MAFAP SPAAA

Monitoring African Food and Agricultural Policies

Suivi des politiques agricoles et alimentaires en Afrique

MAFAP METHODOLOGICAL IMPLEMENTATION GUIDE:

Volume I.

ANALYSIS OF PRICE INCENTIVES AND DISINCENTIVES

Food and Agriculture Organization of the United Nations

Suggested citation:

Barreiro-Hurle, J. and Witwer, M. (2013). MAFAP Methodological Implementation Guide: Volume I. Analysis of price incentives and disincentives. MAFAP Technical Notes Series, FAO, Rome, Italy.

This technical note is a product of the Monitoring African Food and Agricultural Policies project (MAFAP). It is a technical document intended primarily for the use of practitioners interested in implementing the methodology for measuring price incentives and disincentives used in the MAFAP project.

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

The analysis presented in this document is the result of the partnerships established in the context of the MAFAP project with governments of participating countries and a variety of national institutions.

For more information, please visit the MAFAP's website at **http://www.fao.org/mafap**

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Glossary

Access costs	Costs incurred to bring a commodity from one point in the value chain to another. They include costs such as processing, storage, handling, transport and the different margins applied by marketing agents. See also *observed access costs* and *adjusted access costs.*
Adjusted	Descriptive term, which refers to the market situation that could be achieved if distortions from domestic policies and deficiencies in the structure and functioning of the commodity value chain were removed (e.g. if the impacts of trade and domestic market policies, excessive access costs, international market distortions and exchange rate policy distortions were removed). It is used to describe the exchange rate, benchmark price, access costs, reference price, price gap, nominal rate of protection and nominal rate of assistance that would prevail in the absence of these distortions.
Adjusted access costs	Costs incurred to bring a commodity from one point in the value chain to another taking into consideration, where relevant, efficiency improvements in the different steps of the value chain such as agents margins, transport, processing, handling, etc. In addition, value chain specific taxes are taken away if they have been included in the observed access costs.
Adjusted Exchange rate	Price of one country's currency expressed in another country's currency taking away the impact of existing distorting exchange rate policy. In other words, the rate at which one currency could be exchanged for another if the country would have a non-distortive exchange rate policy.
Adjusted nominal rate of protection	Ratio between the price gap and the adjusted reference price evaluated at the same point in the value chain. It measures the effect (in relative terms) of trade and market policies, excessive access costs within the commodity value chain, exchange rate policy, international market distortions and overall market performance on prices received by different agents in the value chain. It can be calculated at the point of competition and at the farm gate. See also *nominal rate of protection and observed rate of protection.*
Adjusted price gap	Difference between the domestic price and the adjusted reference price evaluated at the same point in the value chain. It measures the effect (in absolute terms) of trade and market policies, excessive access costs within the commodity value chain, exchange rate policy, international market distortions and overall market performance on the prices received by different agents in the value chain. It can be calculated at the point of competition and at the farm gate. See also *price gap* and *observed price gap*.
Adjusted reference price	Benchmark price measured at the point of competition or farm gate level after adjustment for respective access costs. It is derived using the data as defined in the adjusted domain. It reflects the maximum price that could be obtained if trade and market policies, excessive access costs within the

	domestic commodity value chain, international market distortions were removed; the country would follow a non-distortive exchange rate policy and overall market performance in the country enhanced. It is derived using adjusted data and can be calculated at the point of competition and at the farm gate. See also *reference price* and *observed reference price*.
Benchmark price	Price of a commodity at the border of a country. It is the price, whether actual or estimated, at which a commodity arrives at a country (if imported) or leaves a county (if exported). It reflects the opportunity cost for domestic market participants. It is the price of the commodity free of country's own policy distortions.
Domestic price at the farm gate	Price received by agricultural producer from the purchaser for a unit of a good produced as output net of any Value Added Tax (VAT), or similar deductible tax, invoiced to the purchaser. It also excludes any transport charges invoiced separately by the producer.
Domestic price at the point of competition	Price of a given commodity in the market where the domestically produced commodity competes with the internationally traded commodity.
Exchange rate	Price of one country's currency expressed in another country's currency. In other words, the rate at which one currency can be exchanged for another. See also *observed exchange rate* and *adjusted exchange rate.*
Market Development Gap	Aggregate estimate of the effect of excessive access costs within a given value chain, exchange rate policy and international market distortions on prices received by producers. In theory, the market development gap reflects the opportunity costs that these inefficiencies represent for producers.
Nominal rate of assistance	Measure of the effect (in relative terms) of domestic market and trade policies, overall market performance and public expenditure in support of the agricultural sector. The nominal rate of assistance is calculated the same way as the nominal rate of protection; however, public expenditure allocated to the commodity is added to the price gap at the farm gate. Therefore, this indicator summarizes the incentives (or disincentives) due to policies, market performance and public expenditure.
Nominal rate of protection	Measure of the effect (in relative terms) of domestic market and trade policies and overall market performance on prices received by agents in the value chain. performance. It is calculated as the ratio between the price gap and reference price measured at the same point in the value chain. It See also *observed nominal rate of protection* and *adjusted nominal rate of protection.*
Observed	Descriptive term, which refers to the actual market situation. It is used to describe the actual exchange rate, benchmark price, access costs, reference

	price, price gap, nominal rate of protection and nominal rate of assistance that prevail under existing market conditions.
Observed access costs	Costs incurred to bring a commodity from one point in the value chain to another as currently prevailing in the country.
Observed exchange rate	Price of one country's currency expressed in another country's currency as currently prevailing in the country. In other words, the rate at which one currency is exchanged for another.
Observed nominal rate of protection	Ratio between the price gap and the observed reference price measured at the same point in the value chain. It measures the effect (in relative terms) of domestic market and trade policies and overall market performance on prices received by agents in the value chain. Calculated at the point of competition and at the farm gate. See also *nominal rate of protection* and *adjusted nominal rate of protection*.
Observed price gap	Difference between domestic price and observed reference price measured at the same point in the value chain. It measures the effect (in absolute terms) of domestic market and trade policies and overall market performance on the prices received by different agents in the value chain. Calculated at the point of competition and at the farm gate. See also *price gap* and *adjusted price gap*.
Observed reference price	Benchmark price measured at the point of competition or farm gate level after adjustment for respective access costs. It is derived using the data as defined in the observed domain. It shows the maximum price that could be obtained if market and trade policies were removed and overall market performance enhanced.
Price gap	Difference between domestic price and reference price measured at the same point of the value chain. It measures the effect (in absolute terms) of domestic market and trade policies and overall market performance on prices received by agents in the value chain. See also *observed price gap* and *adjusted price gap.*

List of Acronyms

ACa_{fg}	Adjusted access costs from point of competition to farm gate
ACa_{wh}	Adjusted access costs from border to point of competition
$ACGa_{fg}$	Adjusted access costs gap from point of competition to the farm gate
$ACGa_{wh}$	Adjusted access costs gap from border to point of competition
ACo_{fg}	Observed access costs from point of competition to the farm gate
ACo_{wh}	Observed access costs from border to point of competition
$ACGo_{fg}$	Observed access costs gap point of competition to the farm gate
$ACGo_{wh}$	Observed access costs gap from border to point of competition
BOT	Budget and other transfers
CIF	Cost, insurance & freight
EAC	East African Community
ER	Exchange rate
ER_a	Adjusted exchange rate
ER_o	Observed exchange rate
ERPG	Exchange rate policy gap
FCFA	Franc of the African Financial Community
FOB	Free on board
KSh	Kenya Shilling
IMG	International markets gap
M	Imports
MAFAP	Monitoring African Food and Agricultural Policies Project
MDG	Market development gap
NRA	Nominal rate of assistance
NRAa	Adjusted nominal rate of assistance
NRAo	Observed nominal rate of assistance
NRP	Nominal rate of protection
NRPafg	Adjusted nominal rate of protection at the farm gate

NRPawh	Adjusted nominal rate of protection at the point of competition
NRPofg	Observed nominal rate of protection at the farm gate
NRPowh	Observed nominal rate of protection at the point of competition
NT	Net trade
Pb_a	Adjusted benchmark price
$P_{b(int\$)}$	Observed benchmark price
$P_{b(loc\$)a}$	Adjusted benchmark price in local currency
$P_{b(loc\$)}$	Observed benchmark price in local currency
PGa_{fg}	Adjusted price gap at the farm gate
PGa_{wh}	Adjusted price gap at the point of competition
PGo_{fg}	Observed price gap at the farm gate
PGo_{wh}	Observed price gap at the point of competition
TI	Trade intensity
TSh	Tanzania Shilling
QL_{fg}	Quality adjustment factor between the point of competition and the farmgate
QL_{wh}	Quality adjustment factor between the border and the point of competition
QT_{fg}	Quantity adjustment factor between the point of competition and the farmgate
QT_{wh}	Quantity adjustment factor between the border and the point of competition
WAEMU	West African Economic and Monetary Union
X	Exports

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PART I. INTRODUCTION

1. Context

The MAFAP project produces a set of indicators that measure the impact of policies and market performance on different commodities, countries and over time. One of the three pillars which MAFAP addresses is the measurement of the effect of policy and market performance on prices perceived by different agents in the value chain. This document provides a hands-on review of how to obtain information for the calculation of these indicators. It also explains what the indicators measure and how they relate to domestic policies, markets and value chain performance. Its target audience is that of practitioners in MAFAP's partner countries that will need to calculate the indicators for specific agricultural commodities in their respective countries.

There is a large body of literature on using price comparisons to calculate rates of assistance and rates of protection as measures of policy incentives and disincentives for agricultural producers, capturing in a single indicator the combined impact of policies and market performance on prices[1].

In most of this literature, a reference price, usually the international price of a given commodity brought to the farm gate by adjusting for access costs, is compared to the domestic farm gate price for the same commodity in a formula of the following form or one from which this form can be derived:

Eq. [1]
$$Nominal\ Rate\ of\ Protection\ (NRP) = \frac{(P_d - P_r)}{P_r} \times 100$$

where P_r is the reference price P_d is the domestic price.

In this tradition, MAFAP has developed a set of indicators to measure market price incentives and disincentives for producers and other agents in domestic commodity markets. One indicator that MAFAP methodology introduces is the market development gap (MDG), which attempts to measure price incentives or disincentives arising from exchange rate misalignments, policy distortions in international markets, lack of market integration, asymmetrical distribution of market power among marketing agents and poor value chain development.

MAFAP builds on the previous work undertaken on policy effort measurement. Most of the previous efforts are based on price comparisons as described above (Tsakok, 1990; Krueger *et al.* 1988 & 1991; Anderson *et al.* 2009). While this analysis focus only on output prices, another stream of the literature has focused on calculating the effective rates of protection and the corresponding effective protection coefficients which were originally proposed by Barber (1955) and Meade (1955) and that have been applied extensively to developing countries. In this measure, both the numerator and the denominator represent value added (value of production minus intermediate inputs) while MAFAP focuses only on output prices. The effective measures account also for the assistance to primary inputs employed rather than only to the commodity. In this sense, MAFAP methodology to calculate price incentives and disincentives closely resembles the proposal of the OECD for calculating the

[1] For a detailed review of the literature on the analysis of agricultural incentives and disincentives in Africa, refer to Section 2.1 in Balie *et al* (2011).

market price differential component of the Producer Support Estimate (OECD, 2010). The main differences between these two approaches relate to the fact that MAFAP estimates the price differentials at two point in the value chain and also considers potential improvements to the value chain performance to calculate adjusted rates of protection and the market development gap.

Readers interested in learning more about the theoretical background of MAFAP's methodology and the different predecessors of this kind of analysis are referred to other MAFAP publications, particularly Balie *et* al (2011a) and Balie *et al* (2011b). These documents describe the economic theory on which MAFAP's methodology is based and provide an in-depth literature review on agricultural market price incentives and disincentives in Africa, respectively.

This methodology implementation guide should be used in conjunction with the MAFAP indicator calculation spreadsheet. After inserting the data described in Sections 4 and 5 of this guide, the spreadsheet calculates reference prices, price gaps, nominal rates of protection, nominal rates of assistance and the market development gap. It also generates graphs and tables with the main indicators. In addition, the examples shown in the following sections are derived from the technical notes drafted for each commodity analyzed in the ten countries where MAFAP was implemented during the first phase of the project. Both the indicator calculation spreadsheet and technical notes are available for download from the project's website (www.fao.org/MAFAP).

PART II. THEORETICAL BACKGROUND

2. Methodology overview

MAFAP analysis compares domestic prices with reference prices for a given agricultural commodity. Reference prices are calculated using the price of the commodity in the international market, which is considered a benchmark price free of the influence from domestic policies and markets. Our methodology estimates two types of reference prices – observed and adjusted. The observed reference price is the maximum price that could be obtained if market and trade policies were removed and overall market performance enhanced, while the adjusted reference price is the maximum price that could be obtained if trade and market policies, excessive access costs within the commodity value chain, international market distortions and exchange rate policy were removed and overall market performance enhanced.

This 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 is 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 observed domestic prices will therefore reveal whether domestic prices represent support (incentives) or a tax (disincentives) to various agents in the value chain.

Observed domestic prices are compared to reference prices at two specific locations along commodity value chains – the farm gate and the point of competition, where domestic products compete with identical products at world market prices. 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 (usually the observed price at wholesale) 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. These include marketing costs between the border and point of competition, as well as between the farm gate and point of competition.

The benchmark price is made comparable to the observed domestic price at the point of competition by adding the access costs between the border and the point of competition, resulting in the observed reference price at the point of competition. This takes into account all the costs an importer would need to bear in order to bring the commodity to market, which in effect, raises the price of the commodity. The reference price at the point of competition is further made comparable to the observed domestic price at the farm gate by deducting the access costs between the farm gate and the point of competition, resulting in the observed reference price at farm gate. This takes into account all the costs incurred by farmers and other agents in bringing the commodity from the farm to the wholesale market. Mathematically, the equations for calculating the observed reference prices at the point of competition (RP_{owh}) and farm gate $\left(RP_{ofg}\right)$ for an imported commodity are as follows:

Eq. [2a] $$RP_{owh} = P_{b(loc\$)} + AC_{owh}$$

Eq. [2b] $$RP_{ofg} = RP_{owh} - AC_{ofg}$$

where AC_{owh} are the observed access costs from the border to the point of competition, 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 $P_{b(\text{loc\$})}$ is the benchmark price in local currency. AC_{ofg} are the observed access costs from the farm gate to the point of competition, 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, imperfect functioning and non-competitive pricing in international markets and inefficiencies along domestic value chains[2], 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, and the unit value FOB price (free on board) for the commodity is normally taken as the benchmark price. Furthermore, observed and adjusted reference prices at the point of competition are obtained by subtracting, rather than adding, the access costs between the border and the point of competition. Mathematically, the equations for calculating the observed reference prices at the point of competition (RP_{owh}) and farm gate $\left(RP_{ofg}\right)$ for an exported commodity are as follows:

Eq. [3] $$RP_{owh} = P_{b(loc\$)} - AC_{owh}$$

Eq. [4] $$RP_{ofg} = RP_{owh} - AC_{ofg}$$

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 trade policy measures directly influencing the price of the commodity in domestic markets (e.g. subsidies and tariffs) and actual market performance, while adjusted price gaps capture the effect of distortions resulting from market functioning in addition to the effect of government policy measures influencing domestic prices. Mathematically, the equations for calculating the observed price gaps at the point of competition (PG_{owh}) and farm gate $\left(PG_{ofg}\right)$ are as follows:

Eq. [5] $$PG_{owh} = P_{wh} - RP_{owh}$$

Eq. [6] $$PG_{ofg} = P_{fg} - RP_{ofg}$$

[2] Inefficiencies along domestic value chains may include government taxes and fees (excluding fees for services), high transportation and processing costs and high profit margins captured by various marketing agents.

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

A positive price gap, resulting when the observed domestic price exceeds the reference price, means that the policy environment and market functioning as a whole generate incentives (support) to producers or wholesalers. For an imported commodity this could be due to distortions such as the existence of a tariff or excessive access costs between the border and the point of competition. On the other hand, if the reference price exceeds the observed 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 subsidized sales 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 across 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:

Eq. [7]
$$NRP_{owh} = \frac{PG_{owh}}{RP_{owh}}$$

Eq. [8]
$$NRP_{ofg} = \frac{PG_{ofg}}{RP_{ofg}}$$

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 Rate of Protection at the farm gate (NRP_{afg}) and wholesale (NRP_{awh}) are defined by the following equations:

Eq. [9]
$$NRP_{awh} = \frac{PG_{awh}}{RP_{awh}}$$

Eq. [10]
$$NRP_{afg} = \frac{PG_{afg}}{RP_{afg}}$$

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 any of the commodities analyzed is added to the price gaps at the 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. Mathematically, the nominal rate of assistance is defined by the following equation:

Eq. [11]
$$NRA = \frac{PG_{afg} + PE_{csp}}{RP_{afg}}$$

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, government taxes and fees (excluding fees for services), high profit margins captured by various marketing agents, illegal bribes and other informal costs. Therefore, the total MDG at farm gate is comprised of three components – gaps due to "excessive" access costs, the exchange rate 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 across 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:

Eq. [12]
$$MDG_{fg} = \frac{(IMG+ERPG+ACG_{wh}+ACG_{fg})}{RP_{afg}}$$

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

MAFAP provides indicators (NRPs, NRAs and MDGs) at both the commodity-specific and aggregate level in order to provide a more general picture. Farm gate indicators for commodities are aggregated as a means of presenting the results for the agricultural sector as a whole or for product groups of different trade status or importance to food security. Aggregate indicators were calculated as a weighted average based on each commodity's relative contribution to the total value of the product group's production. The formula for constructing aggregate indicators for product groups is as follows:

Eq. [13]
$$NRP_g = \frac{\sum_{i=1}^{i=n} NRP_i * PROD_i * RP_{fgi}}{\sum_{i=1}^{i=n} PROD_i * RP_{fgi}}$$

where NRP_g is the aggregated NRP for a subset of n commodities, NRP_i is the NRP for the commodity, $PROD_i$ is the volume of production in tonnes (or any other unit) of the commodity and RP_{fgi} is the reference price of the commodity at the farm gate.[3]

[3] The same formula also applies for aggregated NRAs and MDGs, though NRP_i would be NRA_i and MDG_i, respectively.

3. Summary of indicators

MAFAP analysis produces four commodity-specific indicators – price gaps, nominal rates of protection, nominal rates of assistance and the market development gap. The first three are calculated using two different types of data, observed and adjusted. Furthermore, price gaps and nominal rates of protection are calculated at two points in the value chain, wholesale and farm gate, while the nominal rate of assistance and market development gap are only calculated at farm gate. As noted in the previous section, the market development gap is equal to the difference between the observed and adjusted price gaps at farm gate and is comprised of four components – the exchange rate policy gap, the international markets gap and the access costs gaps from the border to wholesale and from wholesale to farm gate. Table 1 summarizes the 15 indicators that can be calculated for each commodity using MAFAP methodology.

Table 1: Summary of market price incentives and disincentives indicators

Level in the value chain	**Data used for the analysis**		**Decomposition of the differential between the observed and adjusted price gap** Section [6]		
	Observed data Section [4]	*Adjusted data* Section [5]	Exchange rate	International price	Access cost
Point of competition	Observed Price Gap at wholesale **PGo_{wh}**	Adjusted Price Gap at wholesale **PGa_{wh}**	**ERPG$_{wh}$**	**IMG$_{wh}$**	**ACG$_{wh}$**
	Observed Nominal Rate of Protection at wholesale **NRPo_{wh}**	Adjusted Nominal Rate of Protection at wholesale **NRPa_{wh}**	-	-	-
Farm gate	Observed Price Gap at farm gate **PGo_{fg}**	Adjusted Price Gap at farm gate **PGa_{fg}**	-	-	**ACG$_{fg}$**
	Observed Nominal Rate of Protection at farm gate **NRPo_{fg}**	Adjusted Nominal Rate of Protection at farm gate **NRPa_{fg}**	-	-	-
	Observed Nominal Rate of Assistance at the farm gate **NRAo**	Adjusted Nominal Rate of Protection at the farm gate **NRAa**	-	-	-
Market Development Gap = ERPG$_{wh}$ + IMG$_{wh}$ + ACG$_{wh}$ + ACG$_{fg}$					

Source: own elaboration

The MAFAP indicators start with the observed and adjusted price gaps measured at both the wholesale and the farm gate. The observed price gap is the difference between the domestic price and the corresponding observed reference price evaluated at the same location in the value chain. The observed price gap is used to calculate the observed nominal rate of protection. The adjusted price gap follows the same pattern, except that variables used to calculate the corresponding reference price are adjusted to account for several additional sources of domestic price distortions. Similarly, the adjusted price gap is used to calculate the adjusted nominal rate of protection.

Observed reference prices are free of domestic market and trade policy and overall market performance impacts. The same applies for adjusted reference prices, which in addition are understood to be free from international market distortions, exchange rate policy and excessive access costs in the commodity value chain. Domestic prices include the impact of both policies (trade, domestic price support and domestic market regulations) and overall market performance. While policies reflect the government interventions preventing market forces from arbitraging the price differences between domestic and external markets, the inefficient overall market functioning is a specific characteristic of developing economies. Markets in developing countries are characterized by various imperfections such as asymmetric information, monopolistic structures and lack of infrastructure causing agents to incur excessive marketing costs. All of these factors can impede the price transmission from world markets to domestic markets. The existence of a large subsistence sector further limits price transmission.

Observed price gaps reflect both explicit policies and government failure to ensure a better environment that facilitates overall functioning of markets. It is impossible to distinguish unambiguously between these two components. In addition, the adjusted price gaps measure the impact of international market distortions, exchange rate policy distortions and inefficiencies in commodity value chains (Table 2). A more detailed discussion of this can be found in Section 6 of this document.

Table 2: Elements captured by observed and adjusted indicators

	Observed indicators	Adjusted indicators
Trade and market policies		
Overall market performance		
Policy distortions in international markets		
Exchange rate policy		
Value chain performance from the border to the point of competition		
Value chain performance from the point of competition to the farm gate		

Source: Author's own elaboration

Nominal rates of protection are obtained by dividing the price gaps by the reference prices. If crop specific budgetary and other transfers (BOT) are added to the price gap at farm level, then the nominal rates of assistance are obtained. These will be observed or adjusted depending on whether observed or adjusted data is used.

Calculating indicators at both farm gate and point of competition makes it possible to identify how incentives and disincentives are distributed along the value chain. Calculating observed and adjusted indicators makes it possible to identify additional incentives or disincentives in commodity value chains and to estimate the market development gap as defined by MAFAP. However, to obtain a measurement of the full market development gap[4], the analyst will need to combine qualitative and quantitative data, and therefore no single formula can be used to express the concept.

[4] The full market development gap could be defined as the MAFAP market development gap plus the difference between observed and reference prices that cannot be attributed to specific trade and market support policy measures.

As noted in the previous section, commodity-specific indicators can be aggregated to provide summary indicators for key commodity groups (i.e. exports, imports, thinly traded, and commodities essential for food security)[5] or for the agricultural sector as a whole. Aggregate indicators are calculated as weighted averages based on each commodity's relative contribution to the total value of agricultural production (see Section 7).

The next two sections provide a detailed description of how to calculate observed and adjusted indicators, the types of data needed and how to interpret them. Section 6 then considers how the two sets of indicators are related and discusses the concept and estimation of the market development gap. Finally, Section 7 discusses the aggregation of indicators for different commodity groups.

[5] See Barreiro-Hurlé (2011).

PART III. PRACTICAL IMPLEMENTATION

4. Calculation of observed price gaps and nominal rates of protection

To calculate a price gap two prices are needed: the domestic price and the reference price. While the domestic price is taken directly from existing statistics, the reference price has to be constructed. This chapter makes use of the data inputs presented in Table 3, and provide a definition of each one, a description on how to obtain information on them, how to calculate the reference prices and how to calculate and interpret the indicators.

Table 3: Variables used to calculate observed price gaps and nominal rates of protection

MARKET PRICES	
$P_{b(int\$)}$	Observed benchmark price
ER_o	Observed exchange rate
P_{dfg}	Domestic price at farm gate
P_{dwh}	Domestic price at the point of competition
ADJUSTMENT FACTORS	
QL_{wh}	Quality adjustment factor to make the commodity traded at the point of competition and the internationally traded commodity comparable
QL_{fg}	Quality adjustment factor to make the commodity sold by the farmer and the commodity traded at point of competition comparable
QT_{wh}	Quantity adjustment factor to account for shrinkage and losses, as well as any transformations due to processing between the border and the point of competition to make the commodity traded at the point of competition and the internationally traded commodity comparable
QT_{fg}	Quantity adjustment factor to account for shrinkage and losses, as well as any transformations due to processing, between the point of competition and the farm gate to make the commodity sold at the farm gate and the commodity traded at the point of competition comparable
ACCESS COSTS	
ACo_{wh}	Observed access costs from border to the point of competition
ACo_{fg}	Observed access costs from the point competition to farm gate
CALCULATED PRICES	
$P_{b(loc\$)}$	Observed benchmark price in local currency
RPo_{fg}	Observed reference price at the farm level
RPo_{wh}	Observed reference price at the point of competition
PUBLIC EXPENDITURE	
BOT	Budget and other transfers

Source: Author's own elaboration

4.1 Determining the trade status of the commodity

The first step to calculate the observed price gap and nominal rate of protection for a commodity in a country is to determine its trade status. For this the concept of net trade is relevant. Calculating the net trade position of a country for a commodity is straightforward. Imported and exported volumes are compared, and if imports are higher than exports, the commodity is treated as an import. On the other hand, if exports are higher than imports then the commodity is treated as an export. The

process for determining a country's net trade position for a given commodity is defined in equation [14].

Eq. [14] $$Net\ Trade\ (NT_i) = X_i - M_i \begin{cases} if\ NT_i > 0\ \ then\ net\ exporter \\ if\ NT_i < 0\ then\ net\ importer \end{cases}$$

where X_i is the volume of exports of commodity *i*, and M_i the volume of imports of commodity *i*.

The trade status of the commodity is inserted into the MAFAP spreadsheet in row 6 and can be changed for each year. It is key to insert the trade status as this has an impact on how the formulas for reference prices are implemented (see Section 5.5).

There are three main data sources that can be used to investigate the trade status of a commodity: i) national statistics[6]; ii) FAOSTAT[7]; and iii) UN Comtrade[8]. All three sources provide information on exported and imported volumes and values. In theory the three sources should provide the same figures. In practice, however, this might not be the case because of differences in nomenclature (see Box 1), updating or misreporting issues. It is recommended that the net trade position is cross checked using the different sources available to make sure that this position is not contingent on just one source.

Box 1: Understanding data sources and commodity classifications

Even when it can seem obvious, one has to be careful when selecting the product for which trade volumes and benchmark prices are calculated. Trade data is reported by UN Comtrade using the ***Harmonized Commodity Description and Coding System (HS)*** developed and maintained by the World Customs Organization. This is a hierarchical classification system comprised of about 5000 commodity groups, each identified by a six digit code, arranged in a legal and logical structure and supported by well-defined rules to achieve uniform classification.

HS codes are hierarchical in the sense that each HS 2-digit code (also referred to as Chapter) includes all HS 4-digit codes below, and each HS 4-digit code (also referred to as Heading) includes all HS 6-digit codes (also referred to as Code) below. Agricultural products cover chapters 01 to 24.

For example, Chapter 10 "Cereals" includes eight Headings from 10.01 to 10.08 which in turn includes 21 Codes. For example, if the analyst is interested in analyzing rice the following structure is found:

- 10. Cereals
  - 10.01 Wheat and Meslin
  - 10.02 Rye
  - 10.03 Barley
  - 10.04 Oats
  - 10.05 Maize (corn)
  - 10.06 Rice
    - 10.06.10 Rice in the husk (paddy or rough)
    - 10.06.20 Husked (brown) rice
    - 10.06.30 Semi milled or wholly milled rice whether or not polished or glaze
    - 10.06.40 Broken Rice
  - 10.07 Grain Sorghum
  - 10.08 Buckwheat, Millet and canary seeds; other cereals

In order to analyze trade data for rice, all four codes in the 10.06 family should be investigated. By doing so, the analyst can

[6] Examples of national statistics include those from the Tanzania Revenue Authority (TRA) and Uganda Bureau of Statistics (UBOS).
[7] faostat.fao.org/site/406/default.aspx
[8] comtrade.un.org/db/default.aspx

identify the main type of rice traded. For example the United Republic of Tanzania (URT) is a net importer of Rice (HS 10.06). However this masks net exports for 10.06.10 and 10.06.20 and net imports of 10.06.30 and 10.06.40. Since most imports fall under 10.06.40. this product was selected for analysis.

FAOSTAT reports trade data using the ***FAOSTAT Trade Classification*** which includes 574 commodities under two groups: (1) Crops and (2) Livestock Products and Live Animals. Each commodity has a code, name and definition. For rice this classification system includes the following five categories:

27 Rice, paddy
28 Rice Husked
29 Milled/husked rice
31 Milled rice
32 Rice broken

Last, production in FAOSTAT is reported using the ***FAOSTAT Production Domain Commodities*** which includes 294 commodities under four major groups: (1) Crops, (2) Crops Processed, (3) Live Animals and Livestock Primary, and (4) Livestock Processed. In addition the Value of Agricultural Production uses other classifications. Focusing on rice too, production data is only reported for Paddy Rice.

In order to compare rice figures, traded volumes for the different commodities need to be converted to milled equivalent using quantity conversion factors. Conversion factors for commodities can vary across countries, so it is recommended to use the conversion factors specific to the country being analyzed. The following quantity conversion factors are used for rice in the URT:

1 ton of paddy rice = 0.8 tonnes of brown (husked) rice
1 ton of brown (husked) rice = 0.8 tonnes of milled rice
1 ton of paddy rice = 0.65 tonnes of milled rice

Analysts should get acquainted with these different classifications and how they apply to each commodity analyzed to ensure that the correct commodity and benchmark price is selected and that "like is compared with like".

Source: World Customs Organization, UN Comtrade, FAOSTAT, IRRI Rice Knowledge Bank and author's

In some cases commodities are thinly traded, and this has an impact on how to proceed with the selection of the benchmark price. In order to evaluate the degree of openness of an economy for a specific commodity the concept of trade intensity is used. Trade intensity evaluates the relative share of trade over domestic apparent consumption of a commodity as defined in equation [15][9].

Eq. [15]
$$Trade\ Intensity\ (TI) = \frac{(X_i + M_i)}{(Y_i + M_i - X_i)} \times 100$$

where X_i is the volume of exports of commodity *i*, M_i the volume of imports of commodity *i* ,and Y_i the domestic production of commodity *i*.

Domestic production figures can be obtained from national statistics or FAOSTAT. For production figures divergence between sources is less frequent than for trade; however, it can also happen. In general terms, if TI is above ten percent the role of imports or exports in the domestic market will be important enough as to make benchmark prices relevant to the price setting process in the country. If TI is below ten percent this can still be the case, but alternative benchmark prices should be sought to test how the results obtained differ with alternative options for choosing the benchmark price (see below).

When trade intensity figures calculated using the above mentioned databases are low, the issue of informal trade should be considered. These databases cover only formal trade. In some countries

[9] Alternatively, trade intensity can also be calculated over domestic production.

and for some products trade with neighboring countries might follow informal routes and thus might not be reported. By definition there is no official record of informal trade. However, some organizations keep a more or less systematic record of it. For example, the East African Grains Council (EAGC) through its Regional Agriculture Trade Intelligence Network (RATIN)[10] keeps track of informal cross border trade. In West Africa the West Africa Trade Hub project[11] reviews the main trade corridors in the region and provides some data on the size of informal cross-border trade. The USAID funded Famine Early Warning Systems Network (FEWSNET)[12] also provides estimates of informal cross-border trade for some commodities and countries. An additional approach to identify cross-border trade is to compare the exports as declared by one country (i.e. Mali) to one destination (i.e. Burkina) and the imports as declared by that destination country from that country. With this additional data the net trade position of the country can be re-assessed and the relevant benchmark price selected (see Box 2).

For thinly traded commodities, the trade status may vary from year to year and this will have an impact on how the benchmark price will be selected (see Box 4).

Box 2: Considering informal cross-border trade: the case of maize in East Africa

Despite the free trade agreements existing in the region, maize trade in East Africa is still partly informal (World Bank, 2009). In order to investigate the net trade status for maize in the URT, several data sources can be used. If aggregated data from UN Comtrade (i.e. all origins for imports and all destinations for exports) is considered for URT, one can see that traded volumes are small compared to overall domestic consumption and the net trade status changes from year to year.

Maize (*HS 10.05.90 Maize other than seed*) traded volumes (tonnes) for the United Republic of Tanzania

	2005	2006	2007	2008	2009	2010
Imports (M)	14 603	229 205	4 925	16 782	52	4 199
Exports (X)	79 281	22 807	69 578	7 904	207	774
Net Trade (X-M)	64 678	- 206 398	64 653	- 8 879	155	- 3 425
Production (Y)	3 131 610	3 423 020	3 659 000	5 440 710	3 326 200	4 733 070
Trade Intensity	3.1%	6.9%	2.1%	0.5%	0.0%	0.1%

Note: Trade intensity is defined as (X+M)/(Y-X+M)
Source: UN Comtrade and FAOSTAT

The URTS's main partner for maize exports is Kenya and data reported in UN Comtrade shows that the global net trade status is the same as the one calculated using only trade with Kenya. Considering the additional cross-checks mentioned above (i.e. informal cross-border trade and reported exports versus reported imports) one can see that maize is traded more intensively than it would be deduced from official data and that the URT is probably a net exporter of maize throughout the period.

Maize trade volumes (tonnes) between the United Republic of Tanzania and Kenya according to different data sources

	2005	2006	2007	2008	2009	2010
Exports reported by URT to Kenya [1]	49 617	120	21 016	7 848	60	111
Imports reported by Kenya from URT [2]	15 162	4 371	40 135	6 521	2 030	413
Ratio of imports to exports [2]/[1]	0.3	36.4	1.9	0.8	33.8	3.7

[10] www.ratin.net
[11] www.watradehub.com
[12] www.fews.net

Exports to Kenya from URT reported by EAGC [3]			132 988	36 631	110 000	80 000
Ratio of EAGC data to UN Comtrade data [3]/[1]			6.3	4.7	1 833.3	720.7

Sources: UN Comtrade and EAGC

From this analysis it can be concluded that exports of maize from the URT tend to be underreported by official sources. While official data indicates the URT's trade status shifted from net exporter to net importer positions, data on informal trade with Kenya indicates that the URT was actually a a net exporter throughout the period (Stryker, 2012).

The take away message is that before deciding the net trade status of a country with respect to a specific commodity one should consider the role of informal cross border trade. This is particularly so for commodities where trade intensity is low.

Source: Barreiro-Hurle (2012a)

4.2 Market prices

Observed benchmark price ($P_{b(int\$)}$)

Calculating reference prices starts with identifying a **benchmark price ($P_{b(int\$)}$).** The benchmark price reflects the opportunity cost for domestic market participants. In the case of imported goods it represents a price free of domestic policy interventions or impacts of domestic market functioning. In the case of exported goods it represents the price at which the country exports to the world and includes the effect of domestic policies and domestic market functioning. As a general approach the benchmark price is derived from trade data, either exports or imports depending on the net trade status of the country for a specific commodity and year.

Trade is valued as free on board prices (FOB) for an *exported commodity* and as cost, insurance and freight prices (CIF) for an *imported commodity.* FOB is the cost of an export good at the exit point in the exporting country, when it is loaded in the ship or other means of transport in which it will be carried to the importing country. CIF is the landed cost of an import good on the dock or other entry point in the receiving country. It includes the cost of international freight and insurance. It excludes any charge after the import good touches the dock, such as port charges, handling and storage and agents' fees. It also excludes any domestic tariffs and other taxes or fees, duties or subsidies imposed by an importing country.

The unit benchmark price for a product can be obtained by dividing trade values by volumes. It may be an annual average for a specific representative quality of the commodity or the overall annual average if the commodity has no significant differences in quality. In some cases, when there are multiple entry/exit points for imports/exports to/from the country, the unit value for a specific destination(s) or origin(s) might be taken if these are more relevant given the assumptions made for the marketing channel selected for analysis (see below).

Box 3: Using trade data to calculate benchmark prices

IMPORTED COMMODITY: Calculating the benchmark price for rice in Ghana

According to UN Comtrade and FAOSTAT data, during the period 2005-2010 Ghana was a net importer of rice. Based on FAOSTAT production data, the trade intensity for rice in Ghana was over 70 percent throughout the period analyzed. Therefore the unit CIF value for imports in Ghana can be used as a benchmark price.

Considering the different types of rice for which trade is reported (see Box 1) Ghana imports mainly broken rice (HS 10.06.40) which represents on average 80 percent of total rice imports for the 2005-2010 period.

Rice import volumes in Ghana (1000s tonnes)

Commodity	2005	2006	2007	2008	2009	2010
10.06 Rice	393.2	389.7	442.1	395.4	384.0	320.2
10.06.10 Rice in the husk (paddy or rough)	0.1	0.2	0.0	1.1	0.1	0.0
10.06.20 Husked (brown) rice	0.0	0.0	0.0	0.0	0.0	0.0
10.06.30 Semi milled or wholly milled rice whether or not polished or glaze	35.3	35.0	69.8	116.3	93.4	76.9
10.06.40 Broken Rice	357.7	354.5	372.3	278.0	290.5	243.2

Source: UN Comtrade

Using volume and value data for broken rice imports, the benchmark price for the commodity can be calculated by dividing the value of imports by their volume. This unit value represents the CIF value of rice arriving at the Tema Port, which is the country's main point on entry.

Benchmark prices for rice in Ghana

	2005	2006	2007	2008	2009	2010
Volume of Broken Rice imports (1000 tonnes) [1]	358	355	372	278	291	243
Value of broken rice imports (1000 USD) [2]	110 791	101 899	124 898	135 957	157 175	137 733
Benchmark price (USD per tonne) [2]/[1]	310	287	336	489	541	566

Source: UN Comtrade

EXPORTED COMMODITY: Calculating the benchmark price for tobacco in Mozambique

As in most African countries, the majority of tobacco production in Mozambique is exported. Based on FAOSTAT production data and either FAOSTAT or UN Comtrade trade data, during the period 2005-2010 on average 51 percent (FAOSTAT trade data) or 53 percent (UN Comtrade trade data) of total production was exported. Therefore the unit value FOB price for tobacco exports from exports from Mozambique can be used as a benchmark price.

Considering the different types of tobacco for which trade is reported (see Box 1) Mozambique experienced a shift in the type of product exported in 2006. This coincided with the opening of a tobacco processing plant in the country, which started operating in 2006.

Tobacco export volumes in Mozambique (1000s tonnes)

Commodity	2005	2006	2007	2008	2009	2010
Unmanufactured tobacco [24.01]	15.5	39.2	16.0	56.9	44.1	29.5
Tobacco, not stemmed/stripped [24.01.10]	13.9	11.3	2.6	9.3	6.9	2.5
Tobacco, partly/wholly stemmed/stripped [24.01.20]	1.6	28.0	13.3	47.6	37.2	27.0
Tobacco refuse [24.01.30]	-	-	-	-	-	0.0

Source: UN Comtrade

Taking into account the fact that there is a change in the main typr of tobacco exported by Mozambique from 2006

onwards, the benchmark price for tobacco in Mozambique changes from 2005 to 2006-2010. For this first year in the period the unit value of 24.01.10 "Tobacco, not stemmed/stripped" is used while for the rest of the period the unit value of 24.01.20 "Tobacco, partly/wholly stemmed/stripped" is used. This unit value represents the FOB value of tobacco at the Beira Port, which is a main point of exit from the country.

Benchmark prices for tobacco in Mozambique

	2005	2006	2007	2008	2009	2010
Volume of tobacco not stemmed/stripped imports (1000s tonnes) [1]	14					
Value of tobacco not stemmed/stripped imports (1000 USD) [2]	38 736					
Volume of tobacco partly/wholly stemmed/stripped imports (1000s tonnes) [1]		28	13	48	37	27
Value of tobacco partly/wholly stemmed/stripped imports (1000 USD) [2]		78 842	43 315	164 785	154 552	132 139
Benchmark price (USD per ton) [2]/[1]	2 797	2 816	3 253	3 462	4 155	4 893

Source: UN Comtrade

The fact that the commodity used to obtain the benchmark price changes from one year to the other will have to be taken into account when calculating access costs, which should include processing costs as of 2006, and quantity conversion factors.

CONSIDERING MULTIPLE TRADED PRODUCTS FOR A SINGLE FARM PRODUCT: the case of raw cotton, cotton lint and cotton seed.

Farmers grow raw cotton which is ginned and transformed into cotton lint and cotton seed. The benchmark price for raw cotton should therefore be constructed using the price of both commodities taking into account the share of raw cotton that goes to seed and to lint. Since Kenya is a net importer of both products, CIF prices for each were obtained from UN Comtrade (for cotton lint) and FAOSTAT (for cotton seed). The share of lint obtained from raw cotton was taken from different value chain studies for cotton in Kenya and is 0.33. This figure is known as the ginning out turn (GOT) ratio and means that for each tonne of seed cotton 330 kg of cotton lint is produced. The remaining 670 kg are assumed to be cotton seed. If no specific value chain study is available, the GOT ration can also be deduced from production data, as FAOSTAT reports production of the three commodities (seed cotton, cotton seed and cotton lint).

Calculation of the benchmark price for raw cotton using CIF prices for Cotton lint and Cotton seed (USD per tonne)

	2005	2006	2007	2008	2009	2010
I. CIF price for cotton lint imports	897.10	1 258.50	1 341.30	1 825.70	1 229.20	2 060.90
II. CIF price for cotton seed imports	43.80	48.40	97.90	95.70	162.80	127.60
III. Ginning Out Turn Ratio	0.33	0.33	0.33	0.33	0.33	0.33
Benchmark price (I*III + II*(1-III))	**319.50**	**447.70**	**508.20**	**666.60**	**514.70**	**765.60**

Source: UN Comtrade and FAOSTAT

As an alternative, in countries where there is no trade in cotton seed, only the CIF price for cotton lint is used to construct the benchmark price. This is based on the assumption that there are no incentives or disincentives realized from the cotton seed value chain. If this option is taken, a quantity adjustment factor is needed for the ginning phase in the value chain where, cotton lint is obtained from raw cotton. Additionally, the market value of cottonseed has to be deducted from the access costs.

Source: Angelucci *et al* (2012), Dias (2012a) and Monroy (2012)

When trade intensity is low (i.e. below 10 percent) or traded volumes low, unit prices from trade data might not be representative of the opportunity cost of production for domestic market participants. Also in some cases there may be systematic underreporting of the value of traded goods for tax evasion reasons or trade statistics are not fully developed. In such cases it is advisable to consider alternative approaches to calculate benchmark prices.

Alternative options include inter alia taking implicit values for imports (or exports) from neighboring countries (i.e. benchmark price for rice imports in Togo approximated by implicit value of rice imports in Benin); constructing a FOB (CIF) price taking the value of the commodity in the main destination (origin) market and deducting (adding) relevant transport and handling costs from that market to the border of the country (i.e. calculate benchmark prices for a maize importing country using US Gulf FOB prices plus insurance and freight to the country); or using the benchmark price of a perfect or close substitute for the commodity. Some examples of these approaches are presented in Box 4. The underlying premise is to keep in mind what the benchmark price represents, that is the opportunity costs of the commodity to the agents in the country. This is reflected by the price they could obtain for exports or would need to pay for imports.

Box 4: Using prices in destination or origin markets to construct benchmark prices

IMPORTED COMMODITY: rice in Mali

According to both FAOSTAT and UN Comtrade data Mali is a net importer of rice. Despite trade intensity for rice in Mali being above 10 percent for any given year between 2005 and 2010 and over 20 percent for the period as a whole, unit values CIF prices for rice imports are below FOB price for major exporters. Since rice imports in Mali are from the Far East, the lower prices for imports cannot be explained by quality or variety issues.

CIF prices for rice imports in Mali and FOB quotations from main exporting countries (USD per tonne)

	2005	2006	2007	2008	2009	2010
Mali rice [10.06] import unit values	221	253	291	399	455	224
Thailand 100 percent broken FOB price	291	311	335	679	566	507
Thailand 25 percent broken FOB price	258	274	307	600	456	439
Vietnam 5 percent broken FOB price	256	266	300	620	433	419
Vietnam 25 percent broken FOB price	242	247	281	564	383	390

Source: UN Comtrade (Mali), FAOSTAT (Mali, 2009) and International Grains Council (Thailand and Vietnam)

The alternative approach to calculate the benchmark price in this case is to take the FOB price for Thailand 25 percent broken rice (the most commonly imported rice type and the most important origin of imports) and add to it an estimate of insurance and freight from the far east to the port of Abidjan. The cost of insurance and freight from the Far East to Ghana was obtained from the national yearbook of transport edited by the Ministry of Transport in Mali.

Construction of the benchmark price for rice in Mali (USD per tonne)

	2005	2006	2007	2008	2009	2010
Thailand 25 percent broken [1]	258	274	307	600	456	439
Insurance and freight Thailand – Ghana [2]	95	95	95	95	95	95
Benchmark price for rice in Mali [1]+[2]	353	369	402	695	551	534

Source: International Grains Council, Ministry of Transport, and authors.

EXPORTED COMMODITY: maize in Burkina Faso

Trade intensity for maize in Burkina Faso was relatively low, in any given year between 2005 and 2010. Less than four percent of apparent domestic consumption is traded., Burkina Faso was a net exporter of maize during 2005-2006 and 2008-2010 while it is a net importer in 2007. The country's maize exports exports mainly go to Niger while imports come from the Ivory Coast. Unit prices of imports and exports reported by FAOSTAT and UN Comtrade were found to be inconsistent. Moreover, export prices reported by these two sources were significantly lower than domestic producer and wholesale prices. Therefore, it was determined that trade data and prices available were not reliable enough to be used as benchmarks prices.

CIF prices for maize exports from Burkina Faso compared to main domestic prices (USD per tonne)

	2005	2006	2007	2008	2009	2010
UN Comtrade	184	n.d.	Net importer	202	276	260
FAOSTAT	130	92		90	283	266
Wholesale Price in Ouagadougu						

	268	277		402	309	323
Producer Price in main maize producing	184	151		290	210	204

n.d.: no data

Source: UN Comtrade, FAOSTAT and Ministry of Agriculture and Hydraulics.

For years when Burkina Faso was a net exporter an FOB price was constructed from the retail price at the main market in Niger (Niamey). Since there is no tariff levied on maize traded between Niger and Burkina (both are members of West African Economic and Monetary Union - WAEMU), the transport, handling, trader margins and taxes in Niger were deducted from this price to arrive at the estimated price at which maize from Burkina enters Niger.

Calculation of FOB value of maize exports from Burkina Faso using retail price in Niger (2009)

Concept	FCFA per tonne
[1] Retail price in Niamey	233 000
[2] Transport costs Niamey – Burkina Faso border	8 040
[3] Handling	2 000
[4] Retail margin (5 percent of [1])	11 650
[5] Niger taxes on Maize (5 percent of [1])	11 650
[6] Wholesale margin (5 percent of [1]-[4]-[5])	10 485
[7] Calculated FOB value of exports ([1]-[2]-[3]-[4]-[5]-[6])	189 175

Source: RESIMAO and Authors

The same method was used to estimate the benchmark price in 2007, when Burkina is a net importer of maize. Unit values for imports from UN Comtrade and FAOSTAT were checked for consistency and compared to domestic prices. In doing so, they were found to be different according to the source used, significantly lower (i.e. fourfold) than domestic prices and mainly coming from a country within WAEMU (i.e. no import tariffs). Therefore an alternative CIF price was calculated from retail prices in Khorogo (the closest market to Burkina Faso in Ivory Coast), by deducting retail margins and taxes and adding the cost of transport, handling, trader margins and taxes in Ivory Coast.

Calculation of CIF value of maize imports to Burkina Faso using retail price in Ivory Coast (2007-)

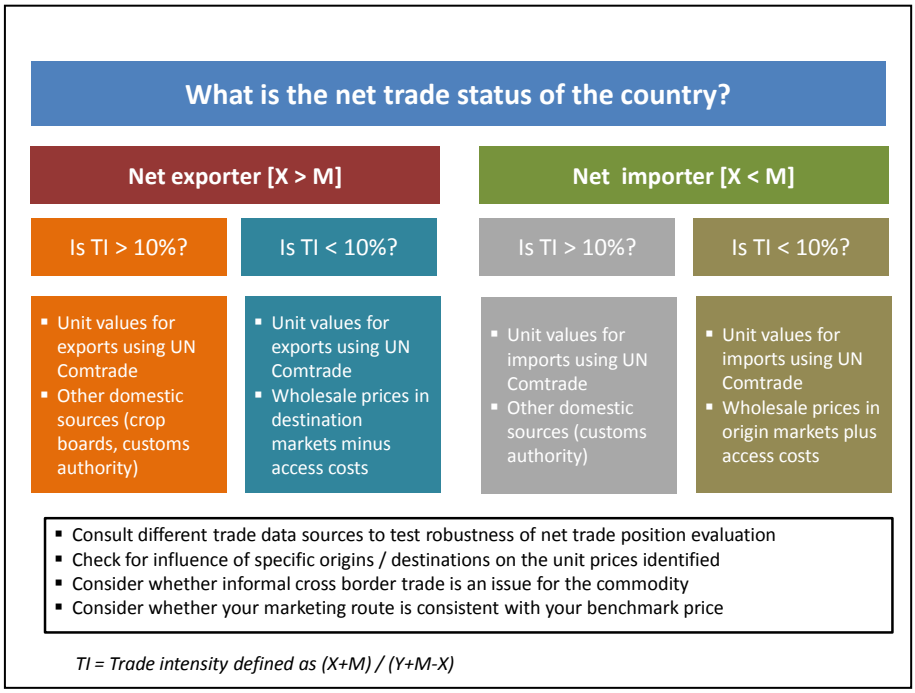
Concept	FCFA per tonne
[1] Retail price in Khorogo	70 000
[2] Retail margin (5 percent of [1])	3 500
[3] Retail taxes in Ivory Coast (5 percent of [1])	3 500
[4] Transport cost Khorogo – Burkina Faso border	2 685
[5] Handling	630
[6] Wholesaler margins (5 percent of [1]-[2]-[3])	3 150
[7] Calculated CIF value of imports ([1]-[2]-[3]+[4]+[5]+[6])	66 465

Source: RESIMAO and Authors

Source: Diallo et al. (2013) and Guissou et al. (2012)

Figure 1 shows a schematic decision tree for selecting relevant data sources for calculating benchmark prices. As a general rule, analysts should consider all possible data sources and consult them to get a clear idea of the price at which commodities enter or leave the domestic market.

Figure 1: Decision tree for identification of the benchmark price



Source: Author's own elaboration

Observed exchange rate (ER_o)

Trade data from international data bases will normally be expressed in international currency units. UN Comtrade and FAOSTAT provide the value of imports or exports in US Dollars. Therefore, if the benchmark price is taken from these sources, it must be converted into domestic currency. To do this we use the exchange rate. The exchange rate is the price of international currency in domestic currency and is expressed as units of domestic currency per unit of international currency.

Exchange rates are available from several data sources. First, they can be obtained from the national bank. As an alternative international databases, such as those hosted in the World Bank (see Box 5) or the International Monetary Fund, provide easy access to long time series of exchange rates for multiple currencies.

Exchange rates are taken for the same period as benchmark prices. Thus, when converting benchmark prices for a specific year, the average nominal exchange rate for that same year should be used.

Box 5: The World Bank World Development Indicators database

The primary World Bank collection of development indicators, compiled from officially-recognized international sources, presents the most current and accurate global development data available. World Development Indicators (WDI) is the World Bank's flagship statistical database and establishes the benchmark against which development progress is measured. WDI aims to provide relevant, high-quality and, internationally comparable statistics about development and the quality of people's lives around the globe. WDI data are presented by country, by topic, and by indicator. In addition to the descriptions of topics, indicator definitions, and data sources, "about the data" notes put indicators in the development context. In the "about the data" notes, information is provided on the usefulness of the data, limitations, and potential weaknesses in the data.

The full WDI database can be downloaded as a single Excel Sheet from the following web address:

data.worldbank.org/data-catalog/world-development-indicators

If the analyst is onlu are interested only in the exchange rate data, this can be obtained following these steps:

1. Click on the "DATABANK" banner (*databank.worldbank.org/data/source/world-development-indicators*);
2. Select the country for which you want the data;
3. Click on the SERIES menu;
4. On the left hand side a dimension filters will appear, select: FINANCIAL SECTOR / EXCHANGE RATES & PRICES;
5. Select the indicator "*official exchange rate*";
6. Click on the TIME menu;
7. Select the period for which you want the data (at the time of writing (March 2013) data could be selected up to 2012, however for the MAFAP Phase I countries it was only available up to 2011);
8. Click on the DOWNLOAD banner on the top right corner of the webpage

Source: databank.worldbank.org

Domestic price at the farm gate (P_{dfg})

Farm gate prices, sometimes referred to as producer prices, are defined as the amount receivable by the producer from the purchaser for a unit of a good or service produced as output minus any VAT, or similar deductible tax, invoiced to the purchaser; it excludes any transport charges invoiced separately by the producer (UN, 2009).

Sources of data on farm gate prices differ from country to country. FAOSTAT has information on producer prices in its price domain; however, it is not comprehensive and sometimes not even available for countries in which MAFAP has been implemented (i.e. the United Republic of Tanzania and Uganda). Preferably, farm gate prices can be obtained from different national data sources such as permanent agricultural surveys (i.e. Burkina Faso, Mali), the national market information system (Mali), or statistics kept by commodity boards (i.e. the Cotton Development Organization in Uganda, the Tanzania Sugar Board and the Ghana Cocoa Board).

If producer prices are not available, then wholesale prices in major producing areas cab used as a proxy. If this option is taken the indicators will not measure the effects of policies and value chain functioning between rural wholesale markets and the farm gate.

A key issue here is the geographical scope to which the farm gate price refers, as it will have a major impact on the way access costs are calculated. In some countries the farm gate price is reported as a country average. In other countries, it is reported for specific production regions. When using wholesale prices as proxies for farm gate prices these relate to a specific market(s).

Lastly, if the country is sufficiently large, policies or market performance appears to be heterogeneous, and markets weakly integrated, then differentiated analysis by specific regional markets might be needed. Relevant information that could hint towards the need of such an analysis can normally be found in existing commodity value chain analysis.

Box 6: Selecting farm gate prices in Phase I of MAFAP

During the implementation of the MAFAP project different approaches were used to identify the domestic price at farm gate. In some countries, farm gate prices were available as national averages or for specific production regions, while in other countries, farm gate prices were not available at all. Moreover, sometimes the quality of farm gate price data is not as high as expected. A simple test to see whether farm gate prices are meaningful is to compare them with wholesale or retail prices in the main consumption areas. In the absence of policies supporting farm gate prices (i.e. floor price fixation) or depressing consumer prices (i.e. subsidized sales), farm gate prices should be lower than wholesale or retail prices. If this is not the case, the selection of farm gate prices will need additional attention and alternatives to the farm gate price data should be considered.

Below is an inventory of the different approaches for a variety of commodities analyzed in five countries where MFAP is implemented. Additional information can be found in the technical notes for each commodity.

National average farm gate prices

Burkina Faso: Cotton, Gum Arabic, Sorghum.
Kenya: Rice, Sugar Cane, Cotton, Tea.
Mali: Cotton.
Uganda: Cotton, Coffee, Sugar Cane.
United Republic of Tanzania: Cashew nuts, Cotton, Coffee, Sugar Cane.

Specific region farm gate prices

Burkina Faso: Rice, Maize, Cattle, Groundnuts, Onion.
Kenya: Wheat, Cattle, Milk.
Mali: Milk, Cattle, Groundnuts, Millet, Sorghum, Rice.
Uganda: Fish, Tea, Wheat.

Specific market wholesale prices

Burkina Faso: not applied.
Kenya: Sorghum.
Mali: Maize.
Uganda: Cassava.
United Republic of Tanzania: Pulses, Maize, Rice, Wheat.

Others

Burkina Faso: Cotton Oil (factory gate price)
Kenya: Maize (wholesale price minus access costs), Coffee (wholesale price minus access costs)
Uganda: Rice (wholesale price minus access costs), Beef (wholesale price minus access costs), Maize (wholesale price minus access costs), Maize (wholesale price minus access cost)

Source: MAFAP Country Reports and MAFAP Technical Notes

Domestic price at the point of competition (P_{dwh})

The point of competition is defined as the market in which the domestically produced commodity competes with the and internationally traded commodity. It should represent a point in the value chain between the farm gate and the point of entry (exit) of imported (exported) commodities.

For imported commodities the usual approach involves obtaining wholesale prices either at the domestic wholesale market where the largest volumes of the commodity are traded (normally the

largest urban area in the country) or a national wide average. If no wholesale prices are available, they can be constructed by deducting an estimated retail margin from retail prices. However if benchmark prices have been obtained for imports from a specific origin, the point of competition may be the main market close to the point of entry into the country (see Box 7). In addition, depending on the structure of the commodity value chain or data availability, a different point of competition can be selected.

For exported commodities, the border is typically considered to be the point of competition. However, the analyst can also consider an intermediate point in the value chain to see how policy and market performances affect different agents. Depending on the nature of the value chain and the data available, this can be the main wholesale market in the country or a relevant wholesale market close to the point of export. For traditional cash crops, this intermediate point is often an international auction and the domestic price at the point of competition is the auction price.. For processed commodities the ex-factory price is often used as the domestic price at the point of competition.

In some cases, if there is no data available the analysis of incentives and disincentives at the point of competition is excluded. However, by doing so, part of the potential of the MAFAP methodology (i.e. identifying where the policy and market environment has the largest effect along the value chain) is lost.

Box 7: Selecting the point of competition in Phase I of MAFAP

For most **staples** the point of competition selected has been the main wholesale market in the country; however data availability or value chain structure can lead to the use of alternative points of competition. For example, when analyzing rice for five countries the point of competition selected was the wholesale market in each country's capital city. In the United Republic of Tanzania, the price at the point of competition was taken from the information provided by the Ministry of Trade regarding the prices in the wholesale market in Dar es Salaam. The same was done in Burkina Faso (wholesale price in Ouagadougou reported by the Inter-professional Rice Committee), Uganda (wholesale price in Kampala as reported by RATIN), Ghana (wholesale price in Accra as reported by the Ministry of Food and Agriculture) or Kenya (wholesale price in Nairobi as reported by RATIN). However, this approach could not be used in Mali and Mozambique. Due to lack of data available, in Mali, the national average wholesale price reported by the Agricultural Markets Observatory (OMA) was taken as the price at the point of competition. Since domestic rice production seldom reached the capital city of Maputo in Mozambique, the price used for analysis was the price at a major wholesale market in the central region, where most rice production is concentrated and rice imports enter the country through the Beira Port. The wholesale prices were taken from Mozambique's Agricultural Market Information System (SIMA).

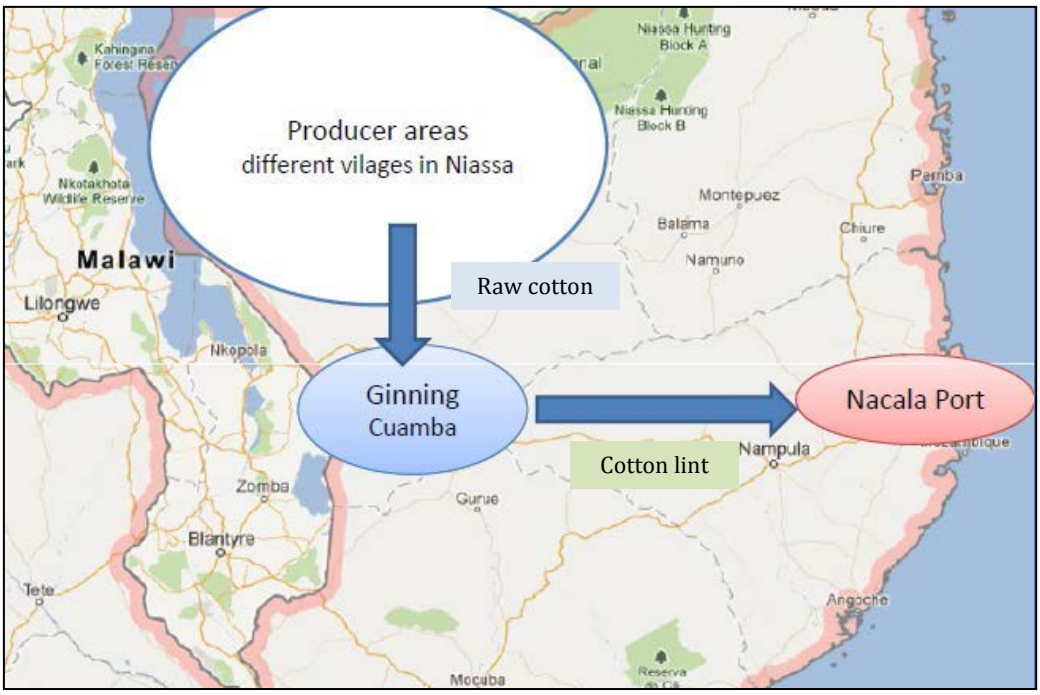
For **traditional export crops** most countries have established some kind of centralized auction where domestic producers or traders can market their produce to exporters. Such is the case for some of the commodities analyzed in Phase I of MAFAP. In particular coffee (in Kenya and the United Republic of Tanzania), tea (in Kenya) and cashew nuts (in the United Republic of Tanzania) have been analyzed considering the auction as the point of competition. Coffee and tea were also analyzed in Uganda; however, since the auction of Ugandan tea takes place at the Mombasa Tea Auction in Kenya, auction an ad-hoc auction price in Uganda was created by deducting the transport and marketing costs from the Uganda processing plants to Mombasa. For coffee in Uganda, an ad-hoc auction price was created by deducting from the benchmark price (unit value of exported coffee) the export tax charged by the Coffee Development Organization. As far as cotton is concerned, the ex-ginnery gate was selected as the point of competition and the ex-ginnery price for cotton lint as the price at the point of competition.

The nature of the point of competition selected needs to be taken into account when interpreting the indicators. For example when the price at the point of competition is a wholesale price, the incentive relates to traders and consumers, but when the point of competition is a factory gate price it relates to the incentives of the processors. Additionally, when the point of competition is an auction price it relates to the incentives of domestic traders.

Source: MAFAP Country Reports and MAFAP Technical Notes

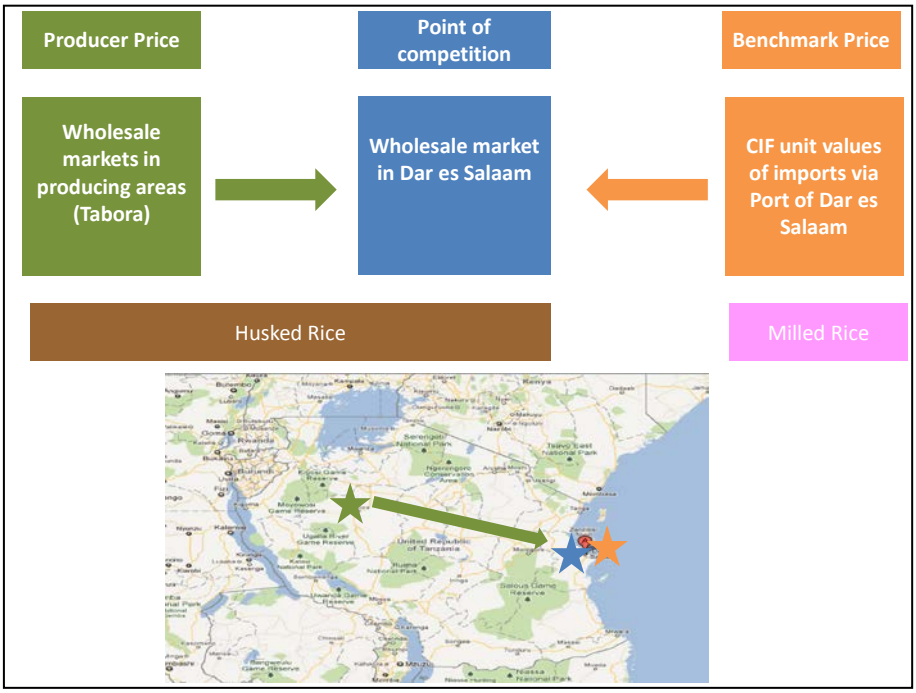
To sum up, the choice of observed prices is the result of considering the structure for the value chain of the commodity in the country and the data availability. Implicit in the coverage and sources for the three prices described above is the marketing channel assumed for the analysis. This marketing channel will need to be taken into account when calculating the components of access costs to be included in the analysis (see Section 4.4) and interpreting the results (see Section 4.7). All this information can be easily summarized in a map (see Figure 2) or value chain diagram (see Figure 3). Such representations are really useful to better understand the underlying hypothesis for the analysis.

Figure 2: Marketing channel for cotton in Mozambique



Source: Dias (2012b) and Author's

Figure 3: Marketing channel for rice in the United Republic of Tanzania



Source: Barreiro-Hurle (2012b) and Author's

4.3 Adjustment factors

One of the most important conditions that needs to be met in order for the price gaps and nominal rates of protection to measure the effect of policy and market performance on the different agents is that the prices being compared must be for the same commodity in terms of quality and quantity. In other words, we must compare "like with like" in order for the analysis and results to hold. If this is not the case, part of the price difference will be due to non-policy or non-market performance reasons. The spreadsheet provided for the calculation of indicators allows for the entry of quality and quantity adjustment factors between the border and the point of competition and between the point of competition and the farm gate.

A **quality adjustment factor** from the border to the point of competition (QL_{wh}) is needed when the commodity for which the benchmark price is obtained is of different quality than the commodity marketed at the point of competition. It can also be that there is a price premium for the domestic product, which is not related to policy (i.e. consumer preference for local products). The quality adjustment factor will remove any "*noise*" associated with quality differences, thereby assuring that the price gap accounts for only policy and general market effects. The decision as to whether a quality adjustment is required should be based on the "descriptive" knowledge of a commodity and its domestic value chain. If imported and domestically produced commodities are sold at different prices in the domestic market, this could be taken as an indication that the analyst should pay attention to quality issues.

Box 8: Quality adjustment factors between the border and the point of competition in practice

A quality adjustment factor has been used for the analysis of four commodities in six countries during the Phase I of MAFAP implementation. Four countries (Burkina Faso, Mali, Mozambique and Nigeria) used quality adjustment factors between the border and the point of competition for the analysis of rice; Kenya used them for the analysis of tea and wheat; and Uganda for the analysis of sugar. Below we explain the rationale for this adjustment factor and the process for calculating it using two examples. Other examples can be found in the Technical Notes on the MAFAP website.

Consumer preference for domestic rice: the case of Burkina Faso

Burkina Faso produces a specific type of rice (Riz de Bagré) which is preferred by local consumers. At the retail level, one can observe that prices for Riz de Bagré are higher than those for imported rice, which is mainly of Asian origin.

Although both products are considered perfect substitutes in terms of usage and volume, there are clearly price differences caused by consumer preferences, which need to be accounted for in the analysis.. To do this, a quality adjustment factor was calculated by taking the ratio between the retail price for domestic rice (18 000 FCFA per 50 kg) and the retail price of imported rice (17 500 FCFA per 50 kg). The adjustment factor thus takes the value of 1.03. An adjustment factor greater than one means that the quality of domestic rice is higher than the quality of imported rice. A similar approach was taken for Mali.

In a situation like this (i.e. where the quality adjustment factor is greater than one), if the quality adjustment factor was not taken into account when calculating the reference price (see Section 4.5), then the price gaps would overestimate (underestimate) the level of incentives (disincentives) for rice in the country.

As the next example shows, the opposite holds if the quality adjustment factor is smaller than one.

Hard versus soft wheat: the case of Kenya

Kenya imports hard wheat varieties but mainly produces soft wheat varieties. In international markets, hard wheat is normally priced higher than soft wheat. To account for this quality difference, an adjustment factor was calculated by taking the ratio between FOB quotations for soft and hard wheat in the US Gulf, which were available from the International Grain Council (IGC).

Calculation of the quality adjustment factor between the border and the point of competition for wheat in Kenya

	2005	2006	2007	2008	2009	2010
[1] US Soft Red Wheat FOB Gulf (USD per ton)	149	140	162	249	282	193
[2] US Hard Red Wheat FOB Gulf (USD per ton)	161	158	200	269	343	235
[3] Quality adjustment factor (percent) [1]/[2]	93	88	81	92	82	82

Source: International Grains Council

The quality adjustment factor takes a value that varies from 0.82 to 0.93, depending on the year. A quality adjustment factor smaller than one means that the quality of domestic wheat is lower than the quality of imported wheat.

In a situation like this (i.e. where the quality adjustment factor is smaller than one), if the quality adjustment factor was not taken into account when calculating the reference price (see Section 4.5), the price gaps would underestimate (overestimate) the level of incentives (disincentives) for wheat in the country.

Source: Short (2012) and Guissou and Ilboudo (2012a)

A **quantity adjustment factor** from the border to the point of competition (QT_{wh}) is needed when the commodity for which the benchmark price is obtained differs from the commodity marketed at the point of competition due to processing or some other physical treatment. In this sense, more (or less) than one unit of domestically traded product is needed to obtain a unit of the one for which the benchmark price is available. For price comparisons to measure the impact of policy and market performance it is key that the reference price and the domestic price at the point of competition are expressed in terms of the same product. In a majority of cases, the quantity adjustment factor is a technical coefficient.

Box 9: Quantity adjustment factors between the border and the point of competition in practice

A quantity adjustment factor has been used for the analysis of five commodities in four countries during Phase I of MAFAP implementation. Two countries (Mali and the United Republic of Tanzania) used quantity adjustment factors between the border and the point of competition for the analysis of milk; Malawi used them for the analysis of tobacco; the United Republic of Tanzania for rice; and Burkina Faso for onion and Arabic gum. Below we explain the rationale for this adjustment factor and the process for calculating it using two examples. Other examples can be found in the Technical Notes on the MAFAP website.

Prices reported for different types of rice: the United Republic of Tanzania

The benchmark price for the analysis of rice in the United Republic of Tanzania was calculated using the unit value import price for of milled rice (see Figure 3), while domestic price data reported by the Ministry of Trade and Industry refers to husked (brown) rice. Given that one tonne of milled rice is obtained from 1.25 tonnes of husked rice (see Box 1), a quantity adjustment factor of 0.8 (1 divided by 1.25) was applied to the benchmark price in order to make it comparable to domestic prices.

As with the quality adjustment factor, if this was not taken into account the price gaps would underestimate (over estimate) the level of incentives (disincentives) for rice in the country.

Trade in powder milk and domestic prices of fresh milk: Mali

Over 80 percent (in volume terms) and 97 percent (in liquid milk equivalents) of milk imports in Mali are in the form of powder milk (HS 04.02 Milk and cream, concentrated or containing added sugar or other sweetening matter). However, data on domestic prices refers to fresh milk.

Since one kilogram of powder milk produces 7.6 litres of liquid milk (Meyer et Duteurtre, 1998), the benchmark prices for powder milk were multiplied by 0.14 (the inverse of 7.6).

Again, not taking this quantity differences into consideration would underestimate (over estimate) the level of incentives (disincentives) for milk in the country.

Source: Barreiro-Hurlé (2012b) and Mas-Aparisi *et al* (2012)

Due to the construction of the formulas in the MAFAP data management and indicator calculation spreadsheet, if a quantity adjustment factor is used from the border to the point of competition it is important to make sure that the access costs (see Section 4.4) refer to the product for which the price at point of competition is reported.

The analyst should be aware that the calculations in the spreadsheet only apply the quantity adjustment factor to the benchmark price. For example, if access costs refer to milled rice and the domestic price at point of competition is expressed in husked rice terms, the access costs will need to be multiplied by the quantity adjustment factor before entering them in the spreadsheet (see Box 9).

Lastly, two issues must be kept in mind when using quantity and quality adjustment factors. First, the analyst should avoid double counting. If price differences in domestic market exist between imported and domestic produced commodity, before using a quality adjustment factor the analyst should consider whether the price differences in the domestic market are actually related to the fact that the products are different (i.e. milled rice versus husked rice). Second, it is important not to mix this adjustment with those due to processing costs, which are dealt with below.

The same quality or quantity differences can occur between the point of competition and the farm gate. Thus, the MAFAP spreadsheet allows the entry of additional adjustment factors specific to this section of the value chain. Again, the use of a quantity or quality adjustment factor between the

point of competition and the farm gate depends on the nature of the commodity for which the prices are obtained (see Box 10).

Box 10: Quantity adjustment factors between the point of competition and the farm gate in practice

A quantity adjustment factor between the point of competition and the farm gate has been used for the analysis of nine commodities in eight countries during Phase I of MAFAP implementation as reflected in the table below.

Commodity	Countries for which QT_{fg} is applied
Cassava	*Nigeria*
Groundnuts	*Burkina Faso*
Maize	*Burkina Faso*
Rice	*Burkina Faso* *Kenya* *Mozambique* *Uganda*
Seed cotton	*Burkina Faso* *Malawi* *Mali* *United Republic of Tanzania*
Sorghum	*Burkina Faso*
Sugar Cane	*Kenya* *Mozambique* *Uganda* *United Republic of Tanzania*
Tea	*Kenya* *Malawi* *Uganda*
Tobacco	*Mozambique*

Below we explain the rationale for this adjustment factor and the process for calculating it using three examples. Other examples can be found in the Technical Notes on the MAFAP website.

Farmers grow sugar cane but sugar is the traded product: quantity adjustment factor for sugar cane in Kenya

Kenya is a net importer of sugar, so the benchmark price used in the analysis was the unit value CIF price for sugar. The price at the point of competition selected for this commodity is the wholesale market in Nairobi, where prices were also obtained in raw sugar units (Ksh per tonne of sugar). The price at the farm gate was obtained for sugar cane, thus in sugar cane units (Ksh per tonne of sugar cane). Both prices were obtained from the Kenya Sugar Board.

To make the reference price for sugar at the point of competition comparable to the farm gate price for sugar cane, a quantity adjustment factor was calculated using FAOSTAT production data and applied. This quantity adjustment factor was taken as the ratio of sugar production to sugar cane production, as this indicates the amount of sugar cane needed to produce one unit (tonne) of sugar (see table below).

	2005	2006	2007	2008	2009	2010
[1] Sugar cane production (1000 tonnes)	4 800	4 932	5 204	5 112	5 611	5 710
[2] Sugar production (1000 tonnes)	488	517	520	512	548	524
[3] Sugar to sugar cane ratio [2]/[3]	0.10	0.10	0.10	0.10	0.10	0.09

Source: FAOSTAT

To apply this quantity adjustment ratio, the reference price for sugar at the point of competition (KSh per tonne of sugar) was multiplied by the sugar to sugar cane ratio to derive the reference price at farm gate for sugar cane (KSh per tonne of sugar cane), as shown in the formula below.

$$RPo_{wh}\left(\frac{KSh}{tonne\ of\ sugar}\right) x\ QT_{fg}\ \left(\frac{sugar}{sugar\ cane}\right) = RPo_{wh}\ in\ sugar\ cane\ equivalent\ \left(\frac{KSh}{tonne\ of\ sugar\ cane}\right)$$

From tea leaves to black tea: quantity adjustment factor for tea in Uganda

The farm gate price for tea in Uganda refers to tea leaves, while the price at the point of competition (i.e. the ex-factory price) refers to black tea. Tea in Uganda is processed at an average rate of 0.225 kg of black tea per one tonne of tea leaves. This conversion rate was used to adjust for quantity differences between the factory gate and the farm gate using the following formula.

$$RPo_{wh}\left(\frac{USh}{tonne\ of\ balck\ tea}\right) x\ QT_{fg}\left(\frac{black\ tea}{tea\ leaves}\right) = RPo_{wh}\ in\ tea\ leaves\ equivalent\ \left(\frac{USh}{tonne\ of\ tea\ leaves}\right)$$

Lack of standardized measurement: quantity adjustment factor for maize in Burkina Faso

Wholesale markets in Burkina Faso have standardized measures for checking whether the quantity sold corresponds with the declared weight. However, this is not the case at the farm gate. The permanent agricultural survey of Burkina Faso for the area where the farm gate price is taken shows that while farmers claim to sell maize in 100 kilogram sacs, the actual weight sold ranges from 102 to 108 kilograms. Therefore a quantity adjustment factor of 1.08 from the point of competition to the farm gate was used in order to capture this lack of standardized measurement for products sold at the farm gate.

Source: Mulinge *et al* (2013), Guissou *et al* (2012) and Kiwanuka and Ahmed (2012)

Again, due to the construction of the formulas in the MAFAP spreadsheet, if a quantity adjustment factor is used from the point of competition to the farm gate it is important to make sure that the access costs (see Section 4.5) refer to the product for which the price at farm gate is reported. The calculations in the spreadsheet only apply the quantity conversion factor to the reference price at the point of competition. For example, if access costs refer to sugar and the domestic price at farm gate is expressed in sugar cane terms, the access costs will need to be multiplied by the quantity adjustment factor before entering them into the spreadsheet.

4.4 Observed access costs

To make the sure that that price gaps measure policy and market functioning impact on prices, both the domestic and the reference prices which are compared need to be taken at the same point in the value chain. The benchmark price shows the opportunity cost at the point of entry (exit) to (from) the country however the domestic prices refer to specific places in the country (see Figures 2 and 3).

To make the benchmark prices comparable to domestic ones, MAFAP uses the concept of **access costs**. Observed access costs should cover all observed marketing costs and margins observed in the market whether these are paid for services (i.e. transportation) or not (i.e. illicit costs). Access costs include the costs of processing, transportation and handling of a product incurred between different points along the value chain. As domestic prices are taken for two points in the value chain, two types of observed access costs need to be calculated, those involved in taking the commodity from the border to the point of competition and those involved in taking the commodity from the point of competition to the farm gate.

Observed access costs should include taxes/subsidies specific to the marketing chain, informal costs, such as bribes at road blocks, and profit margins for agents. Processing costs relate to the physical transformation of primary farm products into marketable ones, e.g. grains are cleaned, dried, or husked; sugar beet is processed into sugar; and animals are slaughtered, cut and packed. Transportation and handling costs relate to the spatial movement of products and represent another source of value added beyond the farm gate. These necessarily include labor for loading and uploading and material needed for packaging. Other less common marketing costs include charges for security and safe guarding of commodities in transit.

Observed access costs from the border to the point of competition (ACo_{wh})

As a general rule, when the country is not landlocked, the access costs from the border to the point of competition (ACo_{wh}) can be divided into three main components: port charges and import procedures (PC), transport costs[13] (TC) and processing costs (PrC). If the country is landlocked and the benchmark price is taken as unit values from trade data at the border of the country, the port charges will not be relevant; however import procedures should be taken into account. If the benchmark price is based on unit values of trade data at the border of country with a port or constructed from FOB data from major exporters (see Box 4) then port costs need to be taken into account. When calculating these access costs, direct trade policy, such as tariffs or export taxes, should not be taken into consideration. For example, if an import has to pay a statutory tariff of 200 USD per ton this should not be included in the calculation of the access costs. In the same way if exports need to pay an export tax of 200 USD per ton this should not be included in the calculation of the access costs. In order to decide what to include as components of access costs it is key to consider the marketing channel selected for the analysis as well as the nature of the benchmark and domestic prices used.

In a general version the observed access cost from the border to the point of competition (ACo_{wh}) are defined as follows:

Eq. [16] $$ACo_{wh} = PC + TC + PrC$$

As mentioned above, it is key that the access costs from the border to the point of competition refer to the same unit as the domestic price at point of competition. Thus, if a quantity adjustment factor was needed (i.e. from milled to husked rice; from sugar to sugar cane) the analyst has to make sure that the access costs refer to the unit of the product for which domestic price at point of competition is referred to (i.e. husked rice, sugar cane). If this is not the case (i.e. it refers to the product for which the benchmark price is obtained) then the access costs need to be multiplied by the quantity adjustment factor.

Box 11: Calculating access costs from the border to the point of competition

Access cost calculation is a time and knowledge intensive activity. For each commodity and each country different concepts of cost need to be taken into account and different data sources need to be consulted. For some components of access costs official statistics might be available (i.e. transport) while for other more ad-hoc data sources will be needed (i.e. specific value chain analysis, consultation with key informants). Two examples for an imported and an exported commodity are reported here. However, as mentioned above, the specific components to use as well as the relevant data sources are country and commodity specific. It is the detailed knowledge of the value chain and the import or export procedures which should be the driving forces for selecting what concepts to include and from where to obtain the data.

Access costs from the border to the point of competition for sorghum in Kenya

Kenya is a net importer of sorghum. The trade intensity of sorghum is around 10 percent during the 2005-2010 period with peaks in 2009 and 2010 when large quantities of sorghum were imported (2009) and then exported (2010) from developed countries to drought stricken Somalia and Sudan. With the exception of food aid shipments originating from the USA and the EU, Kenya imports most of its sorghum from neighboring countries, mainly Uganda. Thus the marketing channel considers imports from Uganda that compete with domestic produced sorghum in Nairobi.

[13] Transport costs should be understood in a wide sense and include handling, storage and any other relevant costs should also be included.

Sorghum does not have changes in product characteristics between the border and the point of competition, nor are there quality differences between imported and domestic sorghum. No specific data on the sorghum value chain was available in Kenya, however sorghum marketing is very similar to maize as both are grains and staple foods in Kenya. As data on the maize value chain for Kenya was available, this was used for the analysis of sorghum. The concepts of access costs for imports from Uganda to Nairobi included in the analysis cover:

- Clearing agent fee
- Plant Health Inspectorate Service
- Kenya Bureau of Standards Fee
- Health Certificate fee
- Road use fee
- Illicit costs
- Transport from Uganda-Kenya border to Nairobi (470 km)

Data was only available for one year (2008), something that is normal when ad-hoc value chain studies are used. To get estimates for the costs in all the other years studied, the costs of 2008 were deflated using the consumer price index. Transport cost in the observed domain included informal costs, such as bribes and delays at road blocks and weigh bridges.

Access costs from the border to the point of competition for sorghum imports in Kenya (Kenyan Shillings per tonne)

	2005	2006	2007	2008	2009	2010	2011
Consumer Price Index (CPI)	0.79	0.83	0.87	1.00	1.11	1.15	1.31
Cost elements							
Clearing agent fee	66	70	73	84	93	97	111
Plant Health Inspectorate Service	24	26	27	31	34	36	41
Kenya Bureau of Standards Fee	24	26	27	31	34	36	41
Health Certificate fee	24	26	27	31	34	36	41
Informal costs	14	15	16	18	20	21	24
Road use fee	49	52	54	62	69	72	82
Transport	2 810	2 980	3 107	3 577	3 953	4 115	4 692
TOTAL ACCESS COST (sum of above)	**3 013**	**3 195**	**3 331**	**3 835**	**4 239**	**4 412**	**5 030**

Shaded column provides actual estimates of costs while the non-shaded columns are deflated values taking into account the consumer price index.

Source: Table 6 in Kilambya and Witwer (2013)

Access costs from the border to the point of competition for peanuts in Burkina Faso

Burkina Faso is a net exporter of peanuts, even when the share of total production exported is quite feeble (never above 2 percent during the study period). From the analysis of the peanut value chain in the country it was concluded that most of the peanut exports are directed to Ghana and the decision whether to send peanuts to export markets or national ones (i.e. the point of competition) takes place at the Pouytenga wholesale market. The marketing channel considered for the analysis sees peanuts going from that wholesale market travel by road to the Burkina-Ghana border pass at Hamalé.

The benchmark price for peanuts was constructed starting with wholesale prices for peanuts at the Tamalé market in Ghana similar to the case of maize case shown in Box 4 providing a FOB equivalent at the border of Hamalé. Access costs from the border to the point of competition therefore need to cover all costs from Pouytenga to Hamalé. Peanuts exported compared to those traded domestically do not have changes in product characteristics between the border and the point of competition, nor are there quality differences between imported and domestic sorghum.

Access costs were obtained via an ad-hoc survey to peanut traders in the market of Pouytenga. The concepts of access costs for exports from Pouytenga to Ghana included in the analysis cover:

- Transport from Pouytenga to the Burkina Faso - Ghana border (265 km)
- Bagging
- Handling
- Storage
- Processing
- Border fees
- Traders' margin

Data was obtained for one year (2010), as asking for past costs in the survey was considered not reliable. Transport cost in the observed domain included informal costs such as bribes and delays at road blocks and weigh bridges.
To get estimates for the costs in all the other years studied, the costs of 2010 were deflated using the consumer price

index. However, traders mentioned that some item costs had not varied during the last five years and figures were only deflated for those costs that changed with time.

Access costs from the border to the point of competition for peanut exports in Burkina Faso (Franc CFA per tonne)

	2005	2006	2007	2008	2009	2010
Consumer Price Index (CPI)	100	102	102	113	116	116
Concept						
Transport cost	11 675	11 904	11 904	13 160	13 503	13 503
Bagging	2 500	2 500	2 500	2 500	2 500	2 500
Handling	1 000	1 000	1 000	1 000	1 000	1 000
Storage	2 500	2 500	2 500	2 500	2 500	2 500
Processing	1 100	1 100	1 100	1 100	1 100	1 100
Border fees	7 500	7 500	7 500	7 500	7 500	7 500
Trader's margin (10 percent of wholesale price)	22 500	18 800	24 800	29 500	23 800	27 500
TOTAL ACCESS COST (sum of above)	48 775	45 304	51 304	57 260	51 903	55 603

Source: Table 6 in Guissou and Ilboudo (2013)

Access costs from the border to the point of competition taking into account quantity adjustment factors: rice in the United Republic of Tanzania

Rice is an import for the United Republic of Tanzania. The imported product for which the benchmark price is obtained is milled rice, while domestic prices refer to husked rice (see Box 9. Access costs consider the cost of all procedures and activities that take milled rice from the port (i.e. on board of the ship) to the point of competition (i.e. the wholesale market in Dar es Salaam). These costs are reported in Tanzanian Shillings per ton of milled rice as it this product that is subject to the procedures and activities involved from the port to the point of competition.

As shown in Box 1, there is physical difference between milled and husked rice, as from a tonne of husked rice only 0.8 tonnes of milled rice are obtained. As mentioned the design of the MAFAP spreadsheet only applies the quantity conversion factor to the benchmark price, to obtain the equivalent of the benchmark price in husked rice equivalent.

$$P_{b(int\$)}\left(\frac{USD}{tonne\ of\ milled\ rice}\right) x\ QT_{wh}\ \left(\frac{tonne\ of\ milled\ rice}{tonne\ of\ husked\ rice}\right)$$
$$= P_{b(int\$)}\ in\ husked\ rice\ units\ \left(\frac{USD}{tonne\ of\ husked\ rice}\right)$$

Access costs from the border to the point of competition for rice imports in the United Republic of Tanzania include the following concepts:

- Pre-inspection charges
- Phytosanitary charges
- Port wharfage fees
- Surface and Maritime Transport Authority (SUMATRA)fee
- Documentation fees
- Clearing agents fees
- Loading and unloading
- Health and food safety standards fees
- Trader margins

All of them relate to a milled rice units as this is the commodity that is imported, thus before inserting the access costs into the MAFAP spreadsheet, these have to be multiplied by the same quantity conversion factor used for the benchmark price.

$$ACo_{wh}\left(\frac{TSh}{tonne\ of\ milled\ rice}\right) x\ QT_{wh}\ \left(\frac{tonne\ of\ milled\ rice}{tonne\ of\ husked\ rice}\right)$$
$$= ACo_{wh}\ in\ husked\ rice\ units\ \left(\frac{Tsh}{tonne\ of\ husked\ rice}\right)$$

The table below shows the access costs for 2009 and their conversion into husked rice units.

Access costs from the border to the point of competition for imported rice in the United Republic of Tanzania.

Concept	2009
[1] Pre-inspection charges [TSh per tonne of milled rice]	7 094.0

[2]	Phytosanitary charges [TSh per tonne of milled rice]	1 546.0
[3]	Port wharfage fees [TSh per tonne of milled rice]	11 824.0
[4]	SUMATRA fee [TSh per tonne of milled rice]	2 435.0
[5]	Documentation fees [TSh per tonne of milled rice]	2 797.0
[6]	Clearing agents fee [TSh per tonne of milled rice]	15 765.0
[7]	Loading and unloading [TSh per tonne of milled rice]	41 236.0
[8]	Health and food standards fee [TSh per tonne of milled rice]	1 000.0
[9]	Trader margins (5 percent of CIF price) [TSh per tonne of milled rice]	39 413.0
[10]	**Access costs [TSh per tonne of milled rice]** *[1]+[2]+….+[9]*	**123 112.0**
[11]	*Quantity adjustment factor [tonnes of milled rice per tonnes of husked rice]*	*0.8*
[12]	**Access costs [TSh per tonne of husked rice equivalent]** *[10] * [11]*	**98 489.0**

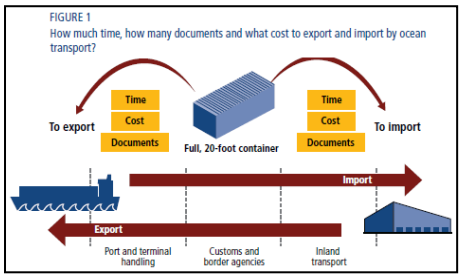
Source: Kilambya and Witwer (2013); Guissou and Ilboudo (2013) and Barreiro-Hurle (2012b)

Box 12: The cost of trading across borders according to the Doing Business Project

The Doing Business Project provides objective measures of business regulations and their enforcement across 185 economies and selected cities at the subnational and regional level. The Doing Business Project, launched in 2002, looks at domestic small and medium-size companies and measures the regulations applying to them through their life cycle. The first Doing Business report, published in 2003, covered five sets of indicators sets and 133 economies. The 2013 edition covers 11 sets of indicators sets and 185 economies.

The topic "trading across borders" if of particular relevance to the measurement of MAFAP Access costs. This topic looks at the procedural requirements for exporting and importing a standardized cargo of goods. Documents associated with every official procedure are counted—from the contractual agreement between the two parties to the delivery of goods—along with the time necessary for completion. The most recent round of data collection for the project was completed in June 2012.

Doing Business measures the time and cost (excluding tariffs) associated with exporting and importing by sea transport, and the number of documents necessary to complete the transaction. The indicators cover documentation requirements and procedures at customs and other regulatory agencies as well as at the port. They also cover logistical aspects, including the time and cost of inland transport between the largest business city and the main port used by traders. The process is depicted in the scheme portrayed in figure 1 while the main components of the measurement of the trading across border topic are listed in the table below.



Components included in the measurement of the trading across borders

Documents required to export and import (number)	Bank documents
	Customs clearance documents
	Port and terminal handling documents
	Transport documents
Time required to export and import (days)	Obtaining all the documents
	Inland transport and handling
	Customs clearance and inspection
	Port and terminal handling
	Does not include ocean transport time
Cost required to export and import (USD per container)	All documentation
	Inland transport and handling
	Customs clearance and inspections
	Port and terminal handling
	Official costs only, no bribes

Cost measures the fees levied on a 20-foot container in U.S. dollars. All the fees associated with completing the procedures to export or import the goods are taken into account. These include costs for documents, administrative fees for customs clearance and inspections, customs broker fees, port-related charges and inland transport costs. The cost does not include customs tariffs and duties or costs related to sea transport. Only official costs are recorded.

For example, for the United Republic of Tanzania the following data is available. For this country the port of entry and exit is Dar es Salaam as well as the main market to (from) which the goods are transported.

Cost required to export and import (USD per 20 foot container) in the United Republic of Tanzania

	2007	2008	2009	2010	2011	2012	2013
EXPORT TOTAL	**1 212**	**1 212**	**1 262**	**1 262**	**1 262**	**1 255**	**1 040**
Document Preparation	520	520	520	520	520	495	270
Customs	240	240	240	240	240	240	250
Terminal Handling	302	302	302	302	302	320	320
Inland transportation	150	150	200	200	200	200	200
IMPORT TOTAL	**1 425**	**1 425**	**1 475**	**1 475**	**1 475**	**1 430**	**1 565**
Document Preparation	520	520	520	520	520	450	575
Customs	240	240	240	240	240	240	250
Terminal Handling	515	515	515	515	515	540	540
Inland transportation	150	150	200	200	200	200	200

This data can be used in two ways: if there is no other data source it can be used as an estimate of the access costs between the border and the point of competition. However two issues must be taken into account. For all countries, the margins of importers should be added. For landlocked countries if the benchmark price is taken at the point of entry into the country special attention must be paid to inland transportations and handling and port and terminal handling, as these might be already included in the CIF unit value. Second, illicit access costs, if known, should be added.

If domestic data sources have been found, as due diligence, the analyst should compare these to the Doing Business estimates in order to check for differences that may arise. If largely different, the analyst should try to identify the reasons behind this difference.

Source: www.doingbusiness.org

Observed access costs from the point of competition to the farm gate (ACo_{fg})

Following the same principle as for the access costs from the border to the point of competition, the access costs from the point of competition to the border allow to make equivalent the benchmark price and the farm gate price by considering all processes and activities that a commodity must undergo from the farm in order to be at the point of competition. It includes the costs of processing, transportation and handling of a product between those two points in the value chain.

Box 13: Calculating access costs from the farm gate to the point of competition

Transport and handling: maize in Ethiopia

For the analysis of maize in Ethiopia the point of competition was assumed to be the wholesale markets in Addis Ababa. The farm gate price is taken from the Jima area located 300 km south west of Addis which is one of the major maize producing areas in Ethiopia.

Access costs from the point of competition to the farm gate include five elements:

i) Loading,
ii) Transport,
iii) Broker fees for accessing trucks,
iv) Broker fees for selling grain in Addis Ababa,
v) Trader margins.

Data was obtained by key informants from the Addis Ababa wholesale market, which included traders, brokers and traders' associations. As it can be seen from the data presented below, margins have seen a declining trend due to the increase of other cost items such as transport and broker fees.

Access costs from the point of competition to the farm gate for maize in Ethiopia (Birr per tonne)

Concept	2005	2006	2007	2008	2009	2010
Loading	20	20	20	20	30	30
Transport	200	200	250	300	350	475
Broker fees – accessing truck	5	5	5	7	10	10
Broker fees – selling grain in Addis	10	10	15	20	25	30
Traders' margins	250	250	250	200	200	200
TOTAL ACCESS COST (sum of above)	**485**	**485**	**540**	**547**	**615**	**745**

Source: Table 7 in Demeke (2012)

Inclusion of processing costs into the calculation: cotton in Kenya

The farm gate price for cotton refers to raw cotton (or seed cotton) while the price at the point of competition refers to cotton lint and cotton seed (see box 3). In addition the price of raw cotton is obtained at the farm gate and the price of cotton lint and cotton seed is ex-ginnery (i.e. price paid for the products at the gate of the factory). Therefore the access costs need to include both the transport of the raw cotton to the ginnery, the costs of the ginning process and the ginners margins. Ginning costs were taken from a value chain analysis for cotton undertaken by the World Bank in 2005 while informal costs for transport of agricultural products were taken from a study on maize marketing undertaken by the World Bank in 2009. Data was updated using the Kenyan consumer price index for years other than those for which the original data was available. All costs have been converted to seed cotton equivalents to take into account the different units of the input commodity (raw cotton) and the output ones (lint and seed) The data used is presented in the table below.

Access costs from the point of competition to the farm gate for cotton in Kenya (KSh per tonne of seed cotton)

Concept	2005	2006	2007	2008	2009	2010
Drying and cleaning	887	942	983	1 131	1 250	1 301
Ginning	827	877	914	1 052	1 163	1 211
Cleaning and packing	1 128	1 196	1 247	1 436	1 587	1 652
Transport from farm to ginnery	363	385	401	492	510	531
Administration	834	885	922	1 062	1 174	1 221
Ginner mark-up (6 percent of seed cotton price)	1 762	1 782	1 782	1 940	2 079	2 792
Council cess	244	258	269	310	343	357
Roadblocks and weighbridges	132	140	146	168	186	193
TOTAL (sum of above)	**6 178**	**6 464**	**6 665**	**7 561**	**8 291**	**9 258**

Source: Table 10 in Monroy (2012)

Considering the quantity adjustment factor: access costs for sugar in the United Republic of Tanzania

In the analysis of price incentives and disincentives in the United Republic of Tanzania the prices at the point of competition refer to sugar in Dar es Salaam while those at the farm gate refer to sugar cane. The access costs for sugar cane in this case included three main components:

i) Sugar cane milling,
ii) Sugar transport from sugar mill to Dar es Salam,
iii) Milling margin over sugar cane.

Sugar milling costs were obtained from South Africa and adapted to the URT context by reducing them by 10 percent as there was evidence that South African costs are significantly higher than those in the rest of Sub-Saharan Africa. Margins were estimated as 10 percent of the purchase price of sugar cane and transport cost using the unit value available for staple foods and the distance between the major production area and Dar es Salaam.

Data on items i) and ii) are referred to sugar units and thus had to be converted into sugar cane equivalents using the quantity adjustment factor. Comparing FAOSTAT data for sugar cane and sugar production in the URT the technical conversion factor was fixed at 0.1 (i.e. 10 tonnes of sugar cane for each tonne of sugar). The final data used for the analysis is reported in the table below.

Access costs from the point of competition to the farm gate for sugar in the United Republic of Tanzania

Concept	2005	2006	2007	2008	2009	2010
Milling, refining and processing (TSh per tonne of sugar)	156 070	167 747	169 939	152 993	176 400	227 181
Milling refining and processing (TSh per tonne of sugar cane) [previous row multiplied by 0.1]	15 607	16 775	16 994	15 299	17 640	22 718
Margin (TSh per tonne of sugar cane)	2 143	2 324	3 044	3 372	3 504	4922
Transport (TSh per tonne of sugar)	43 474	48 202	47 933	46 046	50 832	54 247

Transport (TSh per tonne of sugar cane) [previous row multiplied by 0.1]	4 347	4 820	4 793	4 605	5 083	5 425
Total access costs (TSh per tonne of sugar cane) [sum of shaded rows]	**22 098**	**23 919**	**24 831**	**23 276**	**26 227**	**33 065**

Source: Table 8 in Nkonya and Barreiro-Hurle (2012)

Source: Demeke (2012), Monroy (2012) and Nkonya and Barreiro-Hurle (2012)

4.5 Calculating observed reference prices

Using the data prices, costs and quantity and quality adjustment factors described in the sections above, the MAFAP spreadsheet calculates observed reference prices which are reported in the green area of the spreadsheet (rows 29 to 38). As mentioned above, observed reference prices represent the maximum price that could be obtained in absence of domestic market and trade policies, overall market performance increased and with the existing access costs in the value chain. In order to calculate the observed reference price the following steps are needed.

First, the spreadsheet reports the benchmark price in local currency units ($P_{b(loc\$)}$). To obtain this price, the benchmark price (expresses in USD per tonne) is multiplied by the exchange rate (expressed in local currency units per USD) obtaining the benchmark price (expressed in local currency per tonne) ($P_{b(loc\$)}$).

Eq. [17] $$P_{b(loc\$)}\left(\frac{local\ currency}{tonne}\right) = P_{b(int\$)}\left(\frac{USD}{tonne}\right) \times ER_o\left(\frac{local\ currency}{USD}\right)$$

Next the analyst needs to make the benchmark price in local currency equivalent to the domestic price at the point of competition. For this the analyst should take into account the quantity and quality adjustment factors from the border to the point of competition and the access costs from the border to the point of competition. If the commodity is imported to the country access costs from the border to the point of competition should be added in order to take into account the full cost of imports. In case the commodity is exported they are deducted to take into account the additional costs that are needed in order to be able to compete in international markets and make export prices equivalent to prices at the point of competition. Thus, the observed reference price at the point of competition is determined by the following equations:

Eq. [18a] $$RPo_{wh} = \left(P_{b(loc\$)} \times QT_{wh} \times QL_{wh}\right) + ACo_{wh}\ [\textit{if the commodity is imported}]$$

Eq. [18b] $$RPo_{wh} = \left(P_{b(loc\$)} \times QT_{wh} \times QL_{wh}\right) - ACo_{wh}\ [\textit{if the commodity is exported}]$$

In order to calculate the reference price at point of competition, the MAFAP spreadsheet will take into account the trade status of the commodity (to be inserted in row 6) and possible quality and quantity adjustments factors between the border and the point of competition (to be inserted in rows 23 and 24). The formula used for the calculation will be show in column L.

Last, the reference price at the farm gate is calculated. This is done starting from the reference price at point of competition and taking into account the quantity and quality adjustment factors between the point of competition and the farm gate and the access costs between the point of competition and farm gate. By deducting the access costs from the point of competition to the farm gate (ACo_{fg})

the price at point of competition is made comparable to the price at farm gate. Thus the observed reference price at the farm gate is determined by the following equation:

Eq. [19] $$RPo_{fg} = \left(RPo_{wh} \times QT_{fg} \times QL_{fg}\right) - ACo_{fg}$$

The MAFAP spreadsheet will take into account whether quality and quantity adjustments factors exist between the border and the point of competition (to be inserted in rows 25 and 24) in order to calculate the reference price at the point of competition. The formula used for the calculation will be show in column L. It is important to remember that, even when it might be needed, the spreadsheet will not, however, apply the adjustment factors to access costs (see Box 10).

Observed calculated prices are reported by the MAFAP spreadsheet in rows 30 to 38 (light green shaded cells).

4.6 Calculating observed price gaps and nominal rates of protection

Using domestic and observed reference prices a set of observed indicators is calculated. Observed price gaps are obtained by deducting the observed reference price from the observed domestic price. This comparison is made at two levels: at the point of competition and at the farm gate.

Eq. [20] $$\mathrm{PG}o_{\mathrm{wh}} = \mathrm{P}_{\mathrm{dwh}} - \mathrm{RP}o_{\mathrm{wh}}$$

Eq. [21] $$\mathrm{PG}o_{fg} = \mathrm{P}_{\mathrm{dfg}} - \mathrm{RP}o_{\mathrm{fg}}$$

The observed price gap provides an assessment of the effects of policies and overall market performance as it includes factors impeding arbitrage between international and domestic markets. However, quantitative distinction between these “policy” and “other” sources of the observed price gap is difficult, but every effort should be made to explain these sources qualitatively (see Section 4.7).

An additional group of indicators in this family is the observed nominal rates of protection. They are calculated as the ratios of the observed price gaps in relation to the reference price. This group of indicators allow for cross commodity and cross country comparisons.

Eq. [22] $$\mathrm{NRP}o_{wh} = \frac{P_{dwh-o}}{RPo_{wh}} \times 100$$

Eq. [23] $$\mathrm{NRP}o_{fg} = \frac{P_{dfg-RPo_{fg}}}{RPo_{fg}} \times 100$$

These indicators are calculated by the MAFAP spreadsheet and reported in lines 41 to 56 (light blue shaded cells).

4.7 Interpreting observed indicators

Domestic prices are the result of the interaction of demand and supply, domestic trade and market policies and market performance. Observed reference prices on the other hand do not incorporate domestic trade and market policies. Therefore the difference between the domestic price and the observed reference price is a quantitative indicator that measures the effect of domestic trade and market policies and overall market performance on prices. In order to interpret the results the analyst must take into account all the acquired knowledge during the study of the value chain and the policy environment of the specific commodity.

Interpreting the results can be defined as applying the value chain and policy lens to the results obtained for the different indicators. The MAFAP analysis requires bringing together a quantitative base (the indicators) and a qualitative approach that requires a deep understanding of the policy and value chain environment. The analyst will only be able to give meaning to the indicators by studying the value chain and the policy context for the commodity analyzed. This knowledge is reflected in the technical notes drafted for each commodity and country.

Each policy that is in place in a country has an expected effect on domestic prices. For example import tariffs should increase domestic prices above benchmark ones. On the other hand export taxes should decrease domestic prices below benchmark ones. A comprehensive review of the types of policies and their expected impact on prices can be found in FAO (2011) and Demeke *et al* (2009). Additional information on agricultural policies, their classification and a partial database on agricultural policies in different African countries can be found in FAO's Food and Agriculture Policy Decisions Analysis Initiative (www.fao.org/economic/fapda). However, the analyst is the person who should have the most updated view of policies in place and value chain functioning. It is only by having this information in mind that it is possible to understand and interpret the results obtained.

In a situation where there would be no domestic policies, markets would be perfectly integrated, and the commodity specific value chain would be undistorted the result of the observed price gap and observed nominal rate of protection would be zero. However this situation seldom holds in the analysis of commodities. There is always some policy which affects the commodity, markets are not perfectly integrated and value chains face some distortions.

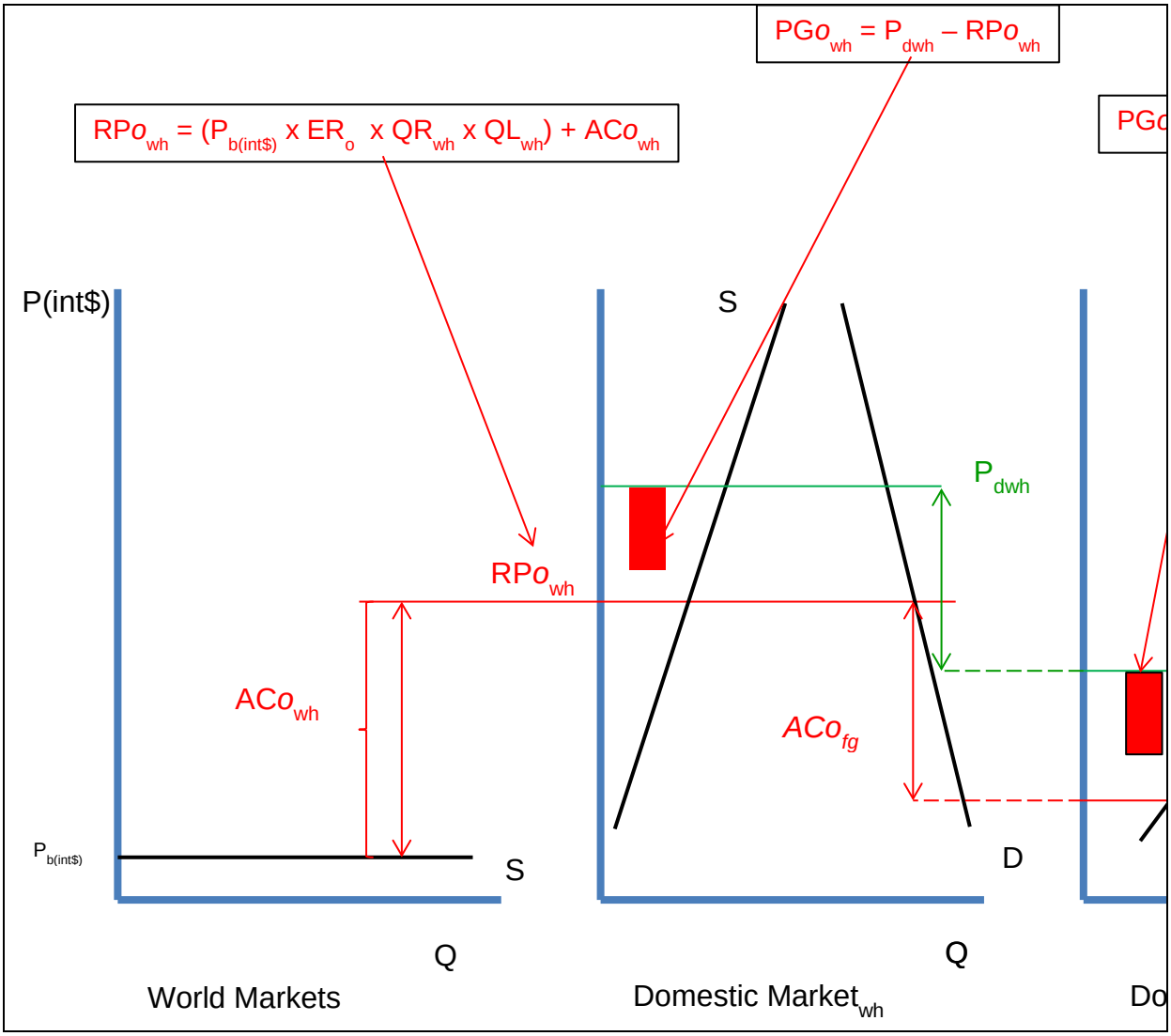
When observed price gaps are positive (i.e. domestic prices are higher than observed reference prices) it can be considered as a quantitative measure of incentives to farmers (if measured at the farm gate) or wholesalers (if measured at the point of competition) resulting from domestic trade and market policies and overall market performance. Market performance is understood asall other factors which impede price arbitrage between domestic and international markets, such as lack of market institutions, poor information, and underdeveloped physical infrastructure. The contrary is true (i.e. gaps are a quantitative measure of the disincentives) when the observed price gaps are negative.

With the necessary caveats associated to the static nature of the analysis undertaken, the price gaps show the maximum change in farm gate or wholesale prices that could occur if domestic market and trade policies were removed and overall market functioning was perfect. The degree to which the change would actually happen would depend on the demand and supply elasticities and the market power of each of the agents.

In order to better understand the observed indicators this document outlines a three step approach: first it provides a graphic representation of price gaps, second it provides a simplified example to explain how the calculations are made, and third it presents real world examples taken from the experience acquired during the phase I of MAFAP.

For example let us consider a **commodity for which a country is a net importer** and trade intensity is high. The imported commodity and the commodity produced domestically are the same in terms of quantity and quality. The country has a 50 percent import tariff, there are no other policies in place and markets are perfectly integrated. This situation is represented in Figure 4.

Figure 4: Graphical representation of the observed price gap analysis for an imported commodity with an import tariff



Starting from the left side of the figure, the observed benchmark price ($Pb_{(int\$)}$) is obtained as the unit value of imports of the commodity into the country. To construct the observed reference price at the point of competition (RPo_{wh}), the benchmark price is multiplied by the observed exchange rate (ER_o) and the observed access costs from the border to the wholesale (ACo_{wh}) are added[14], in these access

[14] Please note that as quality and quantity are not different for the imported and the domestically produced commodity they are assumed to be 1. In the MAFAP spreadsheet they do not need to be inserted

costs the tariff is not included. This observed reference price shows the price at which imported commodities could arrive in the domestic market (central pane of the figure) in absence of policies (i.e. the tariff). The observed reference price is compared to the domestic price at the point of competition (P_{dwh}). The observed price gap at point of competition in this simplified example is the impact of the tariff. Using a numerical example this situation is summarized in Table 4.

Table 4: Simplified analysis of observed price incentives and disincentives at the point of competition for an imported commodity with a 50 percent ad valorem import tariff

Concept*	Symbol	Formula	Unit	Value
Benchmark price	$P_{b(int\$)}$	data	USD per ton	100
Exchange rate	ER_o	data	Local currency per USD	10
Benchmark price in local currency	$P_{b(loc\$)}$	$P_{b(int\$)} * ER_o$	Local currency per ton	1 000
Access costs from border to point of competition	ACo_{wh}	data	Local currency per ton	50
Reference price at point of competition	RPo_{wh}	$P_{b(loc\$)} + ACo_{wh}$	Local currency per ton	1 050
Domestic price at point of competition	P_{dwh}	data	Local currency per ton	1 550
Price gap at point of competition	PGo_{wh}	$P_{dwh} - RPo_{wh}$	Local currency per ton	500
Nominal rate of protection at point of competition	$NRPo_{wh}$	PGo_{wh} / RPo_{wh}	Percent	48%

Shaded rows are concepts that are calculated automatically by the MAFAP spreadsheet.
*all concepts are accompanied by the adjective "observed," which has been omitted for reasons of space.

In this simplified case where only a tariff is in place, the price gap at point of competition is equal to the value of the ad valorem tariff in place (1 000 * 50 percent = 500). The nominal rate of protection at point of competition is 48 percent. It is different from the tariff because the tariff applies to the benchmark price while the nominal rate of protection is calculated using the reference price at point of competition.

From the point of competition then we move towards the farm gate. For this we start the calculations with the observed reference price at point of competition to which the observed access costs from the point of competition to the farm gate (AC_{ofg}) are deducted. Using the same numerical example this situation is summarized in Table 5.

Table 5: Simplified analysis of observed price incentives and disincentives at the farm gate for an imported commodity with a 50 percent ad valorem import tariff

Concept*	Symbol	Formula	Unit	Value
Reference price at point of competition	RPo_{wh}	From table 3	Local currency per ton	1 050
Access costs from point of competition to the farm gate	ACo_{fg}	data	Local currency per ton	350
Reference price at farm gate	RPo_{fg}	$RPo_{wh} - ACo_{fg}$	Local currency per ton	700
Domestic price at farm gate	P_{dfg}	data	Local currency per ton	1 200
Price gap at farm gate	PGo_{fg}	$P_{dfg} - RPo_{fg}$	Local currency per ton	500
Nominal rate of protection at farm gate	$NRPo_{fg}$	PGo_{fg} / RPo_{fg}	Percent	71%

as the embedded formulas detect whether there is an adjustment factor and takes it into account to calculate the reference prices.

Shaded rows are concepts that are calculated automatically by the MAFAP spreadsheet.
* all concepts are accompanied by the adjective "observed" which has been omitted for reasons of space.

Again, in this simplified example the price gap is equivalent to the value of the ad valorem tariff (500 local currency units). The nominal rate of protection is higher than that at the point of competition (71 percent versus 48 percent) because it is calculated in relationship to the observed reference price at the farm gate which is lower than the observed reference price at the point of competition. Figure 5 provides a snapshot of how this calculation looks in the MAFAP spreadsheet. Data is inserted in the yellow area, while calculated prices and indicators are generated automatically by the spreadsheet.

Figure 5: MAFAP indicator calculation spreadsheet with the example data inserted

DATA		Unit	Symbol	Year trade status	2005 m	Notes
Benchmark Price						
	Observed	USD/TON	$P_{b(int\$)}$		100.00	CIF Price
	Adjusted	USD/TON	P_{ba}			
Exchange Rate						
	Observed	Loc/USD	ER_o		10.00	
	Adjusted	Loc/USD	ER_a			
Access costs border - point of competition						
	Observed	Loc/TON	ACo_{wh}		50.00	
	Adjusted	Loc/TON	ACa_{wh}			
Domestic price at point of competition		Loc/TON	P_{dwh}		1,550.00	
Access costs point of competition - farm gate						
	Observed	Loc/TON	ACo_{fg}		350.00	
	Adjusted	Loc/TON	ACa_{fg}			
Farm gate price		Loc/TON	P_{dfg}		1,200.00	
Externalities associated with production		Loc/TON	E			
Budget and other product related transfers		Loc/TON	BOT			From PE Analysis
Quantity conversion factor (border - point of competition)		Fraction	QT_{wh}			
Quality conversion factor (border - point of competition)		Fraction	QL_{wh}			
Quantity conversion factor (point of competition - farm gate)		Fraction	QT_{fg}			
Quality conversion factor (point of competition - farm gate)		Fraction	QL_{fg}			

CALCULATED PRICES		Unit	Symbol	2005	Formula
Benchmark price in local currency					
	Observed	Loc/TON	$P_{b(loc\$)}$	1,000.00	[1]*[2]
	Adjusted	Loc/TON	$P_{b(loc\$)a}$	1,000.00	[1]*[2]
Reference Price at point of competition					
	Observed	Loc/TON	RPo_{wh}	1,050.00	[9]+[3]
	Adjusted	Loc/TON	RPa_{wh}	1,050.00	[10]+[3]
Reference Price at Farm Gate					
	Observed	Loc/TON	RPo_{fg}	700.00	[11]-[5]
	Adjusted	Loc/TON	RPa_{fg}	700.00	[12]-[5]

INDICATORS		Unit	Symbol	2005	Formula
Price gap at point of competition					
	Observed	Loc/TON	PGo_{wh}	500	[4]-[11]
	Adjusted	Loc/TON	PGa_{wh}	500	[4]-[12]
Price gap at farm gate					
	Observed	Loc/TON	PGo_{fg}	500	[6]-[13]
	Adjusted	Loc/TON	PGa_{fg}	500	[6]-[14]
Nominal rate of protection at point of competition					
	Observed	%	$NRPo_{wh}$	48%	[15]/[11]
	Adjusted	%	$NRPa_{wh}$	48%	[16]/[12]
Nominal rate of protection at farm gate					
	Observed	%	$NRPo_{fg}$	71%	[17]/[13]
	Adjusted	%	$NRPa_{fg}$	71%	[18]/[14]

However, in real life such simplified examples are not found. Two or more policies affect domestic prices of agricultural products. Moreover, in Africa markets are not perfectly integrated and price transmission is not perfect. Box 14 shows some of the results obtained for imported commodities in the framework of MAFAP work.

Box 14: MAFAP results on observed price incentives and disincentives for imported commodities

Sugar in the URT: how other policies mitigate the impact of a tariff on prices at the point of competition

Sugar is one of the major agricultural imports in the United Republic of Tanzania. On average 33 percent of total consumption is covered by imports. Sugar imports are subject to the East African Community (EAC) Common External Tariff of 100 percent or 200 USD whatever is highest. Due to sugar scarcity and high prices this tariff is waived ad-hoc by the government either for all traders or for specific companies which use sugar in their processing plants.

Using the data reported in Nkonya and Barreiro-Hurle (2012) the following observed price gaps at point of competition and monetary value of tariffs were obtained.

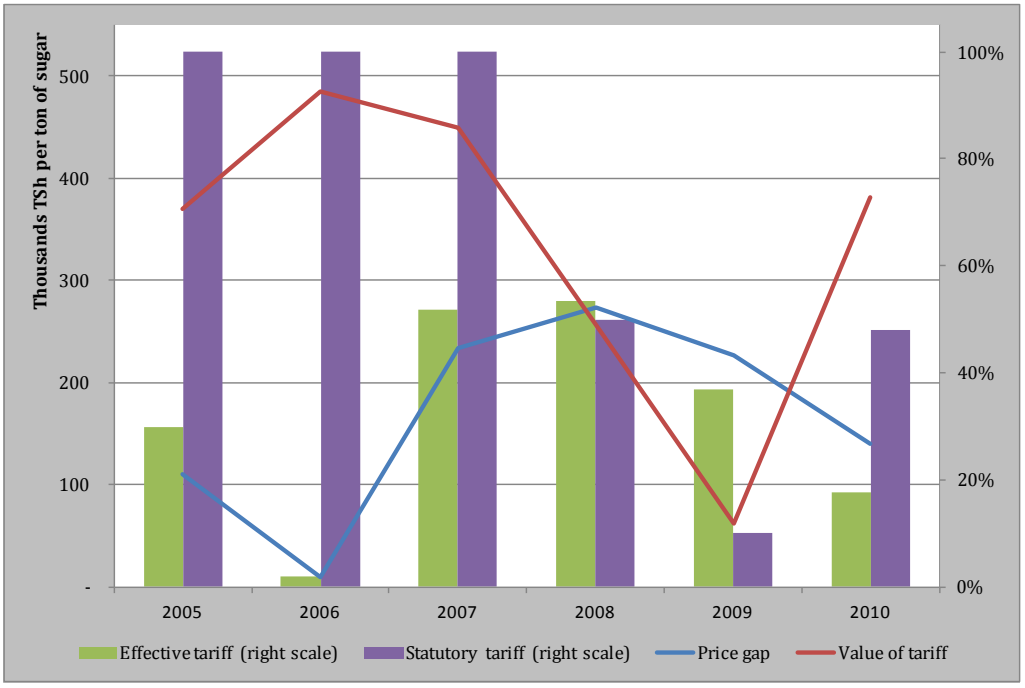
Observed price gaps at the point of competition for sugar in the United Republic of Tanzania and ad valorem tariff equivalents.

Concept	2005	2006	2007	2008	2009	2010
I. Observed price gap at the point of competition (TSh per tonne of sugar)	109 841	9 969	233 596	273 387	227 084	139 810
II. Benchmark price (USD per tonne of sugar)	327	387	361	429	466	564
III. Exchange rate (TSh per USD)	1 129	1 252	1 245	1 196	1 320	1 409
IV. Benchmark price in local currency (TSh per tonne of sugar) [II * III]	369 519	484 818	449 954	512 962	615 610	794 007
V. Tariff rate (percent of benchmark price)*	100	100	100	50	10	48
VI. Value of ad valorem tariff (TSh per tonne of sugar) [IV * V]	369 517	484 818	449 954	256 346	61 561	381 123
VII. Effective tariff (percent of benchmark price) [I /IV]	30	2	52	53	37	18

* For 2008-2010 the tariff rate has been calculated as the weighted average of the different tariff waivers in place.

From the data presented above the following results can be drawn. During the period 2005-2008 the observed price gap was lower than the value of the tariff (comparing rows I. and VI.), or, similarly, the effective tariff was lower than statutory tariff (comparing rows V. and VII.). This is expected as sugar is a very sensitive item in the URT and when prices peak the government sets maximum prices which are below the import parity price (benchmark plus access costs plus tariff). However, when the government waived the tariff even when the price gaps are reduced, these do not fall as much as the tariff waiving would allow. This is due to the lack of coordination between the different administrations prevents consumers benefiting from the lower tariffs and an imperfectly functioning market.

Observed price gap at point of competition, value of the ad valorem tariff, tariff rate and effective tariff rate for sugar in the United Republic of Tanzania.



Rice in Ghana: how market functioning increases the impact of a tariff on prices at the point of competition

Rice is the main agricultural import in Ghana, covering between 30 and 40 percent of total domestic consumption with imports. Rice imports face an ad valorem import tariff of 20 percent. During 2008 due to the high food prices crisis the import duty was lifted and later reinstituted in 2009. Imported rice is of higher quality than domestic one and thus a 0.4 quality adjustment factor is applied. This quality adjustment factor reflects the price premium in international markets of grade 2 rice (the imported variety) versus grade 5 rice (the domestic produced variety).

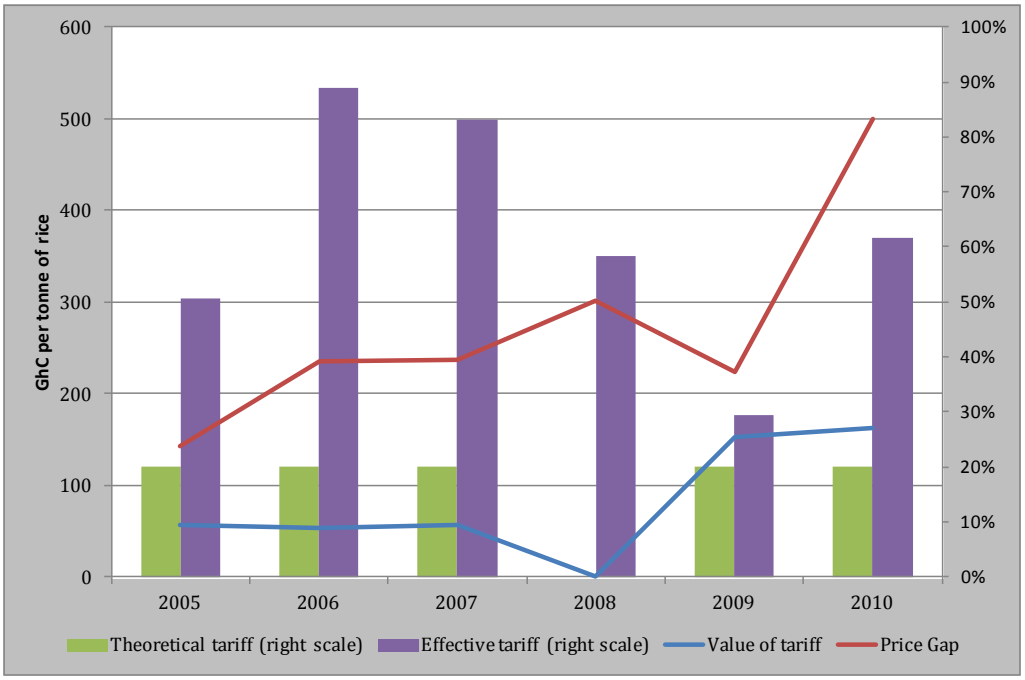
Using the data reported in Angelucci *et al* (2012) the following observed price gaps at point of competition and monetary value of tariffs were obtained.

Observed price gaps at the point of competition for rice in Ghana and ad valorem tariff equivalents.

Concept	2005	2006	2007	2008	2009	2010
I. Observed price gap at the point of competition (GhC per tonne of domestic rice equivalent)	143	235	237	302	224	499
II. Benchmark price (USD per tonne of imported rice)	310	287	303	489	541	566
III. Exchange rate (GhC per USD)	0.91	0.92	0.94	1.06	1.41	1.43
IV. Benchmark price in local currency (GhC per tonne of imported rice) [II * III]	282	264	285	518	763	810
V. Tariff rate (percent of benchmark price)	20	20	20	0	20	20
VI. Value of ad valorem tariff (GhC per tonne of imported rice) [IV * V]	56	53	57	0	153	162
IX. Effective tariff (percent of benchmark price) [(I /IV]	51	89	83	58	29	62

As it can be seen during the whole period the observed price gap was higher than the value of the tariff (comparing rows I. and VI.) or what is the same the effective tariff was lower than the theoretical one (comparing rows V. and VII.). This means that there are additional policy and market functioning costs to import which further increase the costs of imported rice, acting de facto as additional protection. This could include high profit margins by the limited number of major rice importers (only five companies) or informal costs of importing rice through the port of Tema which are not included in the calculation of the reference price.

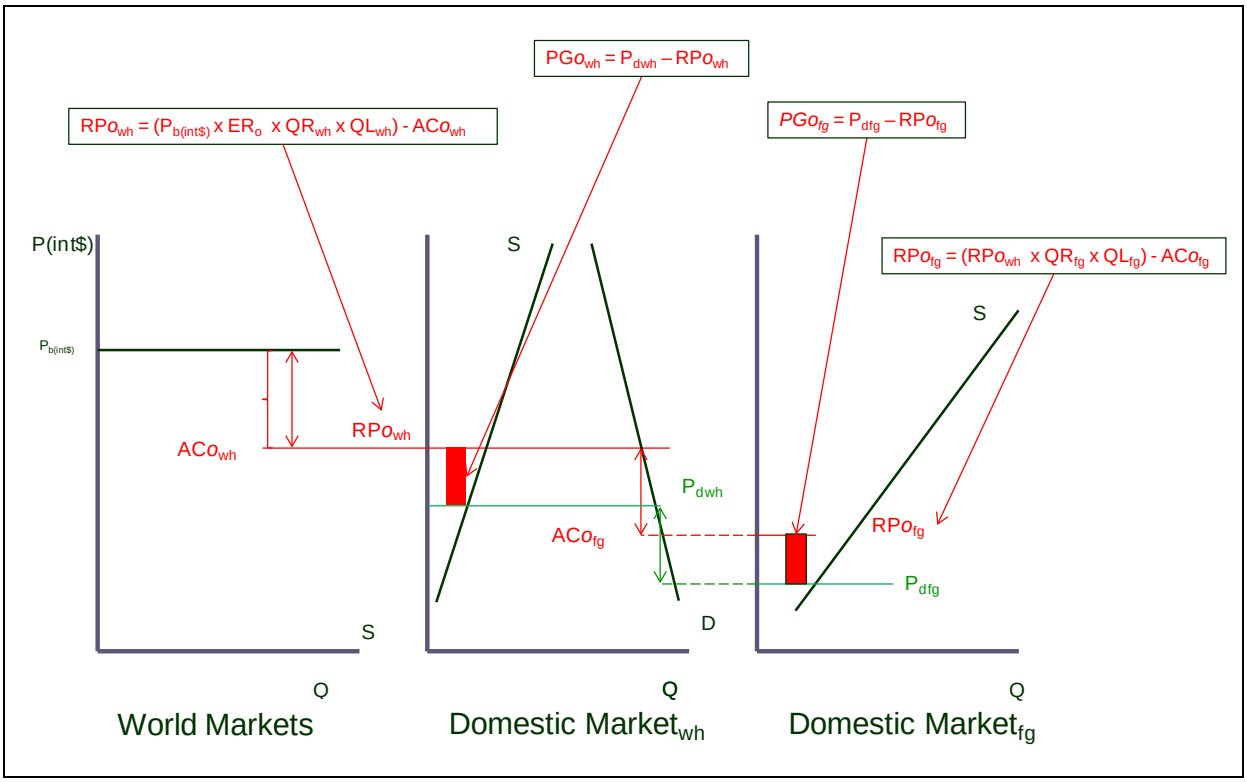
Observed price gap at point of competition, value of the ad valorem tariff, tariff rate and effective tariff rate for rice in Ghana.



Source: Nkonya and Barreiro-Hurle (2012) and Angelucci *et al* (2012).

A similar analysis can be done for the case of **commodities for which a country is a net exporter** and trade intensity is high. Again, the exported commodity and the domestically produced commodity are the same in terms of quantity and quality. The country has a 10 percent export tax, there are no other policies in place and markets are perfectly integrated. This situation is represented in Figure 6.

Figure 6: Graphical representation of the observed price gap analysis for an exported commodity with an export tax



Starting from the left side of the figure, the observed benchmark price ($Pb_{(int\$)}$) is obtained as the unit value of exports of the commodity. To construct the observed reference price at the point of competition (RPo_{wh}), the benchmark price is multiplied by the observed exchange rate (ER_o) and the observed access costs from the border to the wholesale (ACo_{wh}) are deducted[15], in these access costs the export tax is not included. This observed reference price shows the price which could be paid for exported commodities in the domestic market (central pane of the figure) in absence of policies (i.e. the export tax). The observed reference price is compared to the domestic price at the point of competition (P_{dwh}). The observed price gap at point of competition in this simplified example is the impact of the export tax. Using a numerical example this situation is summarized in Table 6.

[15] Please note that as quality and quantity are not different for the imported and the domestically produced commodity they are assumed to be 1. In the MAFAP spreadsheet they do not need to be inserted as the embedded formulas detect whether there is an adjustment factor and takes it into account to calculate the reference prices.

Table 6: Simplified analysis of observed price incentives and disincentives at the point of competition for an exported commodity with a 5 percent export tax

Concept*	Symbol	Formula	Unit	Value
Benchmark price	$P_{b(int\$)}$	data	USD per ton	100
Exchange rate	ER_o	data	Local currency per USD	10
Benchmark price in local currency	$P_{b(loc\$)}$	$P_{b(int\$)} * ER_o$	Local currency per ton	1 000
Access costs from border to point of competition	ACo_{wh}	data	Local currency per ton	50
Reference price at point of competition	RPo_{wh}	$P_{b(loc\$)} - ACo_{wh}$	Local currency per ton	950
Domestic price at point of competition	P_{dwh}	data	Local currency per ton	900
Price gap at point of competition	PGo_{wh}	$P_{dwh} - RPo_{wh}$	Local currency per ton	-50
Nominal rate of protection at point of competition	$NRPo_{wh}$	PGo_{wh} / RPo_{wh}	Percent	-5.3%

Shaded rows are concepts that are calculated automatically by the MAFAP spreadsheet.
* all concepts are accompanied by the adjective "observed" which has been omitted for reasons of space.

In this simplified case where only an export tax is in place, the price gap at point of competition is equal to the value of the export tax in place (1 000 * 5 percent = 50). The nominal rate of protection at point of competition is -5.3 percent. It is different from the export tax because this applies to the benchmark price while the nominal rate of protection is calculated using the reference price at point of competition.

From the point of competition then we move towards the farm gate. For this we start the calculations with the observed reference price at point of competition to which the observed access costs from the point of competition to the farm gate (AC_{ofg}) are deducted. Using the same numerical example this situation is summarized in Table 7.

Table 7: Simplified analysis of observed price incentives and disincentives at the farm gate for an exported commodity with a 5 percent export tax

Concept*	Symbol	Formula	Unit	Value
Reference price at point of competition	RPo_{wh}	From table 5	Local currency per ton	950
Access costs from point of competition to the farm gate	ACo_{fg}	data	Local currency per ton	350
Reference price at farm gate	RPo_{fg}	$RPo_{wh} - ACo_{fg}$	Local currency per ton	600
Domestic price at farm gate	P_{dfg}	data	Local currency per ton	550
Price gap at farm gate	PGo_{fg}	$P_{dfg} - RPo_{fg}$	Local currency per ton	-50
Nominal rate of protection at farm gate	$NRPo_{fg}$	PGo_{fg} / RPo_{fg}	Percent	-8.3%

Shaded rows are concepts that are calculated automatically by the MAFAP spreadsheet.
* all concepts are accompanied by the adjective "observed" which has been omitted for reasons of space.

Again, in this simplified example the price gap is equivalent to the value of the ad valorem tariff (-50 local currency units). The nominal rate of protection is higher than that at the point of competition (-8.3 percent versus -5.3 percent) because it is calculated in relationship to the observed reference price at the farm gate which is lower than the observed reference price at the point of competition. Figure 7 provides a snapshot of how this calculation looks in the MAFAP spreadsheet. Data is inserted

in the yellow area while calculated prices and indicators are generated automatically by the spreadsheet.

Figure 7: MAFAP indicator calculation spreadsheet with the example data inserted

	DATA		Unit	Symbol	Year trade status	2005 x	Notes
	Benchmark Price						
1		*Observed*	XXX/TON	$P_{b(int\$)}$		**100**	FOB Price
1b		*Adjusted*	XXX/TON	P_{ba}			
	Exchange Rate						
2		*Observed*	YYY/XXX	ER_o		10	
2b		*Adjusted*	YYY/XXX	ER_a			
	Access costs border - point of competition						
3		*Observed*	YYY/TON	ACo_{wh}		50	
3b		*Adjusted*	YYY/TON	ACa_{wh}			
4	**Domestic price at point of competition**		YYY/TON	P_{dwh}		**900**	
	Access costs point of competition - farm gate						
5		*Observed*	YYY/TON	ACo_{fg}		350	
5b		*Adjusted*	YYY/TON	ACa_{fg}			
6	**Farm gate price**		YYY/TON	P_{dfg}		550	
7	Externalities associated with production		YYY/TON	E			
8	Budget and other product related transfers		YYY/TON	BOT			From PE Analysis
	Quantity conversion factor (border - point of competition)		Fraction	QT_{wh}			
	Quality conversion factor (border - point of competition)		Fraction	QL_{wh}			
	Quantity conversion factor (point of competition - farm gate)		Fraction	QT_{fg}			
	Quality conversion factor (point of competition - farm gate)		Fraction	QL_{fg}			

	CALCULATED PRICES		Unit	Symbol	2005	Formula
	Benchmark price in local currency					
9		*Observed*	YYY/TON	$P_{b(loc\$)}$	1,000	[1]*[2]
10		*Adjusted*	YYY/TON	$P_{b(loc\$)a}$	1,000	[1]*[2]
	Reference Price at point of competition					
11		*Observed*	YYY/TON	RPo_{wh}	950	[9]-[3]
12		*Adjusted*	YYY/TON	RPa_{wh}	950	[10]-[3]
	Reference Price at Farm Gate					
13		*Observed*	YYY/TON	RPo_{fg}	600	[11]-[5]
14		*Adjusted*	YYY/TON	RPa_{fg}	600	[12]-[5]

	INDICATORS		Unit	Symbol	2005	Formula
	Price gap at point of competition					
15		*Observed*	YYY/TON	PGo_{wh}	(50)	[4]-[11]
16		*Adjusted*	YYY/TON	PGa_{wh}	(50)	[4]-[12]
	Price gap at farm gate					
17		*Observed*	YYY/TON	PGo_{fg}	(50)	[6]-[13]
18		*Adjusted*	YYY/TON	PGa_{fg}	(50)	[6]-[14]
	Nominal rate of protection at point of competition					
19		*Observed*	%	$NRPo_{wh}$	-5.3%	[15]/[11]
20		*Adjusted*	%	$NRPa_{wh}$	-5.3%	[16]/[12]
	Nominal rate of protection at farm gate					
21		*Observed*	%	$NRPo_{fg}$	-8.3%	[17]/[13]
22		*Adjusted*	%	$NRPa_{fg}$	-8.3%	[18]/[14]

However, again in real life such simplified examples are not found in reality. Two or more policies affect domestic prices of agricultural products. Moreover, in Africa markets are not perfectly integrated and price transmission is not perfect. Box 15 shows some of the results obtained for imported commodities in the framework of MAFAP work.

Box 15: MAFAP results on observed price incentives and disincentives for exported commodities

Cocoa in Ghana: export tax and market functioning penalize farmers

Cocoa is the most important export crop in Ghana, accounting for 8.2 percent of GDP and 30 percent of total export earnings in 2010. Ghana is the world's second largest producer and exporter of cocoa beans, after Côte d'Ivoire. It has been estimated that in 2010/2011 Ghana's exports of cocoa overshoot the one million tonne figure. Ghana is the only cocoa producing country that has a controlled marketing system. The gradual reform process of the cocoa sub-sector, which started in the early 1990s, has led to the partial liberalization of internal marketing and the input market and a reform of extension services. However, external marketing is controlled by the state-owned Cocoa Marketing Board (COCOBOD). The functioning of the COCOBOD is financed by a variable export tax which in average stood at 15 percent during the 2005-2010 period.

Using the data reported in Asante-Paku and Angelucci (2012) the following observed price gaps at point of competition and monetary value of export taxes were obtained.

Observed prices, export tax equivalents and access costs for cocoa in Ghana (GhC per tonne)

Concept	2005	2006	2007	2008	2009	2010
I. Benchmark price (USD per ton)	1 450	1 500	1 670	2 300	2 400	3 300
II. Export tax (percent)	7.1	13.1	5.7	6.3	11.7	4.7
III. Exchange rate (GhC per USD)	0.91	0.92	0.94	1.06	1.41	1.43
IV. Value of export tax (GhC per tonne) [I * II *III]	94	181	90	153	396	224
V. Price gap at farm gate	- 85	- 167	- 84	- 163	- 367	- 212

As it can be seen for the whole period the price gap identified using the MAFAP approach is nearly identical to the value of the tax, showing that the value chain works relatively efficiently..

Livestock in Burkina Faso: how market functioning generates disincentives to farmers

During the period 2005-2010, the share of exports of livestock products over total export receipts for Burkina Faso ranged between 9.6% (in 2010) and 16.3% (in 2008). Cattle is the fourth largest source of foreign exchange for Burkina Faso, behind gold, cotton and sesame. External trade flows for livestock products, especially for cattle, are destined for the Nigerian market, and the markets of coastal countries to the north of Burkina Faso.

There is no explicit export tax for live cattle in Burkina Faso, therefore in the presence of a perfectly integrated market for cattle the price gaps should be zero or close to zero. As it can be seen from the data reported in Guissou *et al* (2012) summarized below this is not the case.

Access costs, observed and calculated prices for cattle in Burkina Faso (FCFA per head)

Concept	2005	2006	2007	2008	2009	2010
I. Domestic price at farm gate	132 000	129 076	164 234	201 174	235 429	237 338
II. Reference price at farm gate	223 776	252 882	260 894	292 380	327 674	339 725
III. Benchmark price in domestic currency	296 332	329 055	345 903	381 684	417 610	431 118
IV. Access costs from border to farm gate*	72 556	76 173	85 009	89 304	89 936	91 393
V. Price gap at farm gate (I – II)	- 91 590	- 123 693	- 96 451	- 95 526	- 92 220	- 102 240
VI. Price difference between benchmark price in domestic currency and domestic price at farm gate (III – I)	164 146	199 866	181 460	184 830	182 156	193 633
VII. Access costs to price difference ratio (-[IV / V])	44%	38%	47%	48%	49%	47%

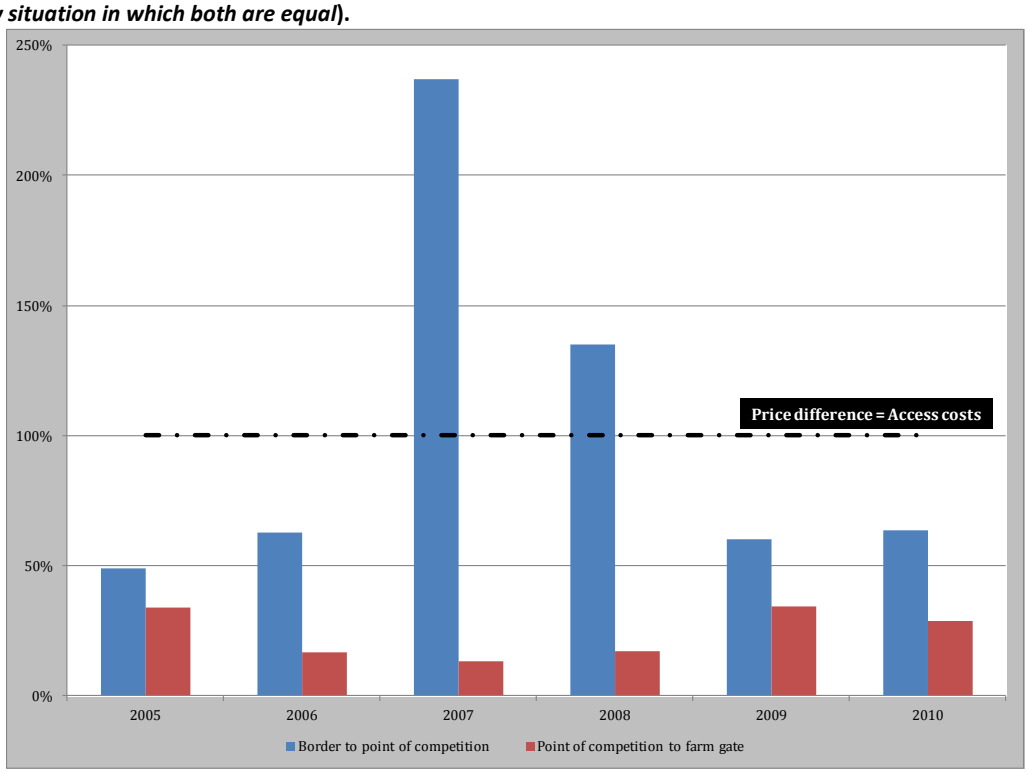
* Includes access cost from border to point of competition and from point of competition to farm gate

In this example, domestic prices at the farm gate are below the reference price during the whole period, with the result that the price gap is negative. This is driven by the fact that information on access costs obtained leads to lower access costs than the actual difference between benchmark price and farm gate price. When revising the elements included in the construction of the access costs we see that informal costs are included, especially arising from unofficial barriers between

some countries in the region. However as the price difference is higher than the access costs it seems that traders also pay lower prices to cattle breeders. This is due to the fact that they cover the risk of raises in transport costs, as they need to outsource this service. In addition they also cover the risk of death of animals during transport and weight losses. All this indicates a low level of development of the value chain.

Comparing the price differential between the different points in the value chain with access costs (border-point of competition and point of competition-farm gate) we see that the main source of taxation is between the point of competition and the farm gate, therefore investments to reduce access costs should focus on this part of the value chain. Moreover, we can see that for 2007 and 2008 exporters could not cover access costs from the point of competition to the border with the gross margin[1] between those two point in the value chain, somewhat justifying the practice of lowering prices to insure against raises in transport costs.

Ratio of access costs to price differences between different points of the value chain for cattle in Burkina Faso (*dotted line show situation in which both are equal*).



[1] Gross margin refers to the difference between the purchasing and the selling price, in this case the difference between the price at point of competition (where exporters buy cattle) and the benchmark price (where exporters sell cattle).

Source: Asante-Paku and Angelucci (2012) and Guissou *et al* (2012)

4.8 Comparing indicators at different points in the value chain

One of the added values of the MAFAP methodology is that the indicators are calculated at two points in the value chain, the point of competition and the farm gate. Comparing the results obtained for the indicators in both points of the value chain the distribution of the policy and market performance impacts between the different actors can be assessed.

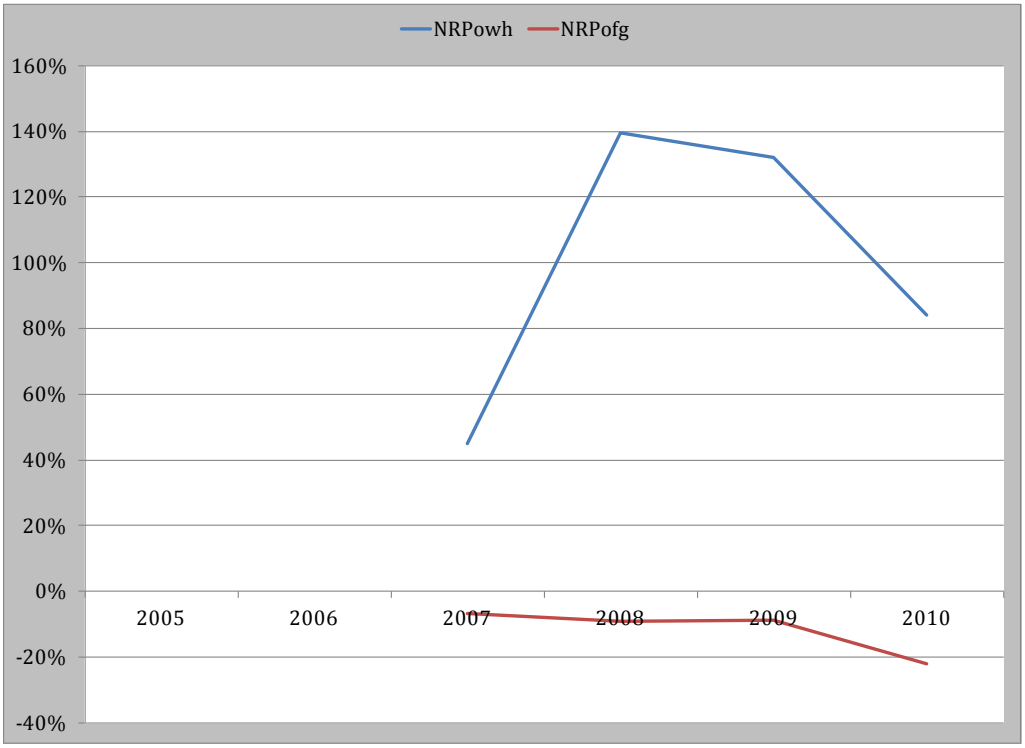
The first thing to keep in mind when comparing indicators at the point of competition to those at the farm gate is the relevant agent. At the farm gate, the relevant agent is the farmer. However, depending on the source used to obtain the farm gate price data (see Box 6), the indicator at the farm gate might not capture all the incentives and disincentives for the farmer. For example, when farm gate prices have been approximated by rural wholesale prices the incentives and disincentives

at the farm gate will not capture the policies or market inefficiencies which exist from the farm gate to the rural market.

At the point of competition the agent for which the incentives and disincentives is calculated are normally traders (wholesalers). However, in the case of processed goods it can be ginners (for cotton) or millers (for sugar).

In one case price gaps at the two different points of the value chain may take opposite signs. For example, price gaps at the point of competition could be positive (i.e. incentives to agents) and at the farm gate negative (i.e. disincentives), or vice versa. An example of the former is the case of maize in Nigeria (Cadoni 2012a). As shown in Figure 8, the nominal rate of protection for maize at the point of competition is positive, while it is negative at the farm gate. As Nigeria is a net importer of maize during the whole period and has had trade restrictive measures in place (either an import ban or an import tariff) positive NRP at the point of competition can be attributed to the impact of trade policy. However, protection is not transmitted to producers, and thus the objective of assuring high prices to farmers to promote production is not achieved, higher price is imposed on consumers. This situation is reflected in the fact that price difference between farm gate and the point of competition exceeds access costs required to move the product between these two points in the value chain. This indicates that maize markets in Nigeria are not sufficiently integrated and that the effects of border protection are entirely captured by maize traders .

Figure 8: Observed nominal rates of protection for maize at the point of competition and the farm gate in Nigeria



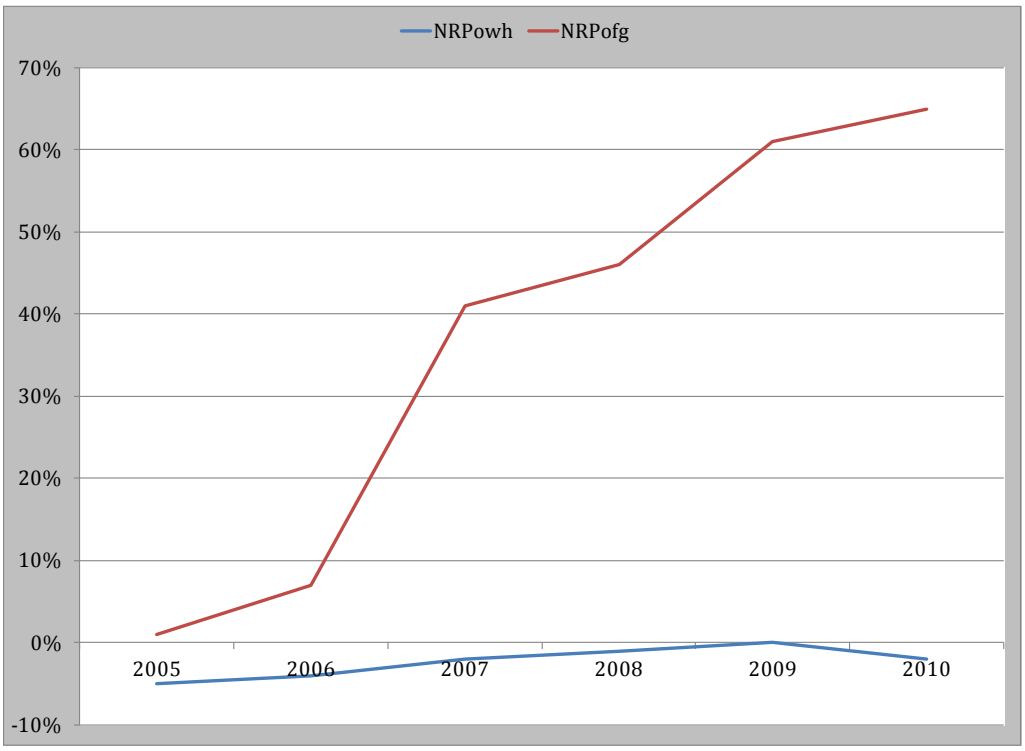
Source: Cadoni (2012a)

Cotton in Burkina Faso (Guissou and Ilboudo, 2012b) represents an opposite case. At the point of competition (in this case the ginneries) the NRP is negative, while at the farm gate it is positive (Figure 9). This suggests that cotton producers are supported, while cotton companies lose out in this

system, especially in 2005 and 2006. In 2007, the government implemented reform of the cotton sector, and introduced a new price-setting mechanism. The system reduced the disincentives of ginners during 2007-2009, however these started to increase again in 2010.

The indicators typically show that cotton system favours producers at the expense of cotton companies. Prices to producers are higher than they would be in a situation of an open and competitive market, in the absence of explicit policy to support cotton exports. This result is characteristic of the situation of cotton in Burkina Faso. Cotton companies exercise a monopsony position in specific production regions and a nationwide price fixation mechanism exists. The price fixation mechanism supports cotton production with the overall objective of boosting the cotton sector which is crucial for the country's economy. However, whether this situation is sustainable or not is still open to discussion (Kaminski et al, 2010).

Figure 9: Observed nominal rates of protection for cotton at the point of competition and the farm gate in Burkina Faso



Note: Indicators at the point of competition refer to cotton lint and at the farm gate to seed cotton.
Source: (Guissou and Ilboudo, 2012b)

In most cases, incentives or disincentives at the farm gate and at the point of competition have different scales, but the same signs. The analyst should consider indicators at both levels in order to see which agents benefit or lose more and how this relates to the policy objectives.

For imported commodities, the most usual case is that incentives at the point of competition are higher than at the farm gate. This means that protection provided by import tariffs diminish as one gets closer to the farm level. This can be due to various reasons, such as lack of market integration, taxation of agricultural marketing, or inefficiencies of the value chain. In order to identify the key drivers for each commodity, analysis of the price and cost data is required, as well as knowledge about policies in place and how particular value chains function.

For exported commodities, the most usual case is when both farmers and agents at the point of competition are penalized. The differences in the scale of disincentives for farmers and downstream agents show who bears the costs of this penalization. For example, in the case of coffee in the United Republic of Tanzania (Baregu *et al* 2013), disincentives at the farm gate are much more important than at the point of competition (the coffee auction). All the burden of the disincentives in the value chain is borne by farmers, probably due to the market power of exporters, which have managed to maintain a dominant position, despite government's efforts to enhance competition within the auction system by the one-license initiative.

4.9 Calculating the Nominal Rate of Assistance: support from commodity-specific budget and other transfers to producers

Volume II of this MAFAP Methodological Implementation guide is dedicated to the analysis of public expenditure in support of agriculture. However, the analysis of price incentives and disincentives allows for the incorporation of data obtained in the analysis of public expenditure to construct an indicator that captures public expenditure in addition to policy and market performance. Combining price and budget information allows the analyst to obtain more complete picture of incentives, in particular, when budget payments are provided in the situation when producers face price disincentives. This indicator is the nominal rate of assistance.

The indicator is calculated taking on board the commodity specific budgetary transfers identified in the public expenditure analysis which should be included in row 22 of the spreadsheet. The nominal rate of assistance is then calculated as follows:

Eq. [24]
$$\mathrm{NRA}o = \frac{(P_{dfg} - RPo_{fg}) + BOT}{RPo_{fg}} \times 100$$

This indicator is only calculated at the farm gate level, as information on BOT is taken only for transfers to producers.

Box 16: Commodity-specific budgetary and other transfers to producers

Taking account of budgetary transfers in Burkina Faso

From the analysis of the public expenditure data in Burkina Faso commodity specific budgetary transfers were identified for three commodities: rice, maize and cotton.

For cotton the total expenditure on the crop was available. To obtain the per ton value of the budget and other transfers this overall figure was divided by total production of raw cotton. The following table compares the relative size of the price gap (which measures the policy and market functioning impacts on prices) and the budget transfers. As it can be seen, with the exception of 2005 incentives provided by policy and market performance are significantly higher than those coming from public expenditure.

Price gap and budget and other transfers for cotton growers in Burkina Faso

Concept	2005	2006	2007	2008	2009	2010
I. Price Gap (FCFA per tonne of raw cotton)	1 098	10 071	45 145	51 861	67 016	86 595
II. Cotton specific budget and other transfers (FCFA per tonne of raw cotton)	4 825	5 264	7 925	12 142	18 460	6 482
Budgetary transfers to price policy transfers in % (II/I*100)	439%	52%	18%	23%	28%	7%
Nominal Rate of Protection (NRP)	1%	7%	41%	46%	66%	70%
Nominal Rate of Assistance (NRA)	3%	10%	48%	57%	85%	75%

Adding budgetary transfer to the analysis leads to a Nominal Rate of Assistance being greater than the Nominal Rate of Protection (see equation 11). In the case of cotton, as the NRP is positive, the NRA reflects additional incentives that cotton growers receive due to budgetary support.

For rice and maize the budget and other transfers are related to the existence of an input subsidy for fertilizer and seeds. Data was obtained in per tonne terms for both commodities and included in the analysis.

Taking into account commodity specific public expenditure in the United Republic of Tanzania.

The analysis of public expenditure in the URT identified commodity specific expenditure for the following four commodities: cashew nuts, coffee, sugar and cotton. For the first three commodities the total expenditure identified in the public expenditure analysis was divided by the production of the commodity to get a per tonne value of the budget and other transfers. In the case of cotton data on expenditure from the Tanzania Cotton Board was used.

The Tanzania Cotton Board provided subsidies to cotton growers in 2009 for insecticides and in 2010 provided a direct price subsidy of 80 TSh per tonne of cotton. However, this budgetary transfers were dwarfed when compared to the high negative price gaps.

Price gap and budget and other transfers for cotton growers in Burkina Faso

Concept	2009	2010
I. Price Gap (TSh per tonne of raw cotton)	- 17 433	- 167 933
II. Cotton specific budget and other transfers (TSh per tonne of raw cotton)	4 390	80 000
Budgetary transfers to price policy transfers in % (II/I*100)	25%	48%
Nominal Rate of Protection (NRP)	-4%	-26%
Nominal Rate of Assistance (NRA)	-3%	-14%

In this example, the NRP is negative and the NRA is less negative. Therefore, the policy to provide incentives for cotton growing through budgetary transfers does not lead to a situation when producers actually have incentives. Removing high price taxation and improving efficiency of ginning would be more effective in creating incentives for cotton producers.

Non-commodity specific public expenditure

Public expenditure analysis shows that not all expenditure in support are commodity specific (see Volume II) and that the share of commodity specific expenditure in the agricultural specific expenditures is quite low. In the analysis done in the MAFAP countries, it ranged from 29 percent in Mali to 3 percent in the United Republic of Tanzania over the period of 2006-2010.

Thus in order to capture the effect of public expenditure on incentives and disincentives using the NRA, non-commodity specific payments to producers need to be allocated to individual commodities. For this we need to make some assumptions. If we consider that non-commodity specific expenditure is evenly distributed across all commodities, the following steps should be followed:

a. Divide the total non-commodity specific public expenditure classified as payments to producers (category I.1.1 in the MAFAP classification) by the volume of agricultural production. This will give a estimate of the per tonne public expenditure in support to farmers. Alternatively this can be done using value of production as the allocation key.
b. Add this figure, in volume terms, in the BOT line of the commodity specific spreadsheets.

The non-commodity specific public expenditure which is not classified as payments to producers can be included in the calculation of the aggregated NRA for the agricultural sector (see Section 7). In this case a wider definition of public expenditure can be used and the same process as described above used. Please note that this means that the agricultural sector NRA *is not* the result of the aggregation of commodity specific NRAs as additional public expenditure needs to be taken into account.

Source: Guissou and Ilboudo (2012b) and Mwinuka and Maro (2013)

5. Calculation of adjusted price gaps and nominal rates of protection

The observed domain measures the impact of trade and market policies and overall market functioning on prices perceived by agents in the value chain. The analysis is based on the actual market situation. However, in some cases the actual market situation does not reflect the highest level of efficiency that could be achieved. To measure the potential effects of these inefficiencies, the MAFAP analysis introduces the term adjusted. This term can be applied to exchange rate, benchmark price, access costs, reference price, price gaps, nominal rates of protection and nominal rates of assistance.

The adjusted family of indicators in the MAFAP methodology incorporates into the analysis some notion of social costs. Sometimes the observed price adjusted for social costs is referred to as the economic costs or the shadow price and basically is calculated as the observed price minus the social cost associated with that price. As a general rule, adjusted values for access costs are expected to be lower than observed ones. However, when dealing with social benefits the shadow price would be greater than observed price. This would be the case for overloading in transport or positive externalities; however the MAFAP methodology provides a separate treatment for externalities which is not included in the calculation of price gaps or nominal rates of protection. In the case of exchange rate and international prices, adjusted values can be higher or lower than observed ones.

Basically the adjusted domain tries to identify whether the data obtained in the observed domain reflect the most efficient functioning of the value chain and is independent of policy interventions. If these are identified they are removed from the calculation of the adjusted concepts that are used in the calculation of the family of adjusted indicators. As shown in Table 8, four main concepts can be subject to revision in order to provide *adjusted* measurement:

A. Benchmark price;
B. Exchange rate;
C. Access costs from the border to the point of competition;
D. Access costs from the point of competition to the farm gate.

So far the MAFAP approach does not consider that adjustment factors can vary from the observed ones when calculating the adjusted indicators.

Table 8: Variables used to calculate adjusted price gaps and nominal rates of protection

MARKET PRICES	
$\mathbf{P_{ba}}$	Adjusted benchmark price
$\mathbf{ER_a}$	Adjusted exchange rate
$\boldsymbol{P_{dfg}}$	*Domestic price at farm gate*
$\boldsymbol{P_{dwh}}$	*Domestic price at point of competition between traded and domestic product*
ADJUSTMENT FACTORS	
$\boldsymbol{QL_{wh}}$	*Quality adjustment factor to make the commodity traded at point of competition and the internationally traded one comparable*
$\boldsymbol{QL_{fg}}$	*Quality adjustment factor to make the commodity sold by the farmer and the one traded at point of competition comparable*
$\boldsymbol{QT_{wh}}$	*Quantity adjustment factor to account for shrinkage and losses between border and point of competition or technical conversion factor to take into account the transformation needed for commodity traded at the point of competition to be comparable with the one internationally traded*
$\boldsymbol{QT_{fg}}$	*Quantity adjustment factor to account for shrinkage and losses between point of competition and the farm gate or technical conversion factor to take into account the transformation needed for commodity sold at the farm gate to be comparable with commodity traded at the point of competition*
ACCESS COSTS	
$\mathbf{AC}\boldsymbol{a}_{\mathbf{wh}}$	Adjusted access costs from border to point of competition
$\mathbf{AC}\boldsymbol{a}_{\mathbf{fg}}$	Adjusted access costs from point competition to farm gate
CALCULATED PRICES	
$\mathbf{P_{b(loc\$)a}}$	Adjusted Benchmark price in local currency
$\mathbf{RP}\boldsymbol{a}_{\mathbf{fg}}$	Adjusted Reference price at the farm level
$\mathbf{RP}\boldsymbol{a}_{\mathbf{wh}}$	Adjusted Reference price at the point of competition between traded and domestic product
PUBLIC EXPENDITURE	
$\boldsymbol{BOT}$	*Budget and other transfers*

Note: Shaded cells do not change with respect to the observed domain.

Source: Author's own elaboration

Thus, using this *adjusted* data, adjusted reference prices, adjusted price gaps, adjusted nominal rates of protection and adjusted nominal rates of assistance can be calculated. In order to make the analysis clear and avoid confusion, the analyst must explicitly mention for which concepts alternative data is not relevant (i.e. no adjusted variables are considered) and for which concept alternative data is relevant but no data source is available (i.e. no information could be obtained to quantify adjusted variables).

Most of the efforts should be devoted to items c. and d. listed above. Table 9 shows the countries and commodities for which adjusted benchmark prices or adjusted exchange rates have been considered. If an adjusted exchange rate is considered this is done for all commodities. However, this is not the case for Mali and Burkina Faso due to the fact that benchmark prices for some commodities have been calculated using regional prices in destination (exports) or origin (imports) wholesale markets which are quoted in the same currency (FCFA) as the domestic prices. Explanation on why adjusted benchmark prices and exchange rates are used and how they are calculated can be found in Sections 5.1 and 5.2.

Table 9: Countries and commodities for which adjusted benchmark prices and adjusted exchange rates have been considered

Adjusted concept considered	Country	Commodity
Benchmark price	Burkina Faso	Arabic gum
		Cotton seed
Exchange rate	Burkina Faso	Groundnuts
		Live cattle
		Seed cotton
		Arabic gum
		Rice
		Sesame
	Mali	Seed cotton
		Cow milk
		Rice
	Malawi	Maize
		Tobacco
		Groundnuts
		Tea
		Seed cotton
		Cassava
	Ethiopia	Maize
		Sorghum
		Teff
		Wheat

5.1 Market prices

Adjusted Benchmark price (P_{ba})

The underlying assumption of the benchmark price is that it is free of country's own policy impacts and reflects a well functioning international market. However, international markets are not always free from market or policy distortions. International prices might be depressed because of support to production in developed countries. Market structure for an export commodity in a country might be controlled by a small number of big companies which exercise monopsony power, lowering the price they pay to domestic producers[16]. Therefore, the MAFAP methodology allows the use of an **adjusted benchmark price** (P_{ba}) to evaluate the incentive or disincentive due to these factors. Obtaining an adjusted benchmark price will need either modeling results for international prices in the absence of policies in developed countries or prices paid in other regions of the world where there is no monopsony power for an equivalent product in terms of quality and distance to destination markets. This option must not be confused with the case mentioned in Box 4 where the benchmark prices are derived from another country's price when trade statistics in the analyzed country are not reliable or traded volumes are too low.

1

[16] If the overall supply chain is integrated this could be to minimize tax payments in the country where cotton is produced. If the supply chain is not integrated it would be just exerting market power.

Box 17: Adjusted benchmark prices in Phase I of MAFAP

Potential to reach higher quality of Arabic gum exports in Burkina Faso

While the theoretical justification for considering adjusted benchmark prices is the presence of uncompetitive international markets it can also be used for other purposes. In the case of Arabic gum in Burkina Faso the adjusted benchmark price was used because quality of Burkinabe Arabic gum is lower to that of neighboring countries.

The adjusted benchmark price increased the observed benchmark price by 100 000 FCFA per ton which was the difference key traders reported to exist between the Arabic Gum from Burkina and that of neighboring countries (Niger).

However, when such an approach is taken the international prices gap (see below) should be attributed to lack of quality performance of Arabic gum growers and not to uncompetitive international markets or excessive market power of exporters.

Depressed export prices for cotton in Burkina Faso

The observed benchmark price for cotton lint exports in Burkina Faso was taken from official trade data (i.e. unit prices of cotton lint exports). However, upon comparison of Burkina Faso export prices and that of the main price in international cotton markets (COTLOOK A index) it was seen that Burkinabe export receive a much lower price than this index, and that the gap was increasing with time. The COTLOOK A index is the average of the lowest five CFR (cost & freight) quotations to the Far East (see www.cotlook.com). Even when the COTLOOK A index includes freight from the country of origin to the far east, this price was taken as the adjusted benchmark price as no alternative was found and there was evidence that the observed benchmark price is subject to the influence of international cotton companies.

The cotton sector in Burkina Faso is characterized by an administrated pricing mechanism and the fact that trade is controlled by three regional monopsonies (i.e. farmers in a region can only sell to one buyer). The price actually received by the cotton company might not be the same price received by the international traders (net of a "normal" trade commission) due to the fact that the sellers are directly or indirectly controlled by the traders. They are indeed to a good extent two sides of the same economic subject, due to the substantial (if not formal) vertical integration between them. This vertical integration may constitute a constraint regarding the choice of the international trader. The cotton company relies on the services of the international trader. Clearly, the cotton company has limited instruments to verify the performances of the international trader. However, if the cotton company and the trader were completely different economic subjects, the first should be free to choose among traders, the one(s) which maximizes the company's revenue, i.e. who pays the highest price for cotton. On the contrary, in situations where the trader itself has a say on the choice of the trader by means of its control on the company itself, the company may not be free to maximize its revenue. By lowering the prices paid to domestic companies below those actually received on international markets, foreign investors (i.e. the international traders) generate profits downstream, by shifting losses upstream. This is a well known mechanism to inflate and expatriate profits used by transnational companies. By the point of view of the producers, the collusion between cotton companies and international traders results in lower seed cotton prices.

Therefore for Burkina Faso an adjusted benchmark price for cotton was used taking the value of the COTLOOK Index.
As the adjusted benchmark price is higher than the observed one, the adjusted reference price is higher than the observed one and the adjusted price gap in more negative than the observed one. In this case this additional disincentive is related to the marketing structure of cotton in Burkina.

Source: Guissou and Ilboudo (2012b) and Guissou *et al* (2012).

Adjusted Exchange Rate (ER_a)

Some countries apply specific policies to maintain the exchange rate at certain levels, or within certain bands, which differ from the exchange rate that would result from free interactions of demand and supply. Such policies also change farmers' incentives or disincentives. However, this is not captured by the MAFAP's observed indicators, as they are constructed using the observed exchange rate which embeds that policy.

Such exchange rate distortions may be revealed by the existence of a parallel or "black" market for local currency. This parallel market exchange rate can be considered as a proxy for adjusted

exchange rate (ER_a). Alternatively, one can find relevant estimates of the alternative exchange rates in research articles or papers.

The most common situation is that of an overvalued exchange rate (i.e. $ER_o < ER_a$). In such a case the adjusted benchmark price in local currency is higher than the observed one.

Box 18: Adjusted exchange rates in Phase I of MAFAP

As shown in Table 9, four of the countries in which MAFAP has been implemented have explicit or implicit exchange rate policies. For all cases there is an issue of currency overvaluation, the adjusted exchange rate is higher than the observed one making imports cheaper and exports more expensive.

Burkina Faso and Mali – The Franc of the African Financial Community (FCFA)

The FCFA has a fixed exchange rate to the Euro (656 FCFA to the Euro in 2013). This exchange rate does not reflect the fundamentals of a free floating currency. Several studies have shown that this fixed exchange rate is overvalued and that the equilibrium exchange rate in absence of this policy would be 20 percent higher (Etta-Nkwellea *et al,* 2010).

Therefore from 2007 onwards for the analysis of commodities for which the benchmark price is obtained in USD the adjusted benchmark price for Mali and Burkina Faso is used adding a 20 percent to the observed exchange rate.

Malawi - the Kwacha

As reported by Pauw *et al* (2013), the Malawi Kwacha has been significantly overvalued since 2007. This is reflected in a dynamic parallel market for foreign exchange. For that reason, an adjusted exchange rate has been applied from 2007 to express the difference between the nominal exchange rate and the exchange rate in the parallel market. The values used are annual averages of parallel market exchange rates of Malawi Kwacha to the US Dollar, as calculated by the Reserve Bank of Malawi. The IMF has confirmed that the overvaluation of the Malawi Kwacha gradually increased to 10.8 percent on average in 2010. In 2011, the African Development Bank indicated in a report that the Malawi Kwacha remained overvalued by between 10 and 20 percent in early 2011. Despite a 10 percent devaluation in August 2011, parallel market rates have more recently increased to 230 Malawi Kwacha per USD in December 2011 against an official rate of 165 Malawi Kwacha to the US dollar.

Thus in the analysis of all commodities in Malawi the parallel market exchange rate, as reported by the Reserve Bank of Malawi was used.

Ethiopia – the Birr

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

It is believed that the domestic currency (Birr) was overvalued, especially in 2008, 2009 and 2010. The extent of overvaluation was estimated at 40 percent during this period and the Government was forced to devalue Birr by 25 percent in September 2010 (Rashid, 2010). High rate of inflation (relative to the low inflation rate among its trading partners) and increasing pressure on foreign exchange reserve are among the major cause of currency appreciation in Ethiopia.

Thus in the analysis of all commodities in Ethiopia an adjusted benchmark price is used assuming that the local currency was, on average, 20 percent overvalued during the period 2005- 2010 This adjustment factor approximates the depreciation of the local currency had a more liberal policy been pursued.

5.2 Adjusted access costs

Observed access costs reflect the current status of the functioning of the value chain for a specific commodity in a country. This situation might not be the most efficient that could be achieved. Moreover, the access costs can include informal charges and taxes that have an impact on the prices perceived by farmers. In the adjusted domain, access costs are revisited to take away the excessive

costs of the value chain functioning and show the potential situation that could be achieved if the necessary actions were taken.

As the principles behind the adjustment are the same for both sections of the value chain considered, they are discussed simultaneously below.

Adjusted access costs from border to point of competition (ACa_{wh})

Adjusted access costs from point of competition to farm gate (ACa_{fg})

For the calculation of the adjusted access costs the analyst has to consider the components included in the construction of the observed access costs. The nature of the improvements included will depend on the degree of details that the data used has. The difference between observed and adjusted costs should be driven by the objective of reflecting the social costs of marketing a commodity in the respective segment of the value chain (as compared to private costs).

Three main aspects should be taken into account:

a. In the calculation of the adjusted access costs ***all transfers should be omitted***. This includes agricultural specific taxes/subsidies and informal costs (i.e. bribes or non-service related fees).

    Government authorities, especially local government authorities may resort to taxing some economic activity to generate revenue. For example they can levy taxes on goods in shipment. These types of government charges are considered social costs and as such should be deducted from the observed access costs to obtain the adjusted values.

    A distinction should be made on fees for government services. When the fee refers to a service provided by the government (i.e. phyto-sanitary inspections), the fee is not considered as a social cost. However, even in such cases, the fees charged can be excessive. In such cases, the social cost is the excess charge for the service. If the fee is below the actual cost of the service, then the social cost is negative (i.e. it is a subsidy). Licenses may also be an instance of social costs but they may also be seen as a fee for the fixed cost of the service. For example, vehicle licenses and excise taxes on diesel can be seen as road user fees and thus they might be considered totally or partially social costs. Bribes are difficult to evaluate. A bribe where there is no offsetting benefit is clearly a social cost and should be deducted. But sometimes a bribe is paid to avoid paying a legitimate government fee. For example, a bribe paid to avoiding a speeding ticket or a bribe paid to avoid or reduce tariffs on imported goods. Even in these cases bribes should be treated as a social cost, and thus deducted from adjusted values.

b. In the calculation of the adjusted access costs processing, handling or transport costs can be reduced if the observed one are considered too high or resulting from sub-optimal functioning of the value chain. For this, information found regarding excessive costs in value chain studies or values from other commodity value chains which are more efficient can be used. In addition, global or regional data sources can be used.

For example the World Bank conducts a Logistics Performance Index (LPI) Survey[17] every two years. The Logistics Performance Index is based on a worldwide survey of operators on the ground (global freight forwarders and express carriers), providing feedback on the logistics "friendliness" of the countries in which they operate and those with which they trade. They combine in-depth knowledge of the countries in which they operate with informed qualitative assessments of other countries with which they trade, and experience of global logistics environment. Feedback from operators is supplemented with quantitative data on the performance of key components of the logistics chain in the country of work, data collected for 155 countries. The LPI consists therefore of both qualitative and quantitative measures and helps build profiles of logistics friendliness for these countries. It measures performance along the logistics supply chain within a country and offers two different perspectives: International and Domestic. International LPI provides qualitative evaluations of a country in six areas by its trading partners - logistics professionals working outside the country. Domestic LPI provides both qualitative and quantitative assessments of a country by logistics professionals working inside it. It includes detailed information on the logistics environment, core logistics processes, institutions, and performance time and cost data.

The USAID supported West Africa Trade Hub project[18] uses a market-driven approach to increase exports from the region – making West Africa competitive in world markets. The Trade Hub provides direct assistance to hundreds of companies in six value chains. That work is complemented by teams tackling problems in transportation, telecommunications, access to finance and business environment that make it difficult for West African companies to compete. One of the areas of the competitive environment considered is transport infrastructure. Since 2007 they have been issuing quarterly reports which assess the costs of transport along eleven corridors. For each of them they report the number of controls, delays associated with the controls and bribed paid.

c. Last, in the calculation of adjusted access costs if observed agents' margins are excessive they can be reduced to a *normal* level. This decision will depend on the type of margins used in the observed access costs.

If no information on actual margins is available from a value chain study or from key informants, the MAFAP approach has been to consider a 10 percent profit margin as the observed one. If this is the case the margins in the adjusted access costs should be 5 percent.

If value chain specific margins were used, then the analyst should evaluate whether these are excessive or not. If they are then in the adjusted domain a reduced version of these (based on that information) should be inputted.

From the nature of the changes made to move from observed access costs to adjusted access costs it can be seen that the following relationship will always hold:

Eq. [25] $$ACo_{wh} > ACo_{wh}$$

Eq. [26] $$ACo_{fg} > ACo_{fg}$$

[17] http://go.worldbank.org/7TEVSUEAR0
[18] http://www.watradehub.com/

As it can be seen, the decision of how to move from the observed to the adjusted access costs is very commodity and country dependant. However the general principles mentioned above should be followed to assure that cross country and cross commodity comparisons can be done.

Moreover, the same concerns with regards to the costs referring to the need for access costs, either from the border to the point of competition or from the point of competition to the farm gate, refer to the same unit as the domestic price at point of competition or the farm gate. Thus, if a quantity adjustment factor was needed (i.e. from milled to husked rice; from sugar to sugar cane) the analyst has to make sure that the access costs refer to the unit of the product for which domestic price at point of competition or at the farm gate is referred to (i.e. husked rice, sugar cane). If this is not the case (i.e. it refers to the product for which the benchmark price or the reference price at point of competition is obtained) then the access costs need to be multiplied by the quantity adjustment factor.

Box 19: Calculating adjusted access costs from the border to the point of competition

Ethiopia - Maize

Ethiopia's import of maize was reported as 54 466 tonnes in 2009, compared to an average of 35 016 tonnes in previous five years. According to FAO database, the volume of official maize import has grown by an annual average of 33 percent in the last five years. Nevertheless, the quantity of import is small and the share of imported maize in the total maize production is very small in Ethiopia; imports accounted for less than one percent of total production in 2000-2009.

The benchmark price for maize is referred to maize landed in the port of Djibouti and the point of competition is taken in the central grains market of Addis Ababa. For the calculation of the observed access costs from the border to the point of competition for the analysis of maize in Ethiopia the following concepts were considered:

a. Surtax and withholding tax
b. Port handling
c. Transport costs from Djibouti to Addis Ababa
d. Unloading
e. Miscellaneous costs accounting for 5 percent of the benchmark price

Data on these items were obtained from a recent value chain study, which were contrasted with information obtained from key informants in the central grains market in Addis Ababa.

When calculating the adjusted access costs the Surtax and withholding tax were deducted. No adjustment was made to transport costs even when the transport costs in the Djibouti – Addis corridor are considered to be excessive. This was due to the fact that the data reported in the value chain study was already lower than the excessive levels reported in several studies. Also as no margins were included in the calculation of observed access costs no change was needed for this concept in the calculation of adjusted access costs.

Thus, observed and adjusted access costs from the border to the point of competition were constructed as follows (results presented only for one year).

Observed and adjusted costs from border to point of competition for Maize in Ethiopia in 2010 (Birr per tonne).

	Observed	Adjusted
Surtax – Withholding tax	92.2	EXCLUDED
Port handling	233.0	233.0
Transport costs	570.0	570.0
Unloading	320.0	320.0
Miscellaneous (5 percent of CIF)	153.7	153.7
TOTAL	**1 081.0**	**988.7**

Shaded cells represent the concepts that change between the observed and adjusted access costs

Source: Table 6 in Demeke (2012)

United Republic of Tanzania - Rice

Rice is one of the main imported agricultural commodities in the United Republic of Tanzania. Imports arrive in the country via the port of Dar es Salaam and the point of competition is set at the wholesale market of Dar es Salaam.

As reported in Box 10, the structure of costs for agricultural commodities imports included the following concepts for the calculation of the observed access costs from the border to the point of competition for the analysis of rice in the URT:

- Pre-inspection charges
- Phytosanitary charges
- Port wharfage fees
- Surface and Maritime Transport Authority (SUMATRA)fee
- Documentation fees
- Clearing agents fees
- Loading and unloading
- Health and food safety standards fees
- Trader margins (5 percent)

For the construction of the adjusted access costs the following changes were made:

a. Dar es Salaam port is known for its high loading and unloading costs. A more conservative estimate of these costs was available from an alternative data source and used in the construction of this component. Instead of considering 20 USD per tonne (base year 2003) we used 4.5 USD per tonne (base year 2006).

As trader margins in the observed measurement of access costs was already fixed at 5 percent no change was made to this component of access costs for the adjusted measurement. If the calculation of observed access costs has included a higher rate of margins, this concept should have been reduced for the calculation of the adjusted access costs.

As these costs referred to milled rice and the domestic price at point of competition referred to husked rice the quantity adjustment factor of 0.8 was used to refer the access costs to husked rice unites (see Box 1).

Observed and adjusted access costs from the border to the point of competition for imported rice in the United Republic of Tanzania.

Concept	Observed	Adjusted
[1] Pre-inspection charges [TSh per tonne of milled rice]	7 094.0	7 094.0
[2] Phytosanitary charges [TSh per tonne of milled rice]	1 546.0	1 546.0
[3] Port wharfage fees [TSh per tonne of milled rice]	11 824.0	11 824.0
[4] SUMATRA fee [TSh per tonne of milled rice]	2 435.0	2 435.0
[5] Documentation fees [TSh per tonne of milled rice]	2 797.0	2 797.0
[6] Clearing agents fee [TSh per tonne of milled rice]	15 765.0	15 765.0
[7] Loading and unloading [TSh per tonne of milled rice]	41 236.0	7 864.9
[8] Health and food standards fee [TSh per tonne of milled rice]	1 000.0	1 000.0
[9] Trader margins (5 percent of CIF price) [TSh per tonne of milled rice]	39 413.0	39 413.0
[10] Access costs [TSh per tonne of milled rice] *[1]+[2]+….+[9]*	**123 112.0**	**89 739.0**
[11] *Quantity adjustment factor [tonnes of milled rice per tonnes of husked rice]*	*0.8*	*0.8*
[12] Access costs [TSh per tonne of husked rice equivalent] *[10] * [11]*	**98 489.0**	**71 791.0**

Shaded cells represent the concepts that change between the observed and adjusted access costs

Source: Demeke (2012) and Barreiro-Hurle (2012b)

Box 20: Calculating adjusted access costs from the farm gate to the point of competition

Nigeria - Rice

Although there are inconsistencies over the quantity and value of rice imported in Nigeria among the main trade databases, all data sources and relevant literature agree on describing Nigeria as a net importer of rice. In the analysis done, Lagos was considered as point of competition for our analysis. Most of formally imported rice is consumed in Lagos, and the city is the main port of entry for formally imported rice (through Apapa Port), as well as the hub from where formally imported rice can be traded to other areas of the country. The data for farm gate prices was taken from a specific region in Nigeria (Niger) were most of the rice production is located.

Based on existing value chain studies for rice in Nigeria, the following components were considered to calculate the access cost from the point of competition (Lagos) to the farm gate (Niger).

- Processing costs,
- local market fees (intended as services),
- rural market trader margin,
- transport to major market,
- warehousing costs, and
- major trader margins.

To calculate the adjusted access costs only margins were modified. From the data on absolute values of margins, implicit traders' margins were calculated as 53 percent over farm gate price for rural market traders and 17 percent over farm gate price for major trader margins. As mentioned above trader margins in the adjusted domain are considered as 5 percent, therefore the adjusted access costs were calculated including the reduced margins ratio.

Observed and adjusted access costs from the farm gate to the point of competition for rice in Nigeria in 2010 (Naira per tonne)

	Observed		**Adjusted**	
	Naira per tonne	*Percent of farm gate price*	*Naira per tonne*	*Percent of farm gate price*
Farm gate price in Niger region	27 062	Not applicable	27 062	Not applicable
Processing costs and local market fees	2 030	Not applicable	2 030	Not applicable
Rural market traders margin	14 208	52.5	1 353	5.0
Transport to Lagos	5 882	Not applicable	5 882	Not applicable
Warehousing costs	451	Not applicable	451	Not applicable
Major trader margins	4 510	16.6	1 353	5.0
TOTAL	27 080		11 069	

Shaded cells represent the concepts that change between the observed and adjusted access costs

Kenya - Sorghum

As mentioned in Box 10, the point of competition considered for the analysis of Sorghum was Nairobi. The farm gate price was taken from the wholesale markets in the main sorghum producing areas located in western Kenya. Due to the lack of commodity specific information on access costs for Sorghum in Kenya the study assumes that the costs available for the maize value chain are a good proxy for those that would exist in the sorghum value chain. This is a plausible assumption as both commodities are similar in terms of density and volume and both are important staples in the Kenyan market. Reported transportation costs for each segment of the value chain are assumed to include the trader's margin, though the exact amount or share of this margin relative to the trader's total costs are unknown. As mentioned above data was available only for 2008 and estimates for the rest of the years were calculated using the consumer price index.

The following concepts were considered when calculating the observed access costs:

- Storage costs
- Transport charges
- Loading and unloading
- Council cess

- Roadblocks and weighbridges
- Drying tent / empty bags

Data was available for two different stages in the value chain, from the primary market to the secondary market and from the secondary market to the wholesale market. As our farm gate price is assumed to reflect the price in primary markets, access costs include both the costs of moving from the primary market to the secondary market and from the secondary market to the wholesale market.

To calculate the adjusted access costs council Cess, bribes and delays at roadblocks and weighbridges were removed from the estimates. As no specific information on trader margins was available no modification related to margins could be made between observed and adjusted access costs.

Observed and adjusted costs from point of competition to farm gate for sorghum in Kenya in 2011 (KSh per tonne).

	Observed	Adjusted
Storage	422	422
Transport	3 725	3 725
Loading / unloading	953	953
Council cess	334	EXCLUDED
Roadblocks and weighbridges	502	EXCLUDED
Drying tent / empty bags	119	119
TOTAL	**6 055**	**5 219**

Shaded cells represent the concepts that change between the observed and adjusted access costs

Source: Table 6 in Witwer and Kilmabya (2012)

Source: Cadoni (2012b) and Kilmabya and Witwer (2012)

5.3 Calculating adjusted prices

Using the adjusted data described in the sections above the MAFAP spreadsheet calculates the adjusted reference prices which are reported in the green area of the spreadsheet (rows 29 to 38). As mentioned above, adjusted reference prices represent the prices that would prevail in the country in absence of domestic policies, the existing market functioning performance, lack of distortions in international markets, lack of exchange rate policy interventions and improved commodity specific value chain performance. The MAFAP spreadsheet detects whether data has been inserted for each adjusted concept and modifies the calculation formulas accordingly. If no adjusted data is inserted the adjusted reference price is calculated using the observed equivalents.

In order to calculate the observed reference price the following steps are needed.

First, the spreadsheet reports the adjusted benchmark price in local currency units ($P_{b(loc\$)a}$). To obtain this price, the adjusted benchmark price (expresses in USD per tonne) is multiplied by the adjusted exchange rate (expressed in local currency units per USD) obtaining the benchmark price (expressed in local currency per tonne) ($P_{b(loc\$)}$).

Eq. [27]
$$P_{b(loc\$)a}\left(\frac{local\ currency}{tonne}\right) = P_{ba}\left(\frac{USD}{tonne}\right) \times ER_a\left(\frac{local\ currency}{USD}\right)$$

Next we need to make the adjusted benchmark price in local currency equivalent to the domestic price at the point of competition. For this we take into account the quantity and quality adjustment factors from the border to the point of competition and the adjusted access costs from the border to the point of competition. If the commodity is imported to the country adjusted access costs from the border to the point of competition should be added in order to take into account the full cost of imports. In case the commodity is exported they are deducted to take into account the additional

costs that are needed in order to be able to compete in international markets and make adjusted export prices equivalent to prices at the point of competition. Thus, the observed reference price at the point of competition is determined by the following equations:

Eq. [28a] $$RPa_{wh} = \left(P_{b(loc\$)a} \times QT_{wh} \times QL_{wh}\right) + ACa_{wh} \text{ [if the commodity is imported]}$$

Eq. [28b] $$RPa_{wh} = \left(P_{b(loc\$)a} \times QT_{wh} \times QL_{wh}\right) - ACa_{wh} \text{ [if the commodity is exported]}$$

The MAFAP spreadsheet will take into account the trade status of the commodity (to be inserted in row 6) and whether quality and quantity adjustments factors between the border and the point of competition (to be inserted in rows 23 and 24) in order to calculate the reference price at the point of competition. It will also use the observed benchmark price, exchange rate and access cost if no adjusted data has been inserted. The formula used for the calculation will be show in column L.

Last, the reference price at the farm gate is calculated. This is done starting from the reference price at point of competition and taking into account the quantity and quality adjustment factors between the point of competition and the farm gate and the access costs between the point of competition and farm gate. By deducting the access costs from the point of competition to the farm gate (ACo_{fg}) the price at point of competition is made comparable to the price at farm gate. Thus the observed reference price at the farm gate is determined by the following equation:

Eq. [29] $$RPa_{fg} = \left(RPa_{wh} \times QT_{fg} \times QL_{fg}\right) - ACa_{fg}$$

The MAFAP spreadsheet will take into account whether quality and quantity adjustments factors exist between the border and the point of competition (to be inserted in rows 25 and 24) in order to calculate the reference price at the point of competition. The formula used for the calculation will be shown in column L.

Adjusted calculated prices are calculated by the MAFAP spreadsheet and reported in rows 30 to 38 (light green shaded cells).

5.4 Calculating adjusted price gaps and adjusted nominal rates of protection

Using domestic and adjusted reference prices the family of adjusted indicators is calculated. Adjusted price gaps are obtained by deducting the adjusted reference price from the domestic price. This comparison is made at two levels: at the point of competition and at the farm gate.

Eq. [30] $$PGa_{wh} = P_{dwh} - RPa_{wh}$$

Eq. [31] $$PGa_{fg} = P_{dfg} - RPa_{fg}$$

An additional group of indicators in this family (the adjusted nominal rates of protection) are calculated as the ratios of the adjusted price gaps in relation to the reference price. This group of indicators allow for cross commodity and cross country comparisons.

Eq. [32] $$\text{NRP}a_{wh} = \frac{P_{dwh} - RPa_{wh}}{RPa_{wh}} \times 100$$

Eq. [33] $$\text{NRP}a_{fg} = \frac{P_{dfg} - RPa_{fg}}{RPa_{fg}} \times 100$$

These indicators are calculated by the MAFAP spreadsheet and reported in lines 41 to 56 (light blue shaded cells).

