MAFAP
SAPAA

Monitoring and Analysing Food and Agricultural Policies
Suivi et analyse des politiques agricoles et alimentaires

METHODOLOGY WORKING PAPER:

Volume I. - MEASURES OF PRICE INCENTIVES

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This technical note is a product of the Monitoring and Analysing Food and Agricultural Policies program (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 programme.

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

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
ERP_a	Adjusted Effective Rate of Protection
ERP_o	Observed Effective Rate of Protection
ERