then this is the first option pursued by wholesalers and millers because (since January 2005) there are no import restrictions or barriers except for the 2.25 percent import declaration fee and transport costs, which are relatively low. However, if the required quantities cannot be obtained from the region, Kenya then becomes dependent on the world market. Then Kenyan wholesalers and millers lobby for a waiver of the 50 percent duty on maize

imported through Mombasa port. In years when imports constitute a major share of the marketed supplies, the structure of the maize value chain changes considerably. The most significant change is that the marketing channels become more concentrated and less competitive. Import contracts through Mombasa tend to be large volume orders placed by large millers, wholesalers, and the NCPB. Small-scale assemblers, itinerant traders, and small millers in the informal marketing channels are less active in drought years because they depend almost totally on small-scale farmers for their supplies, most of whom have little to sell during drought years. With grain being scarce in local informal markets during such years, consumers are increasingly dependent on the large-scale millers (who obtain their supplies from world markets or from the NCPB) for their maize meal. Without competition from the informal milling and retailing sector, large-scale millers and retailers are able to raise their margins, which is economically damaging for poor consumers.

The major maize products marketed in the Country are maize grain (from the market or farms), maize meal (from the *posho* mills), industrial maize meal (sifted and prepackaged by industrial millers), and industrial fortified maize meal (also from the millers). *Posho* mills target low-income urban consumers and rural consumers in certain parts of the Country. *Posho* mills may sell some ready-made products but they mainly offer milling services. *Posho* mill clients buy maize grain or bring what they have dried at home to be processed by the *posho* mill, usually into whole meal flour or into *Muthokoi* (maize grain degermed with the testa partly removed). They may also sell maize flour from their own production which is locally packed in unlabeled, clear plastic bags; and sometimes industrial flour. The industrial maize industry has at least 34 milling companies in 2012 that target the middle- and high-income groups. Their major product is industrial maize flour which is de-germed and sifted and this reduces the oil content and increases its storability. It is packed in 2-kg paper bags and sold in kiosks, shops, and supermarkets (Kirimi et al 2012).

Figure 4. Maize value chain for a typical year (small national deficit)



Source: Kirimi et al 2011

POLICY DECISIONS AND MEASURES

Maize marketing and trade policy in Kenya has been dominated by two major challenges. The first challenge being how to keep farm prices high enough to provide production incentives for farmers while at the same time keeping them low enough to ensure poor consumers' have access to food. The second major challenge has been how to effectively deal with food price instability, which is frequently identified as a major impediment to smallholder productivity growth and food security.

The major short and medium term policy objective for maize is maintaining its availability at stable, affordable prices for Kenyan consumers. The longer term policy focuses on increasing production through research, extension and other similar means. Kenyan policy makers have relied on two main instruments to influence prices and supplies and these are; (i) the state-run National Cereals and Produce board which procures maize and then sells it as a lower government subsidized rate; and (ii) tariffs on maize imports and exports.

Government intervention in maize markets

In Kenya before the market liberalization policy of 1994, the government set farm-gate prices and consumer prices for all basic agricultural commodities like maize, maize meal, sugarcane, sugar, wheat grains, wheat

flour, bread, milk and milk products, etc. Currently, most of the agricultural commodities are technically left to the free market forces of supply and demand to set their prices. However, for maize which is the staple food in Kenya, government intervention in pricing mechanism is still accepted and expected as normal despite the market liberalization in 1994. The Government of Kenya through the National Cereals and Produce Board (NCPB) still feels obliged to intervene in the pricing of maize especially at farm level. The NCPB is a parastatal which was retained as one of the strategic government boards and was given the mandate to carry out both commercial maize trade and also to carry out humanitarian function of carrying the Strategic Grain Reserve (SGR) of 6 million bags kept for emergency to be released into the market or to be distributed through government relief agencies during shortages in the country. Thus NCPB protects the farmers at harvest time by buying maize at government set prices, usually above the free market prices; then again they protect the consumers in times of shortages when they sell the maize at prices below the free market prices.

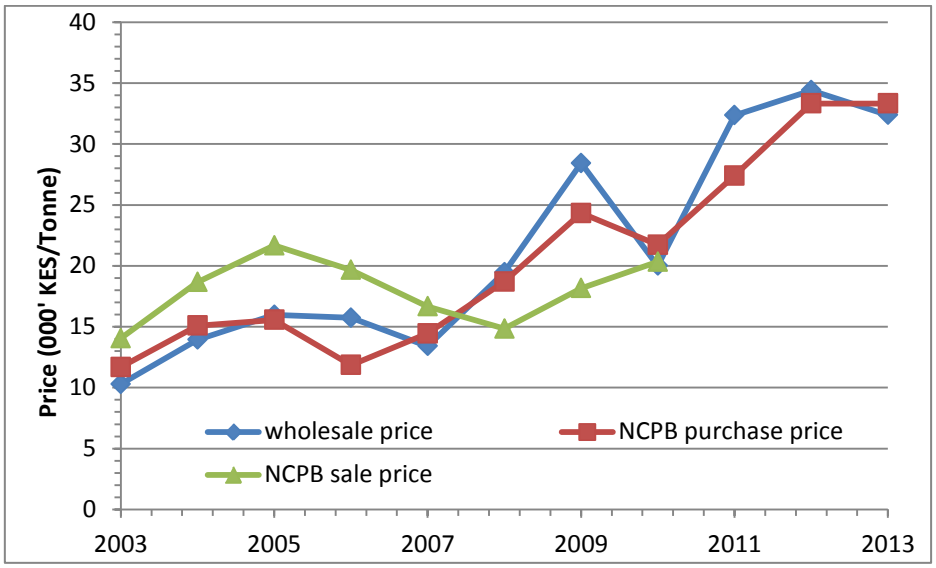
The NCPB purchases have been concentrated in the maize surplus regions where large millers also concentrate their buying activities in. The NCPB's cost of procurement is the amount paid to medium and large scale producers plus marketing costs. Sales at prices below the cost of procurement effectively create a wedge or gap between the prices paid to medium- and large-scale producers and that charged to consumers, raising the former and decreasing the latter. This effectively is a subsidy to medium and large scale producers, which tends to encourage their production, possibly putting downward pressure on market prices received by smallholders and their market share.

NCPB tends to increase its purchases in a good production seasons and reduces its purchases in a poor season to stabilize maize prices (Jayne, Myers, and Nyoro 2008). In 2008, the NCPB buying price was set at KES 1,950/90 kg bag, while the selling price was at between KES 1,435 and KES 1,835/90 kg bag. In 2008, the NCPB imported maize from South Africa at an average cost of KES 3,400/bag (4,800 with duty) and sold most at about KES 1,700/bag. This particular case was due to the high world food prices of 2008, which compelled the Kenya Government to mandate NCPB to sell subsidized grain to millers who would then sell at lower prices to consumers. However, the government was unable to enforce and monitor the millers due to unknown milling costs and consequently, prices of milled maize were not significantly lowered.

NCPB operations were often criticized. According to a recent media report, the operations of the NCPB have raised the producer? price of maize by fixing a price floor well above market levels, with the result that Kenya's maize prices are among the highest in Africa, without generating the expected supply response (todayfinancialnews.com, 2014). Indeed, NCPB purchase prices of maize are above the competing market prices for most of the years from 2003 to 2013 (Figure 5). Moreover, NCPB sold maize at subsidized price during 2008-2010 below its purchase price. The high maize price due to the NCPB activities has benefited a small number of small-scale maize farmers who are net sellers of maize, as well as large-scale commercial maize farmers. Although NCPB purchase only small fraction of maize, NCPB purchase price put an upward pressure on open market prices given that NCPB purchases extends over the period of May to January. Indeed, at the heart of future food policy issues in Kenya is the question of how to maintain adequate maize production incentives for specific producers—the large-scale and small-scale farmers for whom maize is a viable crop for commercialization—without taxing consumers and producers of other farm products through high maize prices.

The Kenyan government has put some taxes on cash crop commodities like sugar, tea and coffee. Such taxes affect the competitiveness of such commodities in local, regional and international markets. Apart from imports, maize being an essential commodity is not taxed.

Figure 5. National Cereal and Produce Board maize purchase and selling prices



Source: NCPB (2014) and Kirimi et al. (2011).

Maize trade policy under EAC Custom Union (CU)

The development of the maize sector in the region is critically associated with food security concerns. Achieving self-sufficiency in maize has been a common feature of the maize development strategy in the region, mainly in Kenya and Tanzania (Vitale, et al., 2013). This strategy has provided the rationale for the maize CET. Kenya, Tanzania and Uganda all have significant maize production, which has on average increased over the last years. The production cycle is rather complementary, as the main surplus areas have different harvesting periods, thus increasing the scope for cross-border trade.

With the adoption of the Common External Tariff (CET), maize entering Kenya from East African Community (EAC) member countries is exempt from tariff although an official 2.75percent duty is still assessed. The CET rate on imported maize of 50 percent is substantially higher than the tariffs applied by Kenya (25 percent) prior to the formation of the CU. As the case with other members of EAC, there were observed variations in applied rates for the three member countries due to the flexibilities envisaged in the CU Protocol. It was the global food crisis of 2008 that led Kenya and Tanzania to utilize the remission provision and remove the import duty on maize in the first half of that year. Kenya removed the duty again during January 2009 to June 2010 in response to a bad harvest and soaring domestic prices. In the face of a drought and poor harvest, Kenya again announced in 2011 Budget Speech duty-free imports of maize (Vitale, et al., 2013).

According to Vitale, et al. (2013), stakeholders do not hold uniform views on the maize CET. At the producers' level, opinions converge around the need for keeping tariff protection to safeguard and promote domestic production and farmers' livelihood. At the same time, there have been several instances in the past when policy rigidity, namely defending the maize import duty for too long, has exacerbated food supply imbalances into crisis, such as in Kenya in 2008 and early 2009. The 2008/2009 food crisis in Kenya demonstrates how a delayed trade policy response (not lifting the tariff) to an emerging food problem

contributed to the crisis. This has raised a controversial debate about the appropriate timing and length of the window for duty-free imports.

The discretionary policy tools used by the government to influence market prices and supplies have raised market uncertainty for traders through:

(i) frequent and unannounced changes in maize import tariff rates;

(ii) export bans; and

(iii) the behaviour of the NCPB, in particular the prices it sets for maize purchase and sale, and the funds allocated for this purpose by the Treasury, which then determine the extent to which the NCPB can defend its official pricing structure and influence market prices.

Nyoro et al. (2007), based on research from the Tegemeo Institute, highlights the anomalies in the policy objectives pursued by Kenya's National Cereals and Produce Board (NCPB). Kenya's marketing policy maintains higher producer prices aimed at raising incomes of the maize farmers, while at the same time hurting them as consumers since most of them are net maize buyers. The net effect of the tariff seems to be highly concentrated benefits for a small group of large farmers with anti-poor distributional effects. The authors note that even the pre-CU maize tariff of 25 percent is redundant because imported maize is rarely competitive even without tariff. A 2008 study by Jayne also supports this position. Jayne and Tschirley (2010) provide a detailed account of the 2008-2009 maize crisis in Kenya and conclude that when a government creates uncertainty over its import intentions or tariff rates during a poor crop season, the typical result is a temporary "under-provision" of imports, which produces price spikes beyond import parity levels and acute food shortages. A key message made is that discretionary use of trade policy instruments reduces incentives of the private sector to investment in agricultural productivity.

The National Accelerated Agricultural Inputs Access Program

In 2007, the Government of Kenya introduced the National Accelerated Agricultural Inputs Access Program implemented by the ministry of agriculture. The program aimed at enhancing maize production. The primary objective of NAAIAP is to improve input access and affordability of the key inputs for small holder farmers below poverty line. Apart from providing farmers with free farm inputs, the program also conduct farmer trainings, farm follow up visits and holds field days. All aimed at increasing maize production.

The NAAIAP was envisioned to address the problem of food insecurity and poverty among resource poor farmers with the stated objectives of improving access to and the affordability of key inputs for smallholders with less than one hectare of land. Fertilizer and improved maize seed were to be provided in a Kilimo Plus "starter kit" through a voucher redeemable at accredited local agro-dealers with the intention of building the capacity of agro-dealers and a better functioning fertilizer network concurrently (Sheahan, et al., 2014). To that end, the Kilimo Plus program was also designed to support agro-dealers through an accreditation process. Targeted farmers would receive the Kilimo Plus "starter kit" for two agricultural seasons before graduating to the Kilimo Biashara package where farmers would pay for inputs at the market price but receive subsidized credit from local financial institutions. It was envisioned that this two-step program would enable households to slowly build up their capacity to engage with the commercial fertilizer market and complementary financial services. Between the input subsidy and associated training provided by government extension services, the total cost per farmer of the originally proposed program was estimated at $211 (Government of Kenya 2006).

3. METHODOLOGY

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

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

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

The benchmark price is made comparable to the domestic price at wholesale by adding the access costs between the border and wholesale, resulting in the observed reference price at wholesale. This takes into account all the costs incurred by importers and other agents to bring the commodity to market, which in effect, raises the price of the commodity. The reference price at wholesale is further made comparable to the domestic price at the farm gate by deducting the access costs between the farm gate and wholesale, resulting in the observed reference price at farm gate. This takes into account all the costs incurred by farmers and other agents to bring the commodity from the farm to the wholesale market. Mathematically, the equations for calculating the observed reference prices at wholesale (RP_{owh}) and farm gate (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 chain[2] and imperfect functioning and non-competitive pricing in international markets, where possible and relevant. The adjusted benchmark prices and access costs are then used to generate a second set of *adjusted* reference prices, in addition to the first set of *observed* reference prices calculated.

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

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

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

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

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

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

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

A positive price gap, resulting when the domestic price exceeds the reference price, means that the policy environment and market functioning as a whole generate incentives (support) to producers or wholesalers.

[2] 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.

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[3]. 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.

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,

[3] 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.

government taxes and fees (excluding fees for services), high profit margins captured by various marketing agents, bribes and other non-tariff barriers. Therefore, the total MDG at farm gate is comprised of three components – gaps due to "excessive" access costs, the exchange rate policy gap and the international market gap. When added together, these components are equivalent to the difference between the observed and adjusted price gaps at farm gate.

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

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

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

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

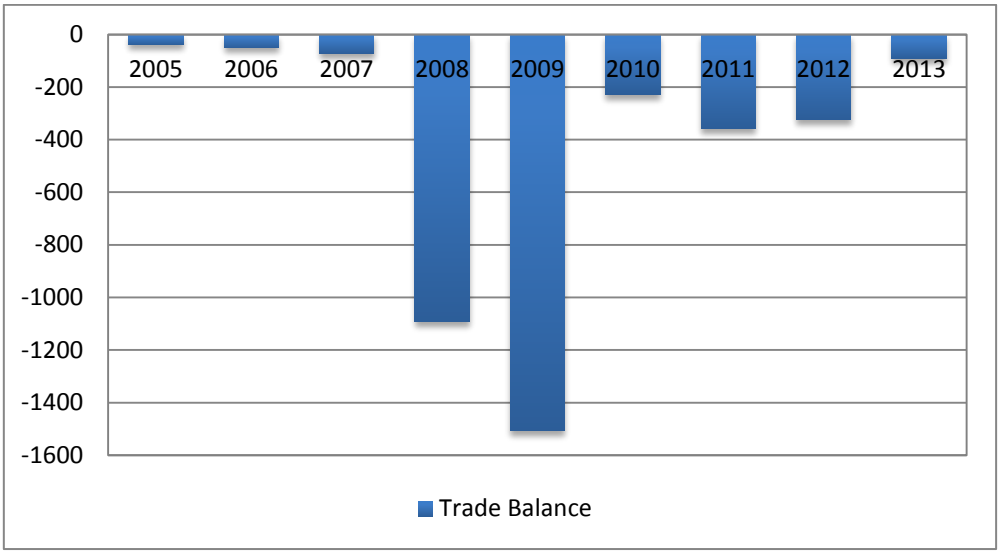
4. DATA REQUIREMENTS AND CALCULATION OF INDICATORS

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

TRADE STATUS OF THE PRODUCT

Kenya is a net importer of maize with a negative trade balance during the entire period of 2005-2013 (Figure 5). Imports represent 1- 43 percent of domestic production depending on the season and domestic production. For example, significant imports were recorded in 2008 and 2009 due to the poor harvest.

Figure 1. Trade balance of maize in Kenya (2005-2013)



Source: Authors' computation from data from KNBS, Economic Review (2008, 2010 and 2014)

MARKET PATHWAY ANALYSED

The analysis undertaken in this report focuses primarily on smallholder value chain during the period of 2005-2013. In this value chain, maize flows from surplus smallholder farms in producing regions through various channels to regional markets in surplus maize-producing districts such as Eldoret and Nakuru and to Nairobi where there is a greater concentration of consumers . Nairobi also receives maize from imports. Thus, it is considered as the point of competition.

The major exporters of maize to Kenya during the last three years include Tanzania, Malawi and Zambia. In addition, informal imports are sourced from Uganda (see Figure 3). In this analysis, the reference prices are estimated for maize imported through the port of Mombasa destined to Nairobi (at the point of competition) and at the farm gate in surplus maize-producing districts..

BENCHMARK PRICES

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

The CIF prices for all maize imports were considered as the benchmark price in this analysis. These prices were obtained from the annual publications of Kenya National Statistical Bureau's Economic Survey for 2008,

2010 and 2014 and reported in Table 3. As the price series indicates, the average CIF prices of maize imports into Kenya are quite variable over time and reflects the price volatility in the international markets. The highest price of maize imports was recorded in 2008 during the World Food Crisis. During this year, Kenya imported massive quantity of over a million ton of grain maize due to poor harvest.

Table 3. Benchmark price

	2005	2006	2007	2008	2009	2010	2011	2012	2013
	USD per Tonne								
Benchmark price	246.31	294.47	162.02	395.27	290.75	300.86	358.63	235.17	284.62

Source: KNBS, Economic Survey, 2008, 2010 and 2014.

DOMESTIC PRICES

Two domestic prices were required for this analysis – the price at the point of competition and the price at the farm gate.

Observed prices at point of competition

Nairobi was also assumed to be the point of competition for smallholders where domestic maize competes at world market prices. Therefore, the observed price at the point of competition is assumed to be the average annual wholesale price for maize in Nairobi, as reported by Kenya National Bureau of Statistics (KNBS) in its Economic Review for 2008, 2010 and 2014. The wholesale prices of maize in Kenya during the period of 2005-2013 are presented in Table 4. During the period of analysis, the wholesale price of maize has increased, nominally, from KES 15,970 in 2005 to KES 32,380 in 2013 (i. e., by over 100%). Surprisingly, the maize wholesale prices in 2007 fell dramatically despite the lower harvest in that year.

Table 4.Observed price at point of competition (Nairobi)

	Domestic prices (KES/Tonne)								
	2005	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**
Price at the point of competition	15,970	15,738	13,413	19,469	28,421	20,007	32,351	34,409	32,380
Producer price	15,237	15,353	15,664	24,454	23,913	17,214	24,999	33,960	31,332

Source: KNBS, Economic Survey, 2008, 2010 and 2014.

Observed prices at farm gate

The average prices of maize paid to producers in Kenya were reported the annual publications of Kenya National Statistical Bureau's Economic Survey for 2008, 2010 and 2014 (Table 4). The reported prices are very close to the wholesale prices in Nairobi but higher producer prices were recorded in 2007 -2008 coinciding with the poor harvests and high world market prices during the World Food Crisis. This is because the surplus production areas feed other deficiency areas beside Nairobi. Nairobi also has the advantage of receiving maize through imports and therefore is likely to be less sensitive to seasonal price hikes resulting from low domestic harvest.

Price comparison over time indicates generally low margins between farm-gate and wholesale maize grain prices. Low margins at this level suggest competition between buyers and assemblers in rural areas. This observation is consistent with conclusions reported by Kirimi et al. (2011), based on prices in Eldoret between 2007 and mid-2009, in that farmers were receiving between 80-85% of the wholesale price in

the same district. However, Kirimi et al. (2011) also attributed the low and declining margins to declining cost of transportation between the farm-gate and wholesale markets relative to the cost of the product.

EXCHANGE RATES

Observed

Average nominal exchange rates between the Kenya Shilling and the US Dollar were used in this analysis. The average rates for each year under review were obtained from the World Bank's World Development Indicators database and presented in Table 5.

Table 5. Average Nominal Exchange Rate (KES/USD)

2005	2006	2007	2008	2009	2010	2011	2012	2013
Exchange rate (KES/USD)								
75.6	72.1	67.3	69.2	77.4	79.2	89.1	84.5	86.1

Source: The World Bank's World Development indicators.

Adjusted

The observed (free market) exchange rate is believed to approximate the equilibrium exchange rate. Therefore, no adjustment was necessary.

ACCESS COSTS

Observed

The observed access costs accounts for all financial costs involved in the movement of the commodity from one point to another along the value chain. In the analysis, two segments are considered: from the border to the point of competition and from the farmgate to the point of competition.

Border to point of competition

The observed access costs from the border to the point of competition for maize represents the cost of importing the good from the world market into the wholesale market in Nairobi representing the point of competition. Since the point of entry of maize into Kenya is assumed to be Mombasa, the access costs from the border to the point of competition include the port charges paid to Grain Bulk Handlers Limited (GBHL) and Kenya Port Authority (KPA), transportation to Nairobi and handling in Nairobi. Kirimi et al. (2009) provided estimates of these costs for 2009 (Table 6). According to these estimates, a tonne of imported maize in 2009 costs USD 72.3 to land in Nairobi. Transportation cost from Mombasa to Nairobi represents the major cost item (USD 32.14 per tonne) which is approximately 44 percent of the total access cost for this segment. A part from import duty, the only fees paid on maize imports is the import declaration fee of 2.25 percent of the CIF price.

Table 6.Observed access costs from border to point of competition (KES/Tonne) in 2009

Cost item	Cost	
	USD/Tonne	KES/Tonne
Port Charges		
Stevedoring	6.50	506
Terminal handling	4.50	350
GBHL to warehouse bagged	4.00	311
Sub-total	**15.00**	**1167.11**
Kenya Port Authority Charges		
Stevedoring	1.50	117
Wharfage	2.00	156
Clearing Agency ($ 1-3 /tonne)	2.00	156
Warehousing Charges	6.43	500
Import Declaration Fee (2.25% of CIF)	5.81	452
Bagging	5.00	389
Shorehandling	1.00	78
Sub-total	**23.74**	**1846.67**
Transport to Nairobi	32.14	2,500
Handling	1.43	111
Total observed access costs (Border to point of competition)	**72.30**	**5625.11**

Source: Kirimi et al. (2009)

The access costs estimates in 2009 presented in Table 6 are used in this analysis to extrapolate the costs for other years (2005-2008 and 2010-20134). The import declaration fee is calculated as a percentage of the CIF price in each year and converted to domestic currency given the market exchange rate presented in Table 5. The dollar value of all other costs is converted to domestic currency for each year using the respective market exchange rate. The resulting access costs can be categorized into three categories: transport, handling and taxes and fees. Table 7 presents the observed access costs from the border to the point of competition.

Table 7. Observed access costs from the border to the point of competition for maize in Kenya.

	2005	2006	2007	2008	2009	2010	2011	2012	2013
	KES/Tonne								
Transport	2,430	2,317	2,163	2,224	2,487	2,545	2,863	2,716	2,767
Handling	2,597	2,477	2,312	2,378	2,672	2,721	3,061	2,903	2,958
Taxes and fees	419	478	245	615	452	536	719	447	551
Observed Access Costs	5,446	5,272	4,720	5,217	5,612	5,802	6,644	6,066	6,277

Source: Authors' extrapolation from data in Table 6.

Farm gate to point of competition

Marketing margins reflect the cost of moving a good from surplus to deficit areas as well as the costs of storage and processing from one stage to the next in the value chain. The World Bank (2009) study of the regional maize market and marketing costs provides detailed data of the marketing costs of maize in Kenya in 2008 covering the costs in the primary, secondary and teritiary (wholesale) markets (Table 8). In this

estimate, the districts of Nakuru and Eldoret (North Rift) were selected to represent the producing zones of Kenya (with the primary market located in Moiben) while Nairobi is proxied as the urban area. Based on the survey of farmers, traders and transporters carried out for this study, the total marketing costs along the domestic supply chains were found to average US$ 85.45 per tonne. Given the domestic prices in 2008, the average derived margin between farm-gate and wholesale prices in Nairobi[4] was US $95.60 per tonne. The estimated marketing costs are about 89 percent of the derived margin. The remaining 11 percent (or 4 percent of the wholesale price) are not only profit margins of traders as this may include (i) costs omitted such as trader licenses and other permits; (ii) differences in distances between farm-gate and wholesale markets; (iii) difference in modes of transportation that imply variance in transport prices; and (v) errors, including those of in price estimates. As pointed out before, this suggests that traders' margins are quite small.

Table 8. Observed access costs of maize sold by traders along the domestic supply chain in 2008.

Cost item	Costs	
	USD/Tonne	KES/Tonne
Farm Gate to Primary Market		
Storage/rental fee	2.10	145
Transportation charges	1.80	125
Hired labor loading/unloading	1.42	98
Council cess	3.13	217
Roadblocks and weighbridges	0.93	64
Primary to Secondary Market		
Storage/rental fee	2.50	173
Transportation charges	16.76	1,159
Hired labor loading/unloading	5.70	394
Council cess	1.35	93
Roadblocks and weighbridges	3.34	231
Drying tent/empty bags	1.50	104
Secondary to Wholesale Market		
Storage/rental fee	2.80	194
Transportation charges	30.04	2,078
Hired labor loading/unloading	6.27	434
Council cess	2.85	197
Roadblocks and weighbridges	2.96	205
Estimated margin	10.15	702
Total observed costs from the farm-gate	**95.60**	**6,613**

Source: World Bank (2009).

The itemized costs in Table 8 are used as the basis for extrapolating the marketing costs in the domestic maize markets in Kenya for 2005-2013. First, the above costs in local currency are considered as the access costs in the base year (2008). Then, the dollar costs of 2008 are converted in local currency in each year using the observed exchange rate (see Table 5). Table 9 summarizes the estimated access costs from the farmgate to the wholesale market in Nairobi (the point of competition) for 2005-2013.

Table 9.Observed access costs from farm-gate to point of competition (KES/Tonne)

[4] The absolute difference between the farm-gate price and the wholesale price in 2008.

	2005	2006	2007	2008	2009	2010	2011	2012	2013
	KES/Tonne								
Transport	3,672	3,504	3,272	3,362	3,759	3,851	4,325	4,107	4,186
Margins	639	630	537	702	1,137	800	1,294	1,376	1,295
Handling	1,684	1,607	1,501	1,542	1,724	1,766	1,984	1,884	1,920
Taxes and fees	1,100	1,050	980	1,007	1,126	1,154	1,296	1,230	1,254
Total Observed Access Cost	7,095	6,790	6,289	6,613	7,746	7,570	8,899	8,597	8,655

Source: Extrapolated from data in Table 8.

Adjusted access costs

Border to point of competition

For maize imports in Kenya through Mombasa port, the only fees charged is the import declaration fee which is considered as a form of taxation although small. As such, the adjusted access costs from the border to the point of competition differ from the observed costs in excluding this tax. Table 10 presents the adjusted access costs from border to the point of competition. These covers two major cost categories, namely transport from Mombasa to Nairobi and handling at the port.

Table 2. Adjusted access costs from border to point of competition for maize in Kenya

	2005	2006	2007	2008	2009	2010	2011	2012	2013
	KES/Tonne								
Transport	2,430	2,317	2,163	2,224	2,487	2,545	2,863	2,716	2,767
Handling	2,597	2,477	2,312	2,378	2,672	2,721	3,061	2,903	2,958
Observed Access Costs	5,027	5,190	5,141	5,633	6,271	6,467	7,332	7,575	7,897

Source: Extrapolated from data in Table 7.

Farm gate to point of competition

As Table 8 indicates, maize is subject to a local tax known as council cess at each marketing stage. In addition, non-tariff barriers in form of payments at roadblocks and weighbridges exist at the three stages of the market. These are significant costs amounting to 14-16 percent of the domestic marketing cost. Since it reflects the social cost of maize marketing, the adjusted access costs from the farm-gate to the point of competition omit these transfers. Table 11 presents the adjusted access costs for this segment.

Table 3. Adjusted access costs from farm-gate to point of competition

	2005	2006	2007	2008	2009	2010	2011	2012	2013
	KES/Tonne								
Transport	3,672	3,504	3,272	3,362	3,759	3,851	4,325	4,107	4,186
Margins	639	630	537	702	1,137	800	1,294	1,376	1,295
Handling	1,684	1,607	1,501	1,542	1,724	1,766	1,984	1,884	1,920
Total access Cost	5,995	5,741	5,309	5,606	6,620	6,417	7,603	7,367	7,401

Source: extrapolated from data in Table 8.

BUDGET AND OTHER TRANSFERS

Kenya policy supports maize in a variety of ways. Maize research is publicly funded through funding of the now Kenya Agriculture and Livestock Research Organization (KALRO). The government also supports maize through its support to group of commodities and cross-cutting agricultural activities such as extension and farmers' training. More recently, the government of Kenya introduced the National Accelerated Agricultural Inputs Access Program (NAAIAP) implemented by the ministry of agriculture in 2007 to enhance maize production and productivity. Based on public expenditure in support of agriculture analysis in Kenya, budget transfers through NAAIAP were identified (Table 12). These transfers span for four years (2006/07-2009/10) and were specific to maize in the form of fertilizer subsidy. As mentioned above, there are other types of transfers that are not specific to maize. The proportion of the expenditure allocated to maize (e.g., through research, extension and other services) is difficult to determine. The public expenditure database does not show any expenditure specific to maize in 2005/06 and 2010/11-2012/13, i.e., support to maize is only through non-specific maize funding. Therefore, these estimates should be considered as the minimum support to maize.

Table 12: Budget Transfers specific to maize in Kenya (2006/07 – 2009/10)

	2005/06	2006/07	2007/08	2008/09	2009/10	2010/11	2011/12	2012/13
Total exp (Million KES)	0	250	639	2,450	1,596	0	0	
Production (000 Tonne)	2,906	3,247	2,930	2,367	2,439	3,465	3,377	3,603
Per Unit (KES/Tonne)	0	85	270	1,005	461	-	-	-

Source: MAFAP Public Expenditure Analysis in Kenya (2014)

QUALITY AND QUANTITY ADJUSTMENTS

Imported maize is probably of a higher and more uniform quality than Kenya maize or that imported from Uganda and Tanzania. This makes it more attractive to large-scale millers. However, this relationship is not quantified, so quality differences were not accounted for in the analysis. This analysis only considers grain maize and therefore, no quantity adjustment is considered.

DATA OVERVIEW

Following the discussions above, the main data sources used and methodological decisions taken for the analysis are summarized in Table 13. Table 14 presents the data used in estimating the price incentives indicators. The estimated observed and adjusted price gaps, the observed and adjusted nominal rate of protection and nominal rates of assistance and the market development gap at the farm gate are summarized in Table 15, Table 16 and table 17, respectively.

Table 13: Data sources and methodological decisions

		Description	
Concept		***Observed***	***Adjusted***
Benchmark price		*The CIF prices for all maize imports, considered as the benchmark price in this analysis, obtained from the annual publications of Kenya National Statistical Bureau's Economic Survey for 2008, 2010 and 2014 (see Table 3)*	*Not Applicable (N.A)*
Domestic price at point of competition		*Annual average wholesale price for maize in Nairobi reported by Kenya National Bureau of Statistics (KNBS) in its Economic Review for 2008, 2010 and 2014 (see Table 4)*	*N.A.*
Domestic price at farm gate		*The average prices of maize paid to producers in Kenya reported in the annual publications of Kenya National Statistical Bureau's Economic Survey for 2008, 2010 and 2014 (see Table 4).*	*N.A.*
Exchange rate		*Average nominal exchange rates obtained from the World Bank's World Development Indicators database (see Table 5).*	
Access cost from the point of competition to the border		*Extrapolated from data reported in Kirimi et al. (2009) covering the port charges paid to Grain Bulk Handlers Limited (GBHL) and Kenya Port Authority (KPA), transportation to Nairobi and handling in Nairobi (see Table 6).*	*Extrapolated from data reported in Kirimi et al. (2009) covering the port charges paid to Grain Bulk Handlers Limited (GBHL) and Kenya Port Authority (KPA), transportation to Nairobi and handling in Nairobi and excluding import declaration fees (see Table 6).*
Access costs from the point of competition to farm gate		*Extrapolated from detailed data of marketing costs of maize in Kenya in 2008 covering the costs in the primary, secondary and tertiary (wholesale) markets reported in The World Bank (2009) study of the regional maize market and marketing costs provides (see Table 9).*	*Extrapolated from the observed access costs by excluding local cess and levies (see Table 11)*
QT adjustment	Bor-PoC	*N.A.*	*N.A.*
	PoC -FG	*N.A.*	*N.A.*
QL adjustment	Bor- PoC	*N.A.*	*N.A.*
	PoC -FG	*N.A.*	*N.A.*

Table 14. Data used in the analysis of the price incentives to small-scale maize producers in Kenya (2005-2013)

DATA		Unit	Symbol	Year trade status	2005 m	2006 m	2007 m	2008 m	2009 m	2010 m	2011 m	2012 m	2013 m
Benchmark Price													
	Observed	US $/TON	$P_{b(int\$)}$		**246.31**	**294.47**	**162.02**	**395.27**	**290.75**	**300.86**	**358.63**	**235.17**	**284.62**
	Adjusted	US $/TON	P_{ba}										
Exchange Rate													
	Observed	KES/US$	ER_o		75.60	72.10	67.30	69.20	77.40	79.20	89.10	84.50	86.10
	Adjusted	KES/US$	ER_a										
Access costs border - point of competition													
	Observed	KES/TON	ACo_{wh}		5,446	5,272	4,720	5,217	5,612	5,802	6,644	6,066	6,277
	Adjusted	KES/TON	ACa_{wh}		5,027	5,190	5,141	5,633	6,271	6,467	7,332	7,575	7,897
Domestic price at point of competition		KES/TON	P_{dwh}		**15,970**	**15,738**	**13,413**	**19,469**	**28,421**	**20,007**	**32,351**	**34,409**	**32,380**
Access costs point of competition - farm gate													
	Observed	KES/TON	ACo_{fg}		7,095	6,790	6,289	6,613	7,746	7,570	8,899	8,597	8,655
	Adjusted	KES/TON	ACa_{fg}		5,995	5,741	5,309	5,606	6,620	6,417	7,603	7,367	7,401
Farm gate price		KES/TON	P_{dfg}		15,237	15,353	15,664	24,454	23,913	17,214	24,999	33,960	31,332
Externalities associated with production		KES/TON	E										
Budget and other product related transfers		KES/TON	BOT		-	-	250.00	639.00	2,450.00	1,596.00	-	-	-
Quantity conversion factor (border - point of competition)		Fraction	QT_{wh}										
Quality conversion factor (border - point of competition)		Fraction	QL_{wh}										
Quantity conversion factor (point of competition - farm gate)		Fraction	QT_{fg}										
Quality conversion factor (point of competition - farm gate)		Fraction	QL_{fg}										

SUMMARY OF INDICATORS

Table 15. MAFAP Price Gaps for Maize in Kenya, (KES/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	(8,097)	(10,765)	(2,211)	(13,101)	305	(9,623)	(6,247)	8,471	1,597
Adjusted price gap at point of competition	(7,678)	(10,287)	(1,966)	(12,485)	757	(9,087)	(5,528)	8,918	2,149
Observed price gap at farm gate	(1,735)	(4,359)	6,329	(1,502)	3,544	(4,846)	(4,699)	16,619	9,204
Adjusted price gap at farm gate	(2,416)	(4,932)	5,594	(1,894)	2,869	(5,463)	(5,276)	15,836	8,501

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

Table 4 : MAFAP Nominal Rates of Protection and Assistance Maize in Kenya, (percent), 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	-33.6%	-40.6%	-14.2%	-40.2%	1.1%	-32.5%	-16.2%	32.7%	5.2%
Adjusted NRP at point of competition	-32.5%	-39.5%	-12.8%	-39.1%	2.7%	-31.2%	-14.6%	35.0%	7.1%
Observed NRP at farm gate	-10.2%	-22.1%	67.8%	-5.8%	17.4%	-22.0%	-15.8%	95.8%	41.6%
Adjusted NRP at farm gate	-13.7%	-24.3%	55.5%	-7.2%	13.6%	-24.1%	-17.4%	87.4%	37.2%
Observed NRA at farm gate	-10.2%	-22.1%	70.5%	-3.3%	29.4%	-14.7%	-15.8%	95.8%	41.6%
Adjusted NRA at farm gate	-13.7%	-24.3%	58.0%	-4.8%	25.3%	-17.1%	-17.4%	87.4%	37.2%

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

Table 5. MAFAP Market Development Gaps for Maize in Kenya, (percent), 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)	419	82	(420)	(417)	(660)	(664)	(689)	(1,509)	(1,620)
Access costs gap to farm gate	(1,100)	(1,050)	(980)	(1,007)	(1,126)	(1,154)	(1,296)	(1,230)	(1,254)
Market Development Gap	(681)	(968)	(1,401)	(1,424)	(1,786)	(1,818)	(1,985)	(2,739)	(2,874)
MDG as % of reference price	-3.9%	-4.7%	-13.0%	-5.2%	-8.1%	-7.6%	-6.3%	-13.6%	-11.5%

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

5. RESULTS AND INTERPRETATION

Table 15-17 summarize the set of MAFAP indicators generated, which include price gaps, nominal rates of protection (NRPs) and nominal rates of assistance and market development gaps (MDGs). Price gaps are market price differentials between the domestic and reference prices of the commodity in each year. More conceptually, they provide an absolute measure of price incentives or disincentives that maize producers face, while NRPs express this absolute measure as ratios that are comparable across countries and commodities. MDGs measure distortions in the value chain, such as excessive access costs, which affect price incentives for producers and wholesalers.

At the point of competition represented by the wholesale market of Nairobi, the price incentives indicators are generally negative and quite variable over time, suggesting that the sale prices at this market level are consistently below the reference prices despite the occasional tariff imposed on maize imports. The observed price gap was almost zero in 2009 and becoming positive only in the last two years (2012-13) as shown in Figure 6. On the other hand, the price gap is only positive in 2012 but close to zero in 2009 and 2013 (Table 15).

Nominal rate of protection at the point of competition, naturally, follows the same trends as the price gap. The observed NRP ranges from -40.6 percent in 2006 to 32.7 percent in 2012 and averaged -15.4 percent over the entire period of analysis (Figure 7). The adjusted NRP ranges from -41.0 percent in in 2008 to 25.4 percent in 2012 and averaged -17.5 percent over the period of analysis (Table 16). Whether positive or negative, both indicators suggest that domestic wholesale price of maize in Kenya significantly deviate from its reference price.

As the observed indicators measure the extent to which government intervention and market functioning affect the domestic price of a commodity, the difference between the observed and the adjusted indicators above is due to the tax levied on maize imports in the form of import declaration fee[5]. However, these differences in the case of maize in Kenya appear to be rather small amounting to 2.25 percent of the CIF price of maize. Such policy transfers at the upper level of the value chain (the import market) tend to increase the importation cost and lower the absolute value of the estimated indicators.