5.5 Interpreting adjusted indicators

Using the adjusted variables to construct the adjusted reference prices leads to reference prices that are also free of additional policies (i.e. exchange rate policy) and the inefficiencies of the commodity specific value chain either at international level or domestically (see Table 2). Therefore, the difference between domestic and adjusted reference prices measure not only the effect of domestic market and trade and of market performance (captured already by the difference between domestic and observed reference prices) but also the effects of these additional distortions.

Interpreting the results adds the specific value chain performance lens and the exchange rate policy to the policy lens used for the interpretation of observed indicators (see Section 4.7). In order to interpret the results the analyst has to consider what are the differences introduced when calculating the adjusted variable, as this will be the driving force in the additional price gaps identified in the adjusted domain. For example, if the adjusted access costs do not consider a specific tax (i.e. the adjusted access costs is lower than the observed access cots), the price gap will increase and the reason behind this additional price gap will be the tax.

The underlying hypothesis is the same as for the analysis of the observed indicators. When adjusted price gaps are positive (i.e. domestic prices are higher than adjusted reference prices) it can be considered as a quantitative measure of the incentive to farmers (if measured at the farm gate) or wholesalers (if measured at the point of competition). In this case it will be the overall incentive resulting from domestic trade and market policies, as well as other factors which impede price arbitrage between domestic and international markets, such as lack of market institutions, poor information, and underdeveloped physical infrastructure (captured in the observed price gap) AND the additional incentive or disincentive due to international market power, exchange rate policy and functioning of the specific value chain which are all considered to contribute to the concept of the market development gap. The contrary is also true (i.e. gaps are a quantitative measure of the disincentives) when the observed price gaps are negative. In the following section we will explain how to identify the additional components of the market development gap that are added when calculating the adjusted indicators.

In this sense, the "*excessive*" access costs can be considered as implicit disincentives to the extent that they could be reduced by suitable investments or better governance. The adjusted reference price shows how the price received by farmers would change if excessive access costs were corrected. For exports, lower access costs result in higher reference prices and thus lower price gaps. For imports, lower access costs from the farm gate to the point of competition have the same effect. However, if excessive access costs from the border to the point of competition exist for imports, the adjusted reference price at the point of competition would be lower than the observed reference price at the point of competition (access costs from the border to the point of competition are added

to the benchmark price in local currency to obtain the reference price at the point of competition, see equations [18a] and [28a]). Thus, inefficiencies in this segment of the value chain act as incentives for farmers.

The MAFAP methodology also proposes, where possible and relevant, to estimate the impact of exchange rate misalignment, imperfect functioning and non competitive pricing in international markets, and monopoly power on prices paid and received in the value chain[19].

As the process for calculating the indicators is exactly the same as for the observed domain with the sole difference of using adjusted values for benchmark price, exchange rate and access costs, there is no need to include a detailed description of how these are calculated.

However, a detailed description of how to integrate and interpret both sets of indicators is included in Chapter 6.

Again, and with the necessary caveats associated to the static nature of the analysis undertaken, the price gaps show the maximum change in farmgate or wholesale prices that could be obtained if policies (including the exchange rate policy) were removed and overall market functioning and commodity specific value chain enhanced. The degree to which the change would actually happen would depend on the demand and supply elasticities and the market power of each of the agents.

6. Comparing observed and adjusted price gaps and nominal rates of protection: a concept of the market development gap

6.1 Estimating the market development gap

MAFAP project measure an aggregated indicator named Market Development Gap (MDG). The MDG is computed as the difference between the observed and adjusted price gaps. At the farm gate level it is also computed as the ration between the difference between the observed and adjusted price gaps divided by the adjusted reference price at the point of competition.

Eq. [34]
$$MDG_{wh} = PGa_{wh} - PGo_{wh}$$
Eq. [35]
$$MDG_{fg} = PGa_{fg} - PGo_{fg}$$

In addition, a relative value of the MDG can be calculated. In the MAFAP approach this only done for the farm gate level. This relative indicator is calculated in relationship to the adjusted reference price at the farm gate level taking the following expression.

Eq. [36]
$$MDG_{\%} = \frac{MDG_{fg}}{RPa_{fg}}$$

The MAFAP Spreadsheet provides the results for these indicators in rows 61 to 68 (light orange shaded cells).

[19] Ideally, it would also be possible to calculate the gaps resulting from uncorrected externalities in production and consumption, but as this would be extremely difficult to do across countries it is not yet proposed as part of the project's core methodology.

As shown below, the market development gap is the aggregate impact on incentives or disincentives of the effect of market or policy distortions in the international markets, exchange rate policies and excessive access costs in the domestic value chain between the border and the point of competition and between the point of competition and the farm gate.

The MAFAP MDG is only part of the overall market development gap that could exist in a country. The nature of the MAFAP MDG depends on what has been taken into account to construct the adjusted variables (benchmark price, exchange rate, access costs). As mentioned in chapter 3, the observed indicators also capture part of a more general definition of market development gaps, that relates to overall market functioning. Overall (lack) of market functioning is a specific characteristic of developing economies. Markets in developing countries are characterized by various imperfections (asymmetric information, monopolistic structures, etc.) and lack of infrastructure which in turn generate excessive marketing costs for market agents. All these can impede the transmission of world prices onto domestic markets, reflecting a bigger or lesser degree of immaturity. The existence of a large subsistence sector further limits the price adjustments. The more markets are integrated (i.e. the more the observed price gap is the effect of explicit trade and market support policies), the more the MAFAP MDG will resemble the total MDG in the country.

6.2 Analytical decomposition of the difference between the observed and adjusted price gap

The first step to analyze the results of the two sets of indicators jointly is to understand the relationship between them. The adjusted price gap adds (or subtracts) four components to the observed price gap. Thus, the difference between the PG*o* and the PG*a* can be split into the four price gaps which represent each of the four domains for which adjusted prices and costs have been introduced. For each one of these domains a specific gap is calculated.

As international market policies and exchange rate policies have an interdependent effect (the benchmark price in domestic currency is the result of multiplying the benchmark price by the exchange rate) in order to calculate the specific contribution to incentives or disincentives via price in a way that allows the total results to be additive the following expressions need to be used (see Box 21).

Eq. [37] International markets gap (IMG)

$$\left[\left(P_{b\,\mathrm{int}\,\$} - P_{ba}\right)\times\left(\frac{ER_a + ER_o}{2}\right)\right]\times QT_{wh}\times QL_{wh}$$

Eq. [38] Exchange rate policy gap (ERPG)

$$\left[\left(ER_o - ER_a\right)\times\left(\frac{P_{b\,\mathrm{int}\,\$} + P_{ba}}{2}\right)\right]\times QT_{wh}\times QL_{wh}$$

Box 21: Decomposing the combined effect of the adjusted exchange rate and the adjusted benchmark price

Using the nomenclature presented in tables 3 and 8 and assuming there are no access costs from the border to the point of competition the observed price gap can be expressed as:

[1a] $\mathrm{PG}o_{wh} = P_{dwh} - \mathrm{RP}o_{wh}$

Considering the way in which the reference price is constructed equation [1] can be re-written as

[2a] $\mathrm{PG}o_{wh} = P_{dwh} - \left(P_{b(int\$)} * ER_o\right)$

In turn the adjusted price gap can be expressed as:

[1b] $\mathrm{PG}o_{wh} = P_{dwh} - \mathrm{RP}a_{wh}$

Considering the way in which the adjusted reference price is constructed equation [1] can be re-written as

[2b] $\mathrm{PG}o_{wh} = P_{dwh} - (P_{ba} * ER_a)$

As it can be seen in both groups of equations P_{dwh} remains constant while the reference price varies due to the changes in exchange rates and benchmark prices.

The derivative of the price gap between the observed and adjusted domains can be expressed as:

[3] $\partial\mathrm{PG} \quad = -\left[(\partial P_b * ER) + (\partial ER * P_b)\right]$

As the changes in the benchmark price and the exchange rate in the equations [2a] and [2b] are not infinitively small, equation [3] can be re-written as:

[4] $\Delta PG = -\left[\left(\left(P_{ba} - P_{b(int\$)}\right) * \overline{ER}\right) + \left((ER_a - ER_o) * \overline{P_b}\right)\right]$

Where

$\overline{ER} = \frac{ER_o + ER_a}{2}$ and $\overline{P_b} = \frac{P_{b(int\$)o} + P_{ba}}{2}$ i.e. the simple averages of the two exchange rate value and the simple average of the two benchmark prices respectively.

Therefore the total change in the price gap due to the use of adjusted exchange rate and benchmark prices can be expressed as:

Contribution of the adjusted benchmark price to the change in the price gap = $-\left(\left(P_{ba} - P_{b(int\$)}\right) * \overline{ER}\right)$
Contribution of the adjusted exchange rate to the change in the price gap = $-\left((ER_a - ER_o) * \overline{P_b}\right)$

These equations, with the addition of the quality and quantity adjustment factors, can be re-written in the forms of equations [37] and [38].

The calculation of the contribution of the access costs adjustment is straightforward, as there is no interaction between the variables, as it is the case for benchmark price and exchange rate.

The access cost gap is defined as the difference between the observed and adjusted access costs and is estimated both for the steps from the border to the point of competition and from this to farm gate.

Eq. [39] Access cost gap to point of competition [ACG_{wh}] = ACo_{wh} - ACa_{wh}
Eq. [40] Access cost gap to farm gate [ACG_{fg}] = ACo_{fg} - ACa_{fg}

Thus, taking into consideration the definition of the four gaps described in equations [37] to [40] and depending on the trade status of the commodity the relationship between the observed and adjusted price gaps can be expressed as follows:

Eq. [41]
$$\begin{cases} for\ imported\ goods \begin{cases} PGa_{wh} = PGo_{wh} + IMG + ERPG + ACG_{wh} \\ PGa_{fg} = PGo_{fg} + IMG + ERPG + ACG_{wh} - ACG_{fg} \end{cases} \\ for\ exported\ goods \begin{cases} PGa_{wh} = PGo_{wh} + IMG + ERPG - ACG_{wh} \\ PGa_{fg} = PGo_{fg} + IMG + ERPG - ACG_{wh} - ACG_{fg} \end{cases} \end{cases}$$

In order to assure these equivalences, an additional modification has to be made if there are quality or quantity conversion factors between the point of competition and the farm gate. When this is the case, the ACG_{fg} has to take into account the impact of quality and quantity adjustments on the price gap at the point of competition. In order to do so, the access cost gap to farm gate takes this expression when quality and quantity adjustments take place:

Eq. [42]
$$ACG_{fg} = \left(ACa_{fg} - ACo_{fg}\right) + \left[\left(RPa_{wh} - RPo_{wh}\right) \times \left(1 - \left(QT_{fg} \times QL_{fg}\right)\right)\right]$$

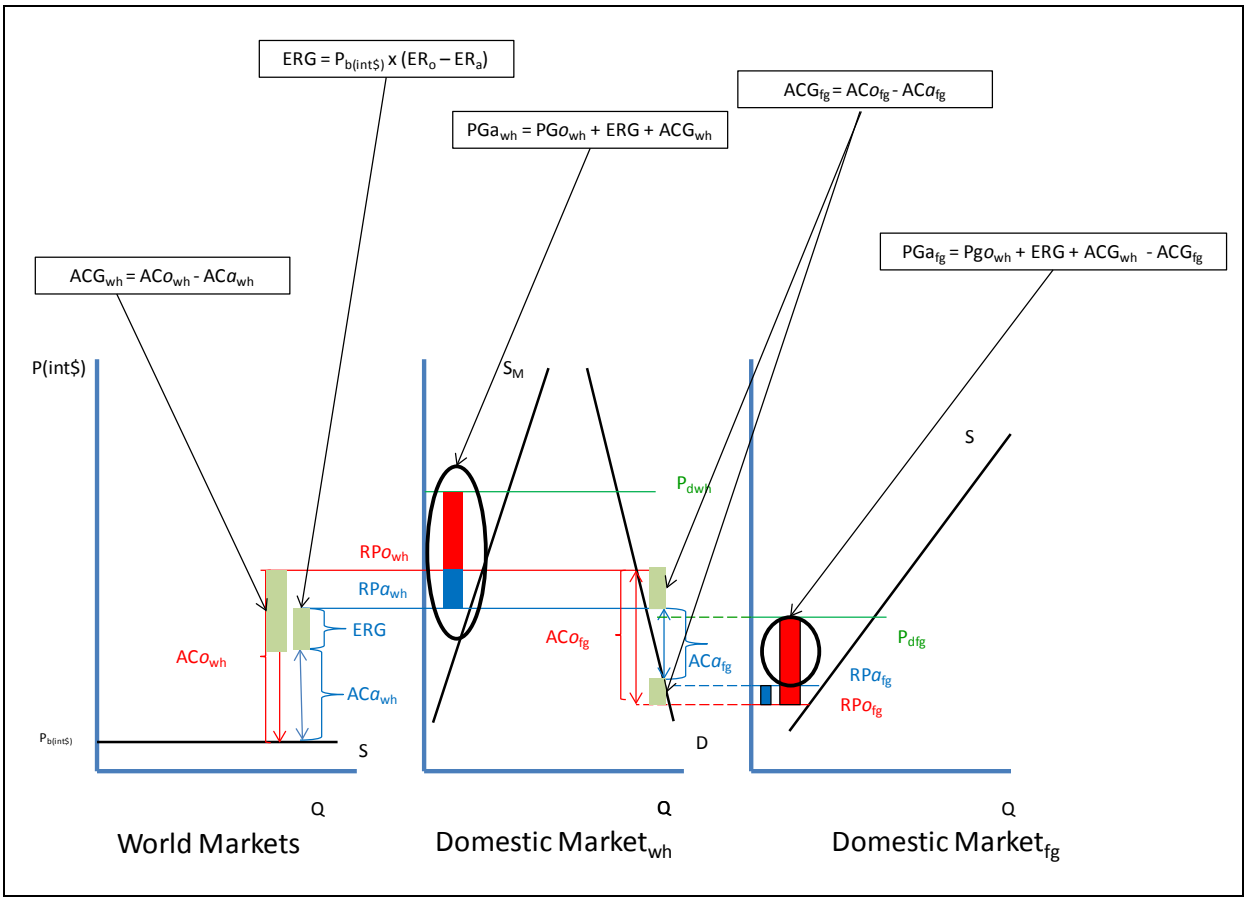
All these formulas, and the necessary changes that have to be made to them, are embedded in the MAFAP spreadsheet. Moreover, if there is no data to calculate adjusted values for the different concepts, the template calculates the adjusted indicators using the observed values and thus IMG, ERPG, ACG_{wh} or ACG_{fg} are set to zero. As mentioned before it is the analyst which must distinguish whether these are real zero (i.e. there is no gap due to exchange rate policy, international markets distortions or inefficient functioning of the commodity specific value chain) or they are assumed to be zero due to lack of data (i.e. the value chain is known not to be efficient but there is no reliable data available to estimate the value of the access costs with a more efficient value chain).

6.3 Interpreting the difference between the observed and adjusted price gap

In order to better understand how the full set of MAFAP indicators are related and can be explained we follow the same approach as in Section 4.7, we start with the graphic representation of price gaps, follow with a simplified example and finish with a real world example taken from the experience acquired during the Phase I of MAFAP.

Figure 10 illustrates the observed and adjusted price gaps for the same imported commodity for which observed price gaps were represented in Figure 4. Both the imported and the domestically produced commodities are the same in terms of quantity and quality. In this example the following policies and value chain characteristics are present. The commodity is subject to an ad valorem import tariff, the country has an overvalued exchange rate, and excessive access costs from border to point of competition and excessive access costs from point of competition to farm gate have been identified in the commodity's value chain.

Figure 10: Graphical representation of the observed and adjusted price gap analysis for an imported commodity with an import tariff, overvalued exchange rate and excessive access costs



Starting from the left side of the figure, the calculations of the observed reference prices (red lines) is the same as described for Figure 4. Adjusted reference prices (blue lines) are calculated using the adjusted exchange rate and the adjusted access costs from the border to the point of competition. The difference between the observed and the adjusted reference price at point of competition is explained by two effects:

I. Considering only the access costs component, lower adjusted access costs from the border to the point of competition than observed ones result in a adjusted reference price which is lower than the observed reference price.

$$ACo_{wh} > ACa_{wh}$$
$$RPo_{wh} = P_{b(int\$)} * ER_o + ACo_{wh} > P_{b(int\$)} * ER_o + ACa_{wh} = RPa_{wh}$$

II. Considering only the exchange rate component, a higher adjusted exchange rate[20] means that the adjusted reference price at point of competition is higher than the observed reference price at point of competition.

[20] As the exchange rate is reported in local currency units per international currency units (i.e. Tanzanian Shillings per US Dollar), when a currency is overvalued this means that the observed exchange rate is lower than it should be. That is, in the adjusted domain the number of local currency units you obtain from an international currency unit is bigger.

$$ER_o < ER_a$$
$$P_{b(int\$)} * ER_o < P_{b(int\$)} * ER_a$$
$$RPo_{wh} = P_{b(int\$)} * ER_o + ACo_{wh} < P_{b(int\$)} * ER_a + ACo_{wh} = RPa_{wh}$$

The total effect will depend on the relative size of both effects. In the graphic example the effect of the adjusted access costs is greater than that of the adjusted exchange rate and therefore the adjusted reference price at the point of competition is lower than the observed reference price at the point of competition. Using a numerical example this situation is summarized in Table 10. We consider that there is a 50 percent ad valorem tariff, the exchange rate is overvalued by 10 percent and import procedures could be improved, reducing the access costs from the border to the point of competition by 50 percent.

Table 10: Simplified analysis of observed and adjusted price incentives and disincentives at the point of competition for an imported commodity with a 50 percent ad valorem import tariff, a currency overvalued by 10 percent and excessive access costs from the border to the point of competition

Concept	Nature of data	Symbol	Formula	Unit	Value
Benchmark price	No change	$P_{b(int\$)}$	data	USD per ton	100
Exchange rate	Observed	ER_o	data	Local currency per USD	10
	Adjusted	ER_a	data		11
Benchmark price in local currency	Observed	$P_{b(loc\$)}$	$P_{b(int\$)} * ER_o$	Local currency per ton	1 000
	Adjusted	$P_{b(loc\$)a}$	$P_{b(int\$)} * ER_a$		1 100
Access costs from border to point of competition	Observed	ACo_{wh}	data	Local currency per ton	400
	Adjusted	ACa_{wh}	Data		200
Reference price at point of competition	Observed	RPo_{wh}	$P_{b(loc\$)} + ACo_{wh}$	Local currency per ton	1 400
	Adjusted	RPa_{wh}	$P_{b(loc\$)a} + ACa_{wh}$		1 300
Domestic price at point of competition	N.a.	P_{dwh}	data	Local currency per ton	1 900
Price gap at point of competition	Observed	PGo_{wh}	$P_{dwh} - RPo_{wh}$	Local currency per ton	500
	Adjusted	PGa_{wh}	$P_{dwh} - RPa_{wh}$		600
Nominal rate of protection at point of competition	Observed	$NRPo_{wh}$	PGo_{wh} / RPo_{wh}	Percent	36
	Adjusted	$NRPa_{wh}$	PGa_{wh} / RPa_{wh}		46
Exchange rate policy gap	N.a.	ERPG	$P_{b(int\$)} * (ER_a - ER_o)$	Local currency per ton	- 100
Access cost gap from the border to the point of competition	N.a.	ACG_{wh}	$ACo_{wh} - ACa_{wh}$	Local currency per ton	200

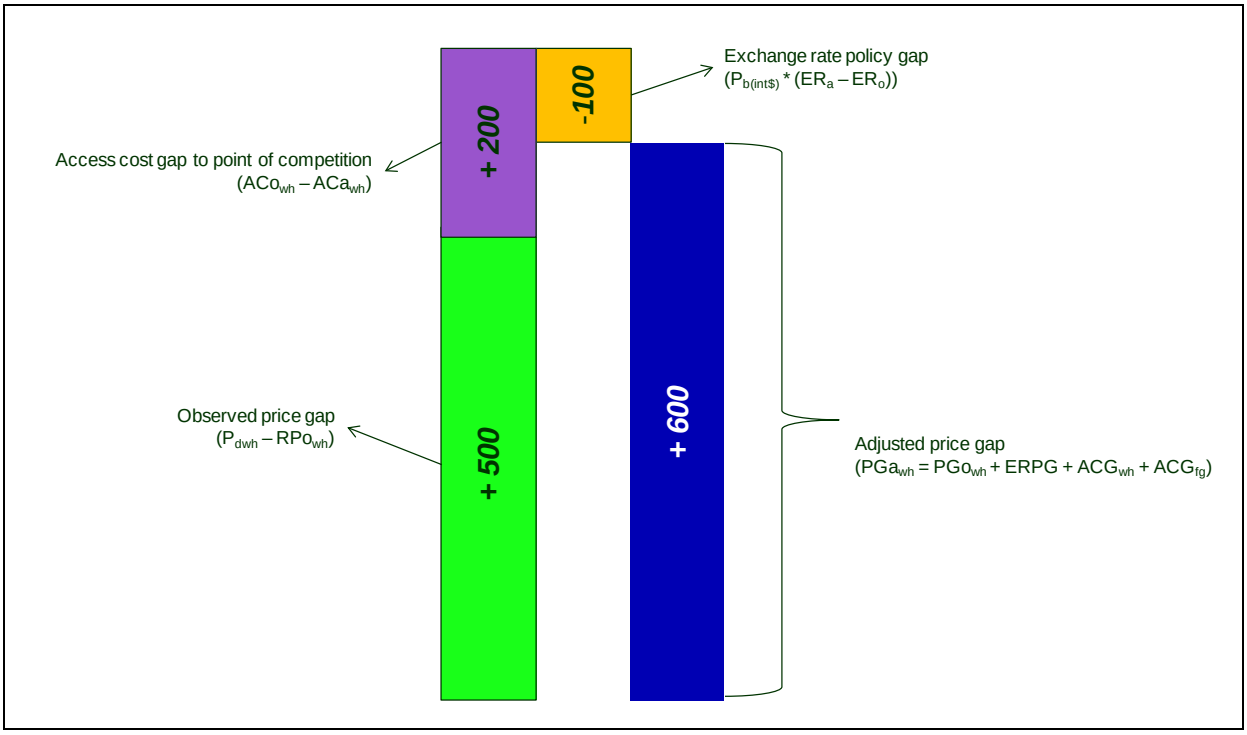
N.a.: not applicable
Shaded rows are concepts that are calculated automatically by the MAFAP spreadsheet.

In this simple case we see again that in the observed domain the price gap is equal to the value of the ad valorem tariff (1000 * 50 percent = 500 local currency units). The adjusted price gap adds to it the effect of the excessive access costs (that is the access costs gap to the point of competition (see equation [36] and [38]) which stands at 200 local currency units) and the effect of the overvalue exchange rate (that is the exchange rate policy gap (see equation [35] and [38]) which stands at minus 100 local currency units). This results in an adjusted price gap at the point of competition of 600. The adjusted price gap is bigger than the observed one because the access cost gap is bigger than the exchange rate policy gap. Please note also that in this example equation [38] holds and the difference between the observed and the adjusted price gaps is the sum of the ERPG and the ACG_{wh}.

The result of the indicator can be explained as follows. The tariff provides incentives at the wholesale level (observed price gap positive). Part of the incentives of the observed domain disappear when one considers the disincentive related to the overvalue exchange rate. The fact that there is an

overvalue exchange rate prevents wholesalers from getting a price that could be up to 100 local currency units higher. However, the fact that the access costs from the border to the point of competition are higher than they could be if the functioning of the entry procedures into the country would be improved means that imports could arrive in the point of competition at lower prices, thus this inefficient access costs are acting as a *de facto* additional tax on imports. The total effect is 600 (adjusted price gap) which includes the incentives of the tariff (500), the disincentives of the overvalued exchange rate (-100) and the incentive due to inefficient import procedures (200). Graphically this is represented in Figure 11.

Figure 11: Representation of the relationship between the observed and adjusted price gaps at the point of competition for an imported commodity (values in local currency per tonne)



From the point of competition then we move towards the farm gate. Here we also assume that observed access costs from the point of competition to the farm gate are excessive. As described in Section 5.2 this could be due to, inter alia, an explicit marketing tax for agricultural products or because transport costs are too high. In this simplified example we consider that observed access costs amount to 400 local currency units per ton which include a marketing tax of 5 percent of the farm gate price. This tax is deducted when calculating the adjusted access costs from the point of competition to the farm gate. Building on this example the situation is summarized in Table 11.

Table 11: Simplified analysis of observed and adjusted price incentives and disincentives at the point of competition for an imported commodity with a 50 percent ad valorem import tariff, a currency overvalued by 10 percent and excessive access costs from the border to the point of competition and from the point of competition to the farm gate

Concept	Nature of data	Symbol	Formula	Unit	Value
Reference price at point of competition	Observed	RPo_{wh}	From Table 10	Local currency per ton	1 400
	Adjusted	RPa_{wh}	From Table 10		1 300
Access costs from point of competition to the farm gate	Observed	ACo_{fg}	data	Local currency per ton	375
	Adjusted	ACa_{fg}	data		300
Reference price at farm gate	Observed	RPo_{fg}	$P_{b(loc\$)} + ACo_{wh}$	Local currency per ton	1 025
	Adjusted	RPa_{fg}	$P_{b(loc\$)a} + ACa_{wh}$		1 00
Domestic price at point of farm gate	N.a.	P_{dfg}	data	Local currency per ton	1 525
Price gap at point of competition	Observed	PGo_{wh}	$P_{dwh} - RPo_{wh}$	Local currency per ton	500
	Adjusted	PGa_{wh}	$P_{dwh} - RPa_{wh}$		525
Nominal rate of protection at point of competition	Observed	$NRPo_{wh}$	PGo_{wh} / RPo_{wh}	Percent	49
	Adjusted	$NRPa_{wh}$	PGa_{wh} / RPa_{wh}		53
Exchange rate policy gap	N.a.	ERPG	From Table 10	Local currency per ton	- 100
Access cost gap from the border to the point of competition	N.a.	ACG_{wh}	From Table 10	Local currency per ton	200
Access cost gap from the point of competition to the farm gate	N.a.	ACG_{fg}	$ACo_{fg} - ACa_{fg}$	Local currency per ton	- 75
Market Development Gap	N.a.	MDG	$ERPG + ACG_{wh} + ACG_{fg}$	Local currency per ton	25

N.a.: not applicable
Shaded rows are concepts that are calculated automatically by the MAFAP spreadsheet.

Again, in this simplified example we see that the observed price gap at farm gate is the value of the ad valorem tariff, which provides incentives to farmers. When considering the results of the adjusted domain the incentive is increased to 525. This is the result of the three components of the market development gap. On top of the exchange rate policy gap and the access costs gap from the border to the point of competition discussed above, the fact that there is an explicit marketing tax for the commodity analyzed reduces the incentives by 75 local currency units. If this tax was removed access costs would be reduced and thus the adjusted reference price at point of competition would be higher and the level of incentives increased. Figure 12 shows the graphical representation of the different price, policy and access costs gaps for this example.

Figure 12: Representation of the relationship between the observed and adjusted price gaps at the farm gate for an imported commodity (values in local currency per tonne)

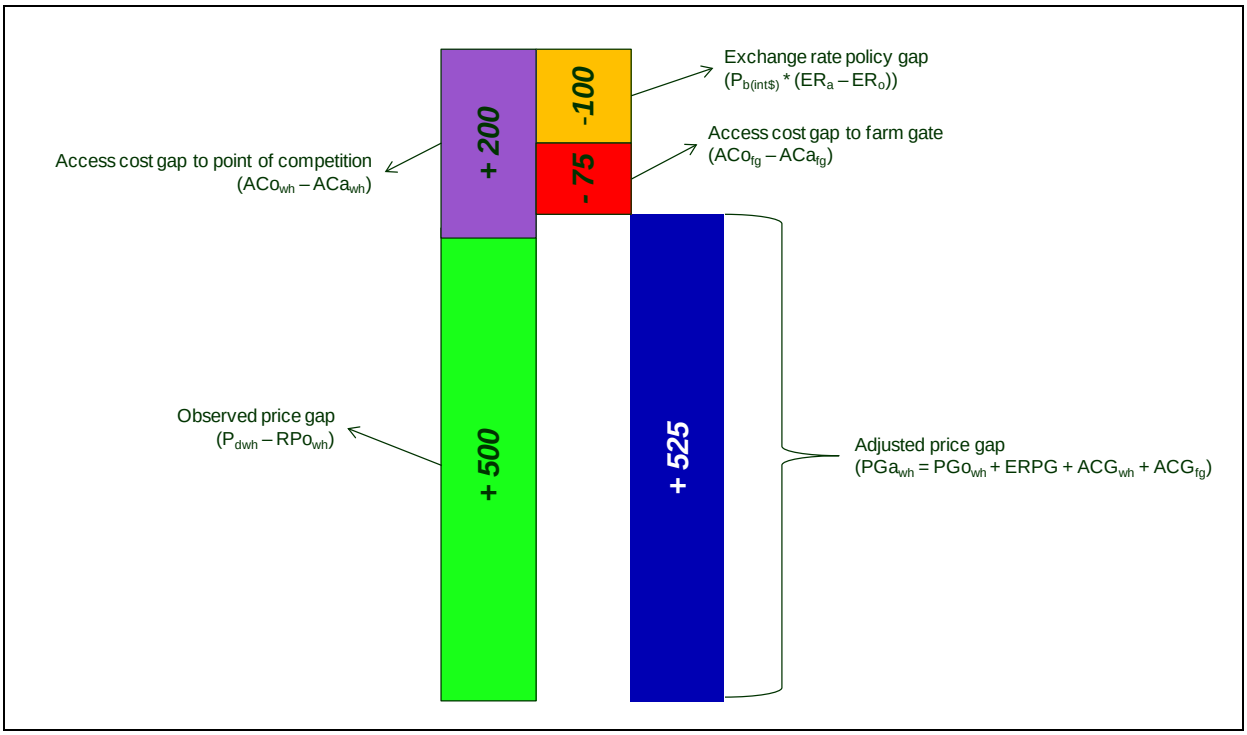


Figure 13 provides a snapshot of how this calculation looks in the MAFAP spreadsheet. Data is inserted in the yellow area (both for observed and adjusted concepts) while calculated prices and indicators are generated automatically by the spreadsheet.