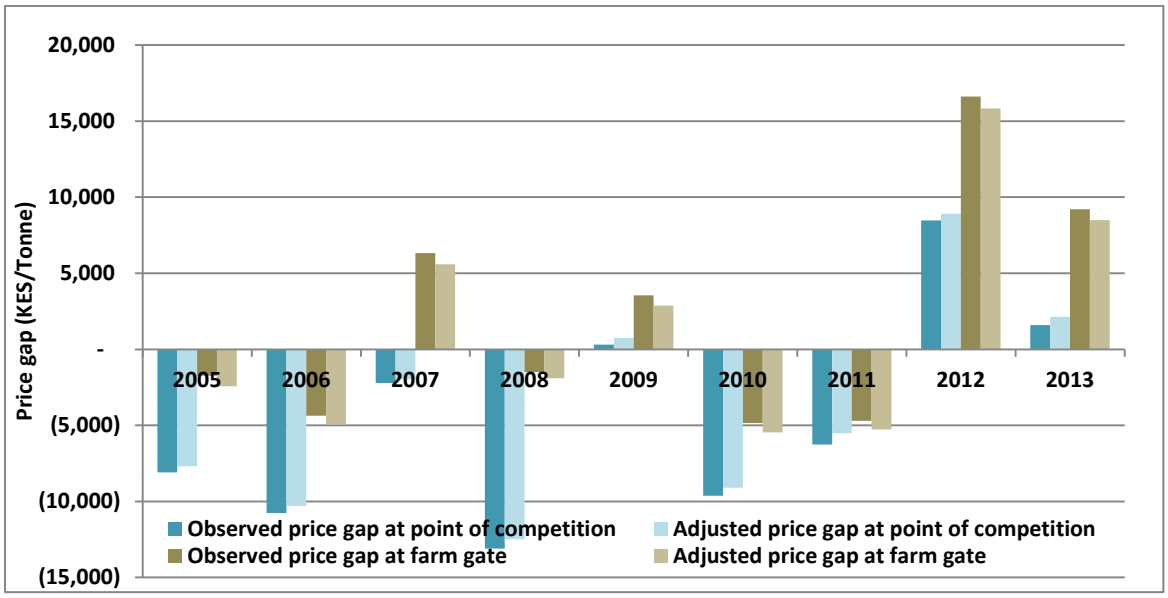
At the producer level, the price incentives indicators are not much different. Negative prices gaps, generally characterizing the period of 2005-2011 were interrupted by moderate positive gaps in 2007 and 2009 (Figure 6). The observed and adjusted nominal rates of protection indicate high producer incentives in 2007, 2009, 2012 and 2013 as high as 96 percent above the reference price. The observed nominal rate of protection averaged 16.3 percent while the adjusted nominal rate of protection averaged about 12 percent. The difference is due to council cess charged on maize sales and non-tariff barriers at the roadblocks and weighbridge at the primary, secondary and tertiary maize markets as reported by the World Bank (2009). These types of marketing costs tend to reduce farm gate prices by KES 393 (USD 5.7) to KES 735 (USD 10.91) per tonne.

Domestic production fell significantly in 2007-2009 leading to significant price surge at the farm-gate and the wholesale due to shortage. In 2008, Kenya made substantial imports to close the gap and to moderate the

[5] Inefficiencies associated with the value chain, such as excessive profit margins and excessive transportation costs above what is perceived as normal, is not present in this case.

rising prices. The supply situation was made worse by the 2009 drought and the

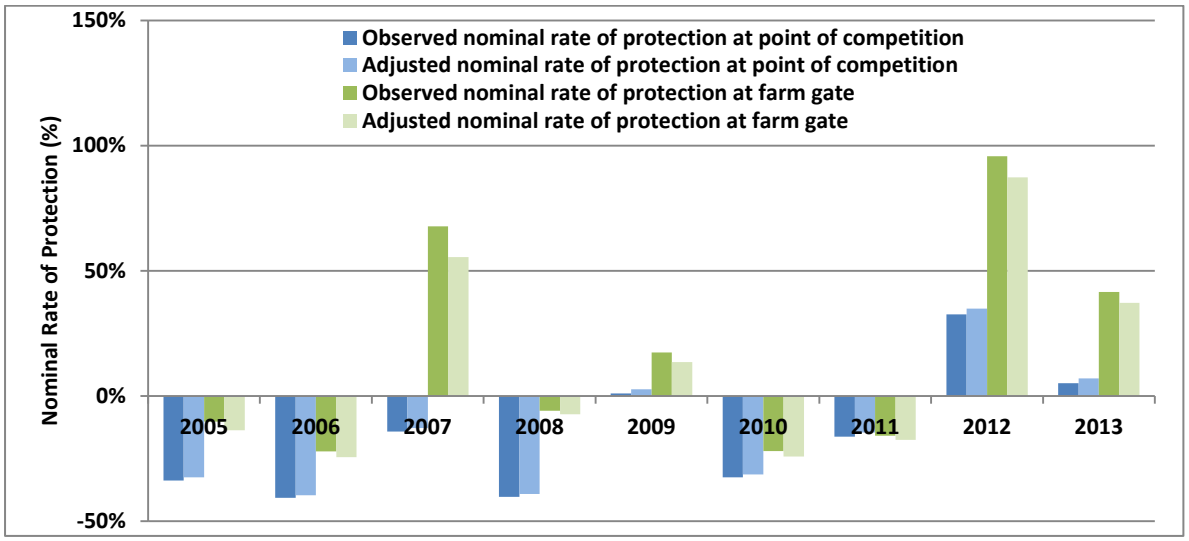
Figure 6. The estimated price gaps for maize in Kenya (2005-2013)



Source: MAFAP results.

resulting low harvest. As a result, moderate gains in incentives to maize producers in 2007 and 2009 were recorded (Figure 7) with relatively low level of disincentives in 2008. The high level of incentives in 2012-2013 may resulted from the high producer and wholesale prices influenced by the limited maize imports and high purchase prices of NCPB in these two years.

Figure 7. The estimated Nominal Rate of Protection for maize in Kenya (2005-2013)

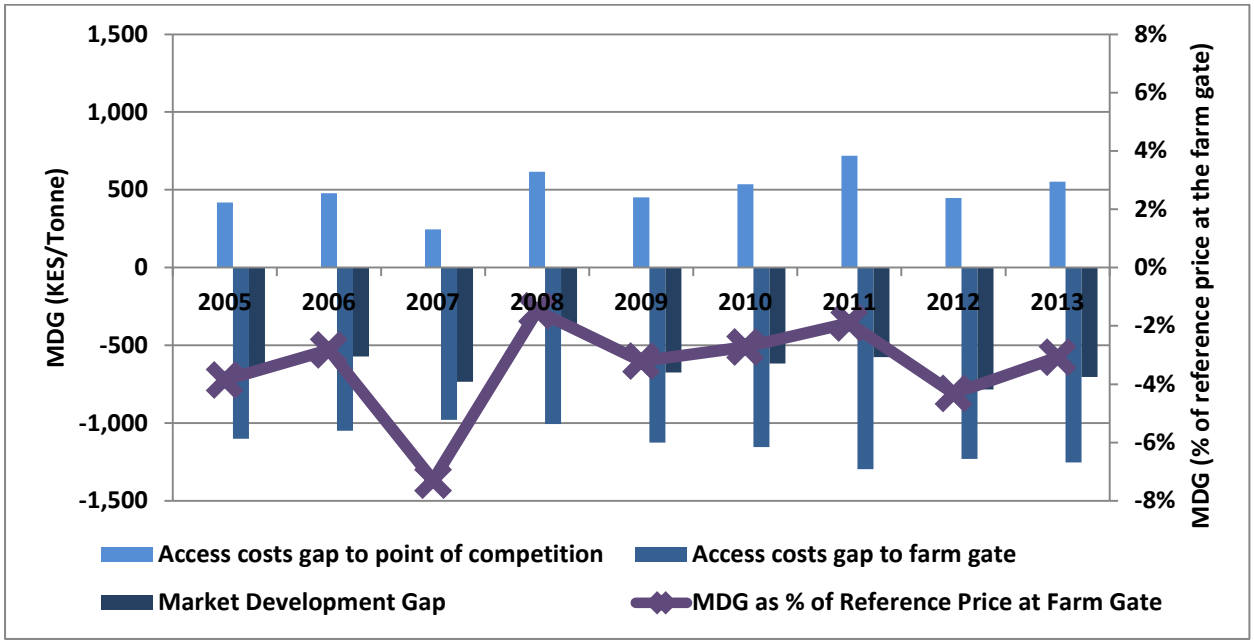


Source: MAFAP results.