Figure 13: MAFAP indicator calculation spreadsheet with the example data inserted

	DATA		Unit	Symbol	Year trade status	2005 m	Notes
	Benchmark Price						
1		*Observed*	USD/TON	$P_{b(int\$)}$		**100.00**	CIF Price
1b		*Adjusted*	USD/TON	P_{ba}			
	Exchange Rate						
2		*Observed*	LOC/USD	ER_o		10.00	
2b		*Adjusted*	LOC/USD	ER_a		11.00	
	Access costs border - point of competition						
3		*Observed*	LOC/TON	ACo_{wh}		400.00	
3b		*Adjusted*	LOC/TON	ACa_{wh}		200.00	
4	**Domestic price at point of competition**		LOC/TON	P_{dwh}		**1,900.00**	
	Access costs point of competition - farm gate						
5		*Observed*	LOC/TON	ACo_{fg}		375.00	
5b		*Adjusted*	LOC/TON	ACa_{fg}		300.00	
6	**Farm gate price**		LOC/TON	P_{dfg}		1,525.00	
7	Externalities associated with production		LOC/TON	E			
8	Budget and other product related transfers		LOC/TON	BOT			From PE Analysis
	Quantity conversion factor (border - point of competition)		Fraction	QT_{wh}			
	Quality conversion factor (border - point of competition)		Fraction	QL_{wh}			
	Quantity conversion factor (point of competition - farm gate)		Fraction	QT_{fg}			
	Quality conversion factor (point of competition - farm gate)		Fraction	QL_{fg}			

	CALCULATED PRICES		Unit	Symbol	2005	Formula
	Benchmark price in local currency					
9		*Observed*	LOC/TON	$P_{b(loc\$)}$	1,000.00	[1]*[2]
10		*Adjusted*	LOC/TON	$P_{b(loc\$)a}$	1,100.00	[1]*[2b]
	Reference Price at point of competition					
11		*Observed*	LOC/TON	RPo_{wh}	1,400.00	[9]+[3]
12		*Adjusted*	LOC/TON	RPa_{wh}	1,300.00	[10]+[3b]
	Reference Price at Farm Gate					
13		*Observed*	LOC/TON	RPo_{fg}	1,025.00	[11]-[5]
14		*Adjusted*	LOC/TON	RPa_{fg}	1,000.00	[12]-[5b]

	INDICATORS		Unit	Symbol	2005	Formula
	Price gap at point of competition					
15		*Observed*	LOC/TON	PGo_{wh}	500.00	[4]-[11]
16		*Adjusted*	LOC/TON	PGa_{wh}	600.00	[4]-[12]
	Price gap at farm gate					
17		*Observed*	LOC/TON	PGo_{fg}	500.00	[6]-[13]
18		*Adjusted*	LOC/TON	PGa_{fg}	525.00	[6]-[14]
	Nominal rate of protection at point of competition					
19		*Observed*	%	$NRPo_{wh}$	36%	[15]/[11]
20		*Adjusted*	%	$NRPa_{wh}$	46%	[16]/[12]
	Nominal rate of protection at farm gate					
21		*Observed*	%	$NRPo_{fg}$	49%	[17]/[13]
22		*Adjusted*	%	$NRPa_{fg}$	53%	[18]/[14]
	Nominal rate of assistance					
23		*Observed*	%	NRAo	49%	([17]+[8])/[13]
24		*Adjusted*	%	NRAa	53%	([18]+[8])/[14]

	Decomposition of PWAfg	Unit	Symbol	2005	Formula
25	International markets gap	LOC/TON	IRG	-	
26	Exchange policy gap	LOC/TON	ERPG	(100.00)	([2]-[2b])*[1]
27	Access costs gap to point of competition	LOC/TON	ACG_{wh}	200.00	[3]-[3b]
28	Access costs gap to farm gate	LOC/TON	ACG_{fg}	(75.00)	[5b]-[5]
29	Externality gap	LOC/TON	EG	-	
	Market Development Gap	LOC/TON	MDG	25.00	[25]+[26]+[27]+[28]+[29]
	Market Development Gap	%	MDG	0.03	MDG/RPafg

However, as in the case of the observed domain, in reality such simplified examples are not found in the real world. Two or more policies affect domestic prices of agricultural commodities. Moreover, in Africa markets are not perfectly integrated and price transmission is not perfect. Box 22 shows some of the results obtained for imported commodities in the framework of the MAFAP work.

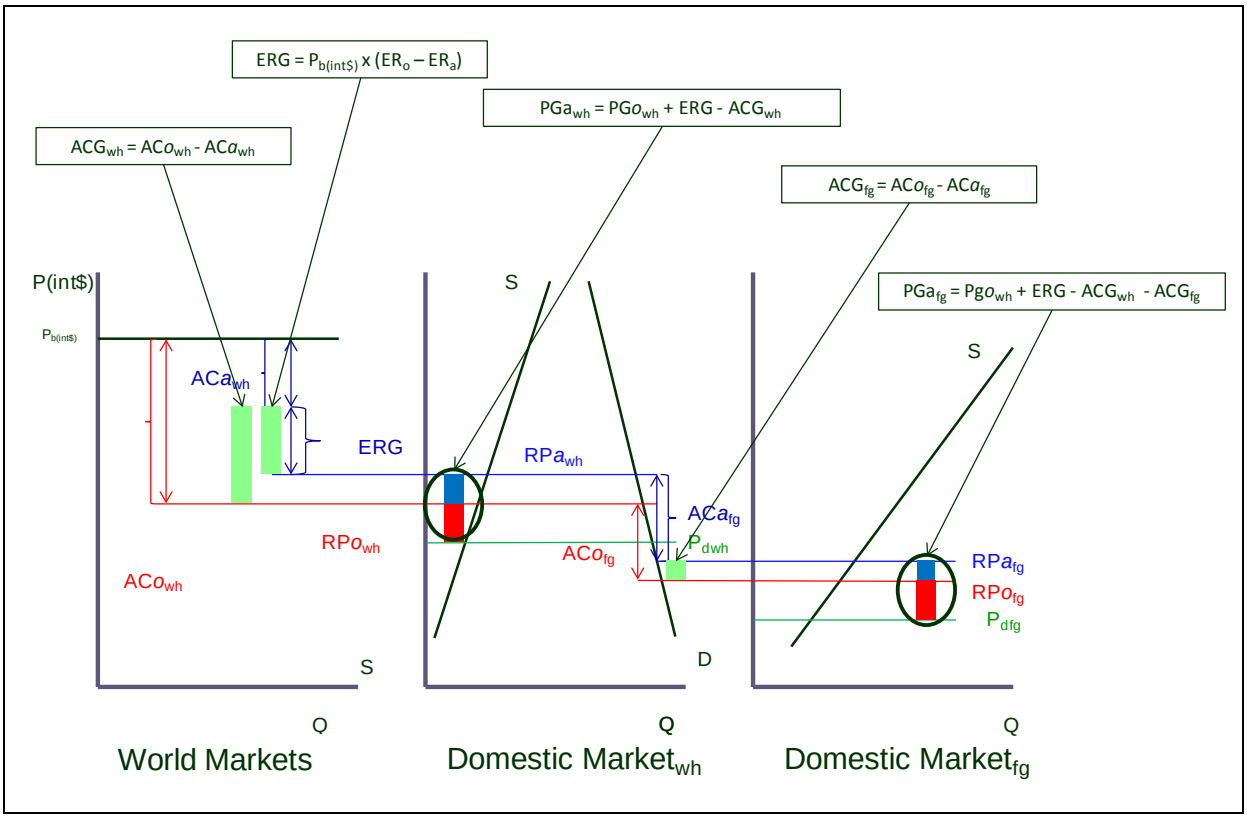
Box 22: MAFAP results on adjusted price incentives and disincentives for imported commodities

TO BE COMPLETED

Source:

As in the case of the observed indicators a similar analysis can be done for commodities for which a country is a net exporter. Figure 14 illustrates the observed and adjusted price gap for the same commodity for which observed price gaps were represented in Figure 6. Both the exported commodity and the commodity for which domestic prices are obtained at point of competition and the farm gate are the same in terms of quantity and quality. In this example the following policies and value chain characteristics are present. The commodity is subject to an export tax, the country has an overvalued exchange rate, and excessive access costs from border to point of competition and excessive access costs from point of competition to farm gate have been identified in the commodity's value chain.

Figure 14: Graphical representation of the observed and adjusted price gap analysis for an exported commodity with an export tax, overvalued exchange rate and excessive access costs



Starting from the left side of the figure, the calculation of the observed reference prices (red lines) is the same as described in Figure 6. Adjusted reference prices (blue lines) are calculated using the adjusted exchange rate and the adjusted access costs from the border to the point of competition. The difference between the observed and the adjusted reference price at the point of competition is explained by two effects:

I. Considering only the access costs component, lower adjusted access costs from the border to the point of competition than observed ones result in an adjusted reference price which is higher than the observed reference price.

$$ACo_{wh} > ACa_{wh}$$
$$RPo_{wh} = P_{b(int\$)} * ER_o - ACo_{wh} < P_{b(int\$)} * ER_o - ACa_{wh} = RPa_{wh}$$

II. Considering only the exchange rate component, a higher adjusted exchange rate[21] means that the adjusted reference price at point of competition is higher than the observed reference price at point of competition.

$$ER_o < ER_a$$
$$P_{b(int\$)} * ER_o < P_{b(int\$)} * ER_a$$
$$RPo_{wh} = P_{b(int\$)} * ER_o - ACo_{wh} < P_{b(int\$)} * ER_a - ACo_{wh} = RPa_{wh}$$

For exported commodities the overall effect is that the adjusted reference price is higher than the observed price negative as both individual effects increase its value. Therefore both ERPG and ACG_{wh} for exports increase the level of disincentives or reduce the level of incentives if the observed indicators were positive. Using a numerical example this situation is summarized in Table 12. We consider there is a 5 percent export tax, the exchange rate is overvalued by 10 percent and the export procedures could be improved from the border to the point of competition by 50 percent.

Table 12: Simplified analysis of observed and adjusted price incentives and disincentives at the point of competition for an exported commodity with a 5 percent export tax, a currency overvalued by 10 percent and excessive access costs from the border to the point of competition

Concept	Nature of data	Symbol	Formula	Unit	Value
Benchmark price	No change	$P_{b(int\$)}$	data	USD per ton	100
Exchange rate	Observed	ER_o	data	Local currency per USD	10
	Adjusted	ER_a	data		11
Benchmark price in local currency	Observed	$P_{b(loc\$)}$	$P_{b(int\$)} * ER_o$	Local currency per ton	1 000
	Adjusted	$P_{b(loc\$)a}$	$P_{b(int\$)} * ER_a$		1 100
Access costs from border to point of competition	Observed	ACo_{wh}	data	Local currency per ton	50
	Adjusted	ACa_{wh}	Data		25
Reference price at point of competition	Observed	RPo_{wh}	$P_{b(loc\$)} - ACo_{wh}$	Local currency per ton	950
	Adjusted	RPa_{wh}	$P_{b(loc\$)a} - ACa_{wh}$		1 075
Domestic price at point of competition	N.a.	P_{dwh}	data	Local currency per ton	900
Price gap at point of competition	Observed	PGo_{wh}	$P_{dwh} - RPo_{wh}$	Local currency per ton	- 50
	Adjusted	PGa_{wh}	$P_{dwh} - RPa_{wh}$		- 175
Nominal rate of protection at point of competition	Observed	$NRPo_{wh}$	PGo_{wh} / RPo_{wh}	Percent	- 5
	Adjusted	$NRPa_{wh}$	PGa_{wh} / RPa_{wh}		- 16
Exchange rate policy gap	N.a.	ERPG	$P_{b(int\$)} * (ER_a - ER_o)$	Local currency per ton	- 100
Access cost gap from the border to the point of competition	N.a.	ACG_{wh}	$ACo_{wh} - ACa_{wh}$	Local currency per ton	- 25

N.a.: not applicable
Shaded rows are concepts that are calculated automatically by the MAFAP spreadsheet.

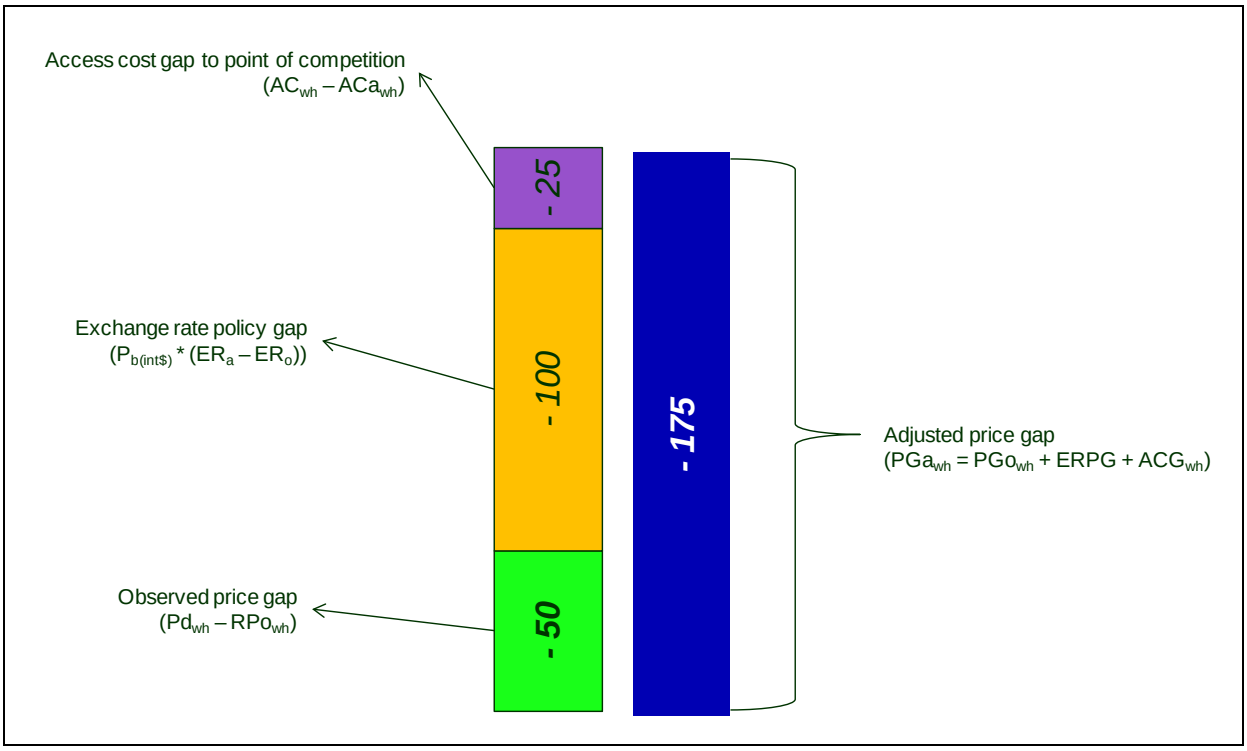
In this simple case, again we see that the observed price gap is a disincentive (i.e. equal to the value of the export tax (1000 * 5 percent = minus 50 local currency units). The adjusted price gap increases the negative size of the gap by adding the access costs gap from the border to the point of competition (see equations [36] and [38])and the exchange rate policy gap (see equations [35] and [38]).

The result of the indicator can be explained as follows. The export tax provides disincentives at the point of competition (observed price negative). This means that agents at the point of competition

[21] See footnote 15.

get lower prices because they have to add to their access costs the export tax[22]. In addition to this additional disincentives come from the overvalued exchange rate, agents could get higher prices (in local currency) for their commodities if the exchange rate policy was removed. Last, excessive access costs from the border to the point of competition also prevent agents from getting higher prices, i.e. the inefficiencies are acting as an additional *de facto* export tax. The total effect (-175 local currency units per ton) is the results of the export tax (-50 local currency units per ton), the exchange rate policy gap (-100 local currency units per ton) and the access costs gap from the border to the point of competition (-25 local currency units per ton). Figure 15 shows the graphical representation of the different price, policy and access costs gaps for this example.

Figure 15: Representation of the relationship between the observed and adjusted price gaps at the point of competition for an exported commodity (values in local currency per tonne)



From the point of competition we then move towards the farm gate. Here we also assume that the observed access costs from the point of competition to the farm gate are excessive. As described in Section 5.2 this could be due to, inter alia, an explicit marketing tax for agricultural products or because transport costs are too high. In this simplified example we consider that the observed access costs from the point of competition to the farm gate include 50 local currency units which account for fees and weighbridges haulers need to pay when transporting the good. These fees are deducted when calculating the adjusted access costs from the point of competition to the farm gate. Building on this example the situation is summarized in Table 13.

[22] Remember that the export tax is not included in the calculation of the reference price.

Table 13: Simplified analysis of observed and adjusted price incentives and disincentives at the point of competition for an exported commodity with a 5 percent export tax, a currency overvalued by 10 percent and excessive access costs from the border to the point of competition and from the point of competition to the farm gate

Concept	Nature of data	Symbol	Formula	Unit	Value
Reference price at point of competition	Observed	RPo_{wh}	From Table 12	Local currency per ton	950
	Adjusted	RPa_{wh}	From Table 12		1 075
Access costs from point of competition to farm gate	Observed	ACo_{fg}	data	Local currency per ton	350
	Adjusted	ACa_{fg}	data		300
Reference price at farm gate	Observed	RPo_{wh}	$P_{b(loc\$)}$ - ACo_{wh}	Local currency per ton	600
	Adjusted	RPa_{wh}	$P_{b(loc\$)a}$ - ACa_{wh}		775
Domestic price at farm gate	N.a.	P_{dfg}	data	Local currency per ton	550
Price gap at farm gate	Observed	PGo_{fg}	P_{dfg} - RPo_{fg}	Local currency per ton	- 50
	Adjusted	PGa_{fg}	P_{dfg} - RPa_{fg}		- 225
Nominal rate of protection at farm gate	Observed	$NRPo_{fg}$	PGo_{fg} / RPo_{fg}	Percent	- 8
	Adjusted	$NRPa_{fg}$	PGa_{fg} / RPa_{fg}		- 29
Exchange rate policy gap	N.a.	ERPG	$P_{b(int\$)} * (ER_a - ER_o)$	Local currency per ton	- 100
Access cost gap from the border to the point of competition	N.a.	ACG_{wh}	ACo_{wh} - ACa_{wh}	Local currency per ton	- 25
Access cost gap from the border to the point of competition	N.a.	ACG_{wh}	ACo_{fg} - ACa_{fg}	Local currency per ton	- 50
Market Development Gap	N.a.	MFG	ERPG + ACG_{wh} + ACG_{fg}	Local currency per ton	- 175

N.a.: not applicable
Shaded rows are concepts that are calculated automatically by the MAFAP spreadsheet.

Again, in this simplified example we see that the observed price gap is the value of the export tax, which acts as a disincentive for farmers. When considering the adjusted domain, the disincentive increases to 225 local currency units per tonne. This is the result of the three components of the market development gap. On top of the exchange policy price gap and the access costs gap from the border to the point of competition discussed above, the fact that transport costs include fees and weighbridges haulers need to pay when transporting the good increases the disincentives by 50 local currency units per ton. If action was taken to eliminate these informal fees farmers could get higher prices for their product. Of course, one should not forget that due to the static nature of the analysis, the extent to which the elimination of the fees would be transferred totally to farmers would depend on the demand and supply elasticities. Figure 16 shows the graphical representation of the different price, policy and access costs gaps for this example.

Figure 16: Representation of the relationship between the observed and adjusted price gaps at the point of competition for an exported commodity (values in local currency per tonne)

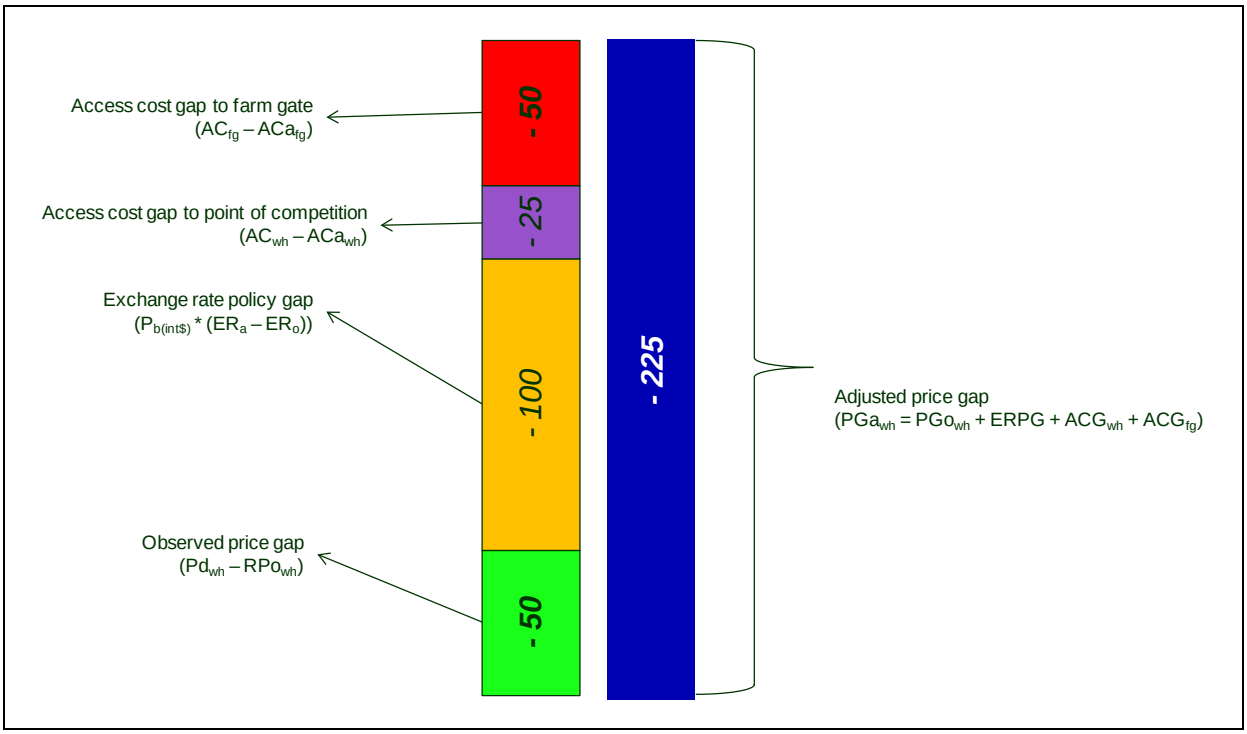


Figure 17 provides a snapshot of how this calculation looks like in the MAFAP spreadsheet. Data is inserted in the yellow area (both for observed and adjusted concepts) while calculated prices are generated automatically by the spreadsheet.

Figure 17: MAFAP indicator calculation spreadsheet with the example data inserted

	DATA		Unit	Symbol	Year trade status	2005 x	Notes
	Benchmark Price						
1		*Observed*	USD/TON	$P_{b(int\$)}$		**100.00**	FOB Price
1b		*Adjusted*	USD/TON	P_{ba}			
	Exchange Rate						
2		*Observed*	LOC/USD	ER_o		10.00	
2b		*Adjusted*	LOC/USD	ER_a		11.00	
	Access costs border - point of competition						
3		*Observed*	LOC/TON	ACo_{wh}		50.00	
3b		*Adjusted*	LOC/TON	ACa_{wh}		25.00	
4	**Domestic price at point of competition**		LOC/TON	P_{dwh}		**900.00**	
	Access costs point of competition - farm gate						
5		*Observed*	LOC/TON	ACo_{fg}		350.00	
5b		*Adjusted*	LOC/TON	ACa_{fg}		300.00	
6	**Farm gate price**		LOC/TON	P_{dfg}		550.00	
7	Externalities associated with production		LOC/TON	E			
8	Budget and other product related transfers		LOC/TON	BOT			From PE Analysis
	Quantity conversion factor (border - point of competition)		Fraction	QT_{wh}			
	Quality conversion factor (border - point of competition)		Fraction	QL_{wh}			
	Quantity conversion factor (point of competition - farm gate)		Fraction	QT_{fg}			
	Quality conversion factor (point of competition - farm gate)		Fraction	QL_{fg}			

	CALCULATED PRICES		Unit	Symbol	2005	Formula
	Benchmark price in local currency					
9		*Observed*	LOC/TON	$P_{b(loc\$)}$	1,000.00	[1]*[2]
10		*Adjusted*	LOC/TON	$P_{b(loc\$)a}$	1,100.00	[1]*[2b]
	Reference Price at point of competition					
11		*Observed*	LOC/TON	RPo_{wh}	950.00	[9]-[3]
12		*Adjusted*	LOC/TON	RPa_{wh}	1,075.00	[10]-[3b]
	Reference Price at Farm Gate					
13		*Observed*	LOC/TON	RPo_{fg}	600.00	[11]-[5]
14		*Adjusted*	LOC/TON	RPa_{fg}	775.00	[12]-[5b]

	INDICATORS		Unit	Symbol	2005	Formula
	Price gap at point of competition					
15		*Observed*	LOC/TON	PGo_{wh}	(50.00)	[4]-[11]
16		*Adjusted*	LOC/TON	PGa_{wh}	(175.00)	[4]-[12]
	Price gap at farm gate					
17		*Observed*	LOC/TON	PGo_{fg}	(50.00)	[6]-[13]
18		*Adjusted*	LOC/TON	PGa_{fg}	(225.00)	[6]-[14]
	Nominal rate of protection at point of competition					
19		*Observed*	%	$NRPo_{wh}$	-5%	[15]/[11]
20		*Adjusted*	%	$NRPa_{wh}$	-16%	[16]/[12]
	Nominal rate of protection at farm gate					
21		*Observed*	%	$NRPo_{fg}$	-8%	[17]/[13]
22		*Adjusted*	%	$NRPa_{fg}$	-29%	[18]/[14]
	Nominal rate of assistance					
23		*Observed*	%	NRAo	-8%	([17]+[8])/[13]
24		*Adjusted*	%	NRAa	-29%	([18]+[8])/[14]

	Decomposition of PWAfg	Unit	Symbol	2005	Formula
25	International markets gap	LOC/TON	IRG	-	
26	Exchange policy gap	LOC/TON	ERPG	(100.00)	([2]-[2b])*[1]
27	Access costs gap to point of competition	LOC/TON	ACG_{wh}	(25.00)	([3b]-[3])
28	Access costs gap to farm gate	LOC/TON	ACG_{fg}	(50.00)	[5b]-[5]
29	Externality gap	LOC/TON	EG	-	
	Market Development Gap	LOC/TON	MDG	(175.00)	[25]+[26]+[27]+[28]+[29]
	Market Development Gap	%	MDG	(0.23)	MDG/RPafg

However, as in the case of the observed domain, in reality such simplified examples are not found in the real world. Two or more policies affect domestic prices of agricultural prices. Moreover, in Africa markets are not perfectly integrated and price transmission is not perfect. Box 23 shows some of the results obtained for imported commodities in the framework of the MAFAP work.

Box 23: MAFAP results on adjusted price incentives and disincentives for exported commodities

TO BE COMPLETED

Source:

7. From commodity specific indicators to aggregated indicators

Building on the commodity specific indictors, the MAFAP methodology allows for the calculation of aggregate indicators (NRPs, NRAs and MDGs) to create a more general picture of price incentives and disincentives for the agricultural sector.

The first aggregated indicator is that of Market Price Support (MPS). This indicator is obtained by multiplying the price gap (observed or adjusted) by the total volume of production (Equation [44]). This indicator is an absolute measure of transfers to producers and is evaluated in local currency units. If the price gaps are taken from the observed domain they measure the policy and market performance, if they are taken from the adjusted domain they add to this the effects of international market distortions, exchange rate policy and inefficiencies of the commodity specific value chain. Again, the extent to which the latter are measured depend on how the adjusted concepts have been constructed.

Eq. [44]

$$MPS\ (local\ currency\ units) = PG_{fg}\left(\frac{local\ currency\ units}{tonne\ of\ product}\right) * Production\ volume\ (tonne\ of\ product)$$

The MPS can be aggregated for different commodities in a country. However, if the MPS is to be compared across countries the MPS values have to be converted into international currency units.

The MPS for individual commodities is calculated in the MAFAP Spreadsheet in rows 72 to 76. The analyst has to include the volume of production for each commodity, paying special attention to make sure that the product to which the production is reported is the same as the product for which the farm gate price data is reported.

Second, farm gate-level indicators for commodities are aggregated into relevant product groups. Four main aggregates are considered – the agricultural sector as a whole (covering all commodities), imported commodities, exported commodities and commodities important for food security (commodities representing an important size of the country's diet)[23]. Aggregate indicators are calculated as weighted averages based on each commodity's relative contribution to the total value of agricultural production. The formula for constructing aggregate indicators for product groups is as follows:

Eq. [45]

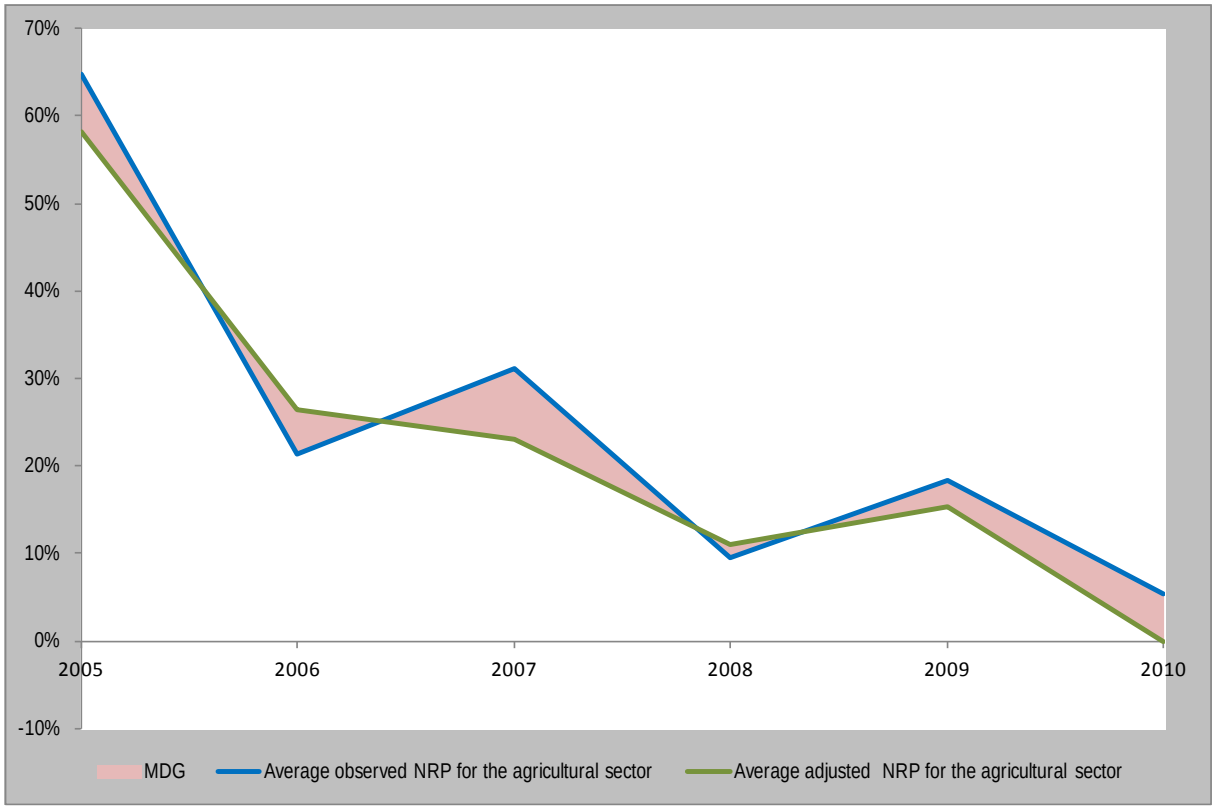
$$NRP_g = \frac{\sum_{i=1}^{i=n} NRP_i * PROD_i * RP_{fgi}}{\sum_{i=1}^{i=n} PROD_i * RP_{fgi}}$$

where NRP_g is the aggregated NRP for a subset of n commodities, NRP_i is the NRP for the commodity, $PROD_i$ is the volume of production in tonnes (or any other unit) of the commodity and RP_{fgi} is the reference price of the commodity at the farm gate[24].

[23] For a more detailed description of the commodity groups please refer to Barreiro-Hurlé (2011).
[24] The same formula also applies for aggregated NRAs and MDGs, though NRP_i would be NRA_i and MDG_i, respectively.

For the calculation of this aggregated NRP's a second MAFAP Spreadsheet is available. In this spreadsheet the analyst has to input the NRPo and NRPa for each commodity, the $MDG_{\%}$, the production volumes and the RPo_{fg} and RPa_{fg}. The Spreadsheet calculates the aggregated indicators and a set of graphs (see Figure 18 for an example) to summarize the results.

Figure 18: Sample graph of aggregate indicators ($NRPo_{fg}$, $NRPa_{fg}$ and MDG) for the agricultural sector in the United Republic of Tanzania



Source: MAFAP (2013)

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