The National Accelerated Agricultural Inputs Access Program (NAAIAP) introduced by the government of Kenya represents additional budget transfers to maize producers through provision of inputs. The project spans four years (2006/07-2009/10). These transfers moderated the negative impact of price disincentives during most of this period as the nominal rate of assistance suggests (Table 16). In contrast to the nominal rates of protection, the incentives to producers increase (or the disincentives decreased) by 3-12 percent during the same period. However, for such programs to be effective in improving maize productivity, a longer duration and wider coverage may be needed.

Maize markets in Kenya are characterized by two sources of inefficiencies. At the upper level of the value chain, indirect taxation of imports in the form of fees and levies paid for port handling, market development gap tend to be positive but small (Table 17). This transfer adds to the cost of maize imports with a net effect being an increase in cost of maize imports. This market development gap between the border and wholesale represent marginal increase in the wholesale price because they actually raise the cost of bringing maize imports from their point of entry to the wholesale market and, therefore, act as natural protection (positive MDGs). These inefficiencies are reflected in the access costs gaps to wholesale shown in Figures 8. At the lower level of the value chain, producer price is being reduced by council cess and non-tariff barriers. The net effect of is a negative market development gap of about USD 14.55 per tonne or 1.5 to 7.3 percent of the reference price at the farm gate.

Figure 7. The estimated Market Development Gap for maize in Kenya (2005-2013)



Source: MAFAP results.

Based on the correlation matrix presented in Table 18, we note the following:

1. Strong positive correlation exists between the producer price and the wholesale price estimated correlation coefficient of 0.9. Both prices were strongly and positively correlated with the NCPB purchase price of maize with a correlation coefficient of slightly above 0.9. This suggest that NCPB purchase price represents a price ceiling for maize markets that is closely followed by the wholesale markets and consequently determines producer prices (see Figure 5). This domestic price determination caused by NCPB pricing, combined by the tendency of NCPB to sell maize at subsidized prices to millers, makes the NCPB purchase price often a price ceiling. As a result, the

domestic prices were often kept below the equivalent world price resulting in disincentives to producers.

2. Producer prices, wholesale prices at the point of competition and NCPB purchase prices are only moderately positively correlated with the CIF price of maize with correlation coefficients of 0.39, 0.53 and 0.41, respectively. NCPB purchase price is apparently not based on import parity of maize in Kenya. Consequently, both the wholesale markets and producer prices tend to be isolated to a degree from the world markets by the price set by NCPB. However, under exceptional circumstances, maize markets do interact, but only for brief periods, with world markets. Major events, such as political unrest in 2007/2008 and a subsequent drought in 2009, resulted in maize shortages, high prices and an increase in imports. Sub-national markets became much more integrated, and prices were determined more by international prices than by NCPB prices in the various regional markets. Consequently, these events generated positive incentives to smallholder maize producers in 2007 and 2009 (Figure 7).

3. Applied tariff has negative but week correlation with the producer and wholesale price with a correlation coefficients of -0.21, and -0.29, respectively. However, moderate to strong negative correlation exists between the applied tariff rate and the CIF price. This suggests that the waiver of the tariff is based on these prices. Apparently, the government waive or reduce the tariff on maize imports during high producer and wholesale prices resulting from maize shortage, and high world prices. Obviously, this is inconsistent with the usual use of the tariff instrument to protect domestic producers. Consequently, the discretionary use of the tariff as a policy instrument is targeting consumers rather than producers of maize. Given that the NCPB purchase price, the major determinant of the wholesale and producer price of maize, is only moderately related to CIF price of maize, the applied tariff has no impact on producers. To the extent of NCPB maize subsidy to millers, tariff may only influence consumers.

4. Surprisingly, domestic production of maize has only moderate and negative correlation with imports and positive relationship with the applied tariff. This suggests that the government of Kenya lift or reduce the tariff when production is low to allow the import of low costs maize to close for maize deficit. For instance, in 2009, Kenya waived its tariff on imports from outside the EAC, allowing millers and wholesalers to import maize duty-free from world markets. This resulted in a Nairobi wholesale price that was very close to the import parity price throughout the year. As a result, the nominal rate of protection at the point of competition in this year approached zero.

5. Consequently, producer incentives is positively affected by the NCPB purchase price through its influence on producer prices and negatively affected by the CIF price of maize. The tariff as a policy instrument to protect domestic producers, appears to be ineffective to increase producers' incentives as indicated by the low correlation with the adjusted NRP at the farm-gate. This is probably due to the frequent adjustment of the tariff rate particularly when world market prices of maize are high. Both production and imports have no influence on producers' incentives (Table 18).

Table 18. The correlation matrix of factors influencing maize markets in Kenya

	Product-ion	Imports	CIF	Producer price	Wholesale price	Applied tariff	NCPB purchase price	Adjusted NRP (farm-gate)	Adjusted NRP (wholesale)
Production	1	-0.64	0.00	0.04	0.20	0.49	0.21	0.07	0.20
Imports		1	0.31	0.24	0.22	-0.81	0.11	-0.05	0.09
CIF price			1	0.39	0.53	-0.63	0.41	-0.53	-0.13
Producer price				1	0.90	-0.21	0.92	0.55	0.77
Wholesale price					1	-0.29	0.95	0.35	0.77
Applied tariff						1	-0.11	0.29	0.08
NCPB purchase price							1	0.46	0.79
Adjusted NRP (farm-gate)								1	0.83
Adjusted NRP (wholesale)									1

Note. The above correlation coefficients are calculated from a relatively short time series of 9 years (2005-2013).

Source: Authors' calculation.

The Government of Kenya faces a dual challenge in achieving its major short and medium term policy objective for maize of maintaining its availability at stable, affordable prices for Kenyan consumers. Maintaining the availability of maize requires providing reasonable incentives to producers to improve maize productivity which may not necessarily be consistent with keeping the prices affordable to consumers. Kenyan maize policy have relied on two main instruments to influence prices and supplies, namely, procurement of maize by the state-run National Cereals and Produce board and then sells it as a lower government subsidized rate; and the use of tariffs on maize imports.

The above discussion suggest that the main policy instrument used to affect market prices of maize in Kenya is the trading activities of the NCPB. It does this through purchasing grain and selling it to millers often at a subsidized price. This was most obvious in 2008 and 2009, when selling prices were actually below purchase prices. But even in other years when the selling price is greater than the purchase price, there will be a subsidy if the NCPB does not cover all of its unknown marketing costs. In addition to lowering producer prices and consequently lower or negative nominal rates of protection, these subsidies causes also uncertainty of market prices for traders.

Combining the NCPB pricing and selling practices with the discretionary use of tariff is a major source of uncertainty. When a government creates uncertainty over its import intentions or tariff rates during a poor crop season, the typical result is a temporary "under- provision" of imports, which produces price spikes beyond import parity levels and acute food shortages (Jayne and Tschirley, 2010). A key message made is that discretionary use of pricing and trade policy instruments reduces incentives of the private sector to investment in agricultural productivity.

Clearly, these policy instruments serve to lower maize prices for consumers, one of the intended government policy objectives. However, this policy failed to provide the intended incentives to producers to promote increased maize production and higher productivity, given that NCPB purchase price is not strongly linked to the world market. To promote increased production and higher productivity of maize and efficient allocation of resources being based at comparative advantage, NCPB should set its price at the import price parity of maize and avoid selling maize at subsidized prices to millers.

6. CONCLUSION AND RECOMMENDATIONS

MAIN MESSAGE

Kenya has had to cope with tremendous instability in its maize market since 2005. This instability was driven by domestic factors, such as shocks to production caused by political unrest in 2007/2008 and a subsequent drought in 2009. These extraordinary events resulted in a large maize deficit, an increase in duty-free imports and high domestic prices. During this period, the Nairobi maize market seemed to be much more integrated with sub-national and international markets than in other years. Consequently, domestic maize prices were close to the import parity in 2008 and 2009. Although the maize sector appears to have recovered in recent years, domestic prices continued to rise despite the declining maize prices in the world market since 2012. As the maize sector is facing complex policies and may be contradictory government policies, the result is generally price disincentives to maize producers in most of years from 2005 to 2013.

The major driving force influencing producers' incentives is the NCPB's activities in stabilizing prices for consumers and lowering prices for millers. However, these activities together with the discretionary use of the tariff present the major constraints to align domestic prices with world market which explain patterns of the price disincentives to producers during most of the period of analysis. Finally, the MDGs that could be identified were relatively small and seemed to have a marginal impact on the overall level of incentives (or disincentives) received by farmers. It is likely, however, that large MDGs are in fact present; otherwise there would have been evidence that sub-national markets are better integrated.

RECOMMENDATIONS

The main policy instrument used to affect market prices of maize in Kenya is the trading activities of the NCPB combined with the discretionary use of tariff. While the Government of Kenya may manage to stabilize consumers' price and lower the price of maize flour at the retail, such policy causes price disincentives to producers. This would discourage producers' incentives to invest in productivity improvement.

The Government of Kenya needs to consider a maize policy that will allow for free alignment of domestic prices with world markets and thus reducing producers' disincentives and provide an enabling environment for an efficient resource allocation. To achieve this goal, NCPB purchase pricing which influence domestic market prices should be based on import price parity. Moreover, the discretionary use of the tariff should be avoided to reduce market uncertainty. Finally, to protect consumers from surging prices, the government may rely on alternative targeted mechanisms such as food stamps.

LIMITATIONS

All results and conclusions provided are contingent on the quality of the data. Wholesale price data for a number of market centers and benchmark trade data are relatively good and available on a monthly basis. Although not published on a monthly or regional basis, the farm level price data is published annually by Kenya Bureau of Statistics as the average price paid to producers. However, marketing costs from the farm-gate to wholesale and from the border to the point of competition (cost of import) are each available only for a single year. More recent data on these are needed for future extension of this analysis.

FURTHER INVESTIGATION AND RESEARCH

There are a number of areas where further research would be useful:

- Further investigate the effects NCPB's activities have on different agents in Kenya's maize value chains. Greater transparency on the cost of NCPB operations is certainly needed.;
- Produce better estimates of NCPB subsidies to measure the nominal rate of assistance for producers. Investigate further how NCPB activities affect different types of farmers (e.g. medium and large farms, small farms and farms which do not market maize), and investigate seasonal and regional impacts;
- Consider additional indicators for impacts on consumers and food security.

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ANNEX I: Data and calculations used in the analysis

DATA		Unit	Symbol	Year	2005	2006	2007	2008	2009	2010	2011	2012	2013
				trade status	m	m	m	m	m	m	m	m	m
Benchmark Price													
	Observed	US $/TON	$P_{b(int\$)}$		**246.31**	**294.47**	**162.02**	**395.27**	**290.75**	**300.86**	**358.63**	**235.17**	**284.62**
	Adjusted	US $/TON	P_{ba}										
Exchange Rate													
	Observed	KES/US$	ER_o		75.60	72.10	67.30	69.20	77.40	79.20	89.10	84.50	86.10
	Adjusted	KES/US$	ER_a										
Access costs border - point of competition													
	Observed	KES/TON	ACo_{wh}		5,446	5,272	4,720	5,217	5,612	5,802	6,644	6,066	6,277
	Adjusted	KES/TON	ACa_{wh}		5,027	4,794	4,475	4,601	5,160	5,266	5,925	5,619	5,725
Domestic price at point of competition		KES/TON	P_{dwh}		**15,970**	**15,738**	**13,413**	**19,469**	**28,421**	**20,007**	**32,351**	**34,409**	**32,380**
Access costs point of competition - farm gate													
	Observed	KES/TON	ACo_{fg}		7,095	6,790	6,289	6,613	7,746	7,570	8,899	8,597	8,655
	Adjusted	KES/TON	ACa_{fg}		5,995	5,741	5,309	5,606	6,620	6,417	7,603	7,367	7,401
Farm gate price		KES/TON	P_{dfg}		15,237	15,353	15,664	24,454	23,913	17,214	24,999	33,960	31,332
Externalities associated with production		KES/TON	E										
Budget and other product related transfers		KES/TON	BOT		-	-	250	639	2,450	1,596	-	-	-
Quantity conversion factor (border - point of competitio		Fraction	QT_{wh}										
Quality conversion factor (border - point of competition)		Fraction	QL_{wh}										
Quantity conversion factor (point of competition - farm g		Fraction	QT_{fg}										
Quality conversion factor (point of competition - farm ga		Fraction	QL_{fg}										

CALCULATED PRICES		Unit	Symbol	2005	2006	2007	2008	2009	2010	2011	2012	2013
Benchmark price in local currency												
	Observed	KES/TON	$P_{b(loc\$)}$	18,621	21,231	10,904	27,353	22,504	23,828	31,954	19,872	24,506
	Adjusted	KES/TON	$P_{b(loc\$)a}$	18,621	21,231	10,904	27,353	22,504	23,828	31,954	19,872	24,506
Reference Price at point of competition												
	Observed	KES/TON	RPo_{wh}	24,067	26,503	15,624	32,570	28,116	29,630	38,598	25,938	30,783
	Adjusted	KES/TON	RPa_{wh}	23,648	26,025	15,379	31,954	27,664	29,094	37,879	25,491	30,231
Reference Price at Farm Gate												
	Observed	KES/TON	RPo_{fg}	16,972	19,712	9,335	25,956	20,369	22,060	29,698	17,341	22,127
	Adjusted	KES/TON	RPa_{fg}	17,653	20,285	10,070	26,348	21,044	22,677	30,275	18,124	22,830

INDICATORS		Unit	Symbol	2,005	2,006	2,007	2,008	2,009	2,010	2,011	2,012	2,013
Price gap at point of competition												
	Observed	KES/TON	PGo_{wh}	(8,097)	(10,765)	(2,211)	(13,101)	305	(9,623)	(6,247)	8,471	1,597
	Adjusted	KES/TON	PGa_{wh}	(7,678)	(10,287)	(1,966)	(12,485)	757	(9,087)	(5,528)	8,918	2,149
Price gap at farm gate												
	Observed	KES/TON	PGo_{fg}	(1,735)	(4,359)	6,329	(1,502)	3,544	(4,846)	(4,699)	16,619	9,204
	Adjusted	KES/TON	PGa_{fg}	(2,416)	(4,932)	5,594	(1,894)	2,869	(5,463)	(5,276)	15,836	8,501
Nominal rate of protection at point of competition												
	Observed	%	$NRPo_{wh}$	-33.64%	-40.62%	-14.15%	-40.22%	1.09%	-32.48%	-16.18%	32.66%	5.19%
	Adjusted	%	$NRPa_{wh}$	-32.47%	-39.53%	-12.78%	-39.07%	2.74%	-31.23%	-14.59%	34.99%	7.11%
Nominal rate of protection at farm gate												
	Observed	%	$NRPo_{fg}$	-10.22%	-22.12%	67.79%	-5.79%	17.40%	-21.97%	-15.82%	95.84%	41.60%
	Adjusted	%	$NRPa_{fg}$	-13.69%	-24.31%	55.55%	-7.19%	13.64%	-24.09%	-17.43%	87.37%	37.24%
Nominal rate of assistance												
	Observed	%	NRAo	-10.22%	-22.12%	70.47%	-3.33%	29.43%	-14.73%	-15.82%	95.84%	41.60%
	Adjusted	%	NRAa	-13.69%	-24.31%	58.03%	-4.76%	25.28%	-17.05%	-17.43%	87.37%	37.24%

Decomposition of PWAfg	Unit	Symbol	2005	2006	2007	2008	2009	2010	2011	2012	2013
International markets gap	KES/TON	IRG	-	-	-	-	-	-	-	-	-
Exchange policy gap	KES/TON	ERPG	-	-	-	-	-	-	-	-	-
Access costs gap to point of competition	KES/TON	ACG_{wh}	419	478	245	615	452	536	719	447	551
Access costs gap to farm gate	KES/TON	ACG_{fg}	(1,100)	(1,050)	(980)	(1,007)	(1,126)	(1,154)	(1,296)	(1,230)	(1,254)
Externality gap	KES/TON	EG	-	-	-	-	-	-	-	-	-
Market Development Gap	KES/TON	MDG	(681)	(572)	(735)	(392)	(674)	(617)	(577)	(783)	(703)
Market Development Gap	%	MDG	-4%	-3%	-7%	-1%	-3%	-3%	-2%	-4%	-3%

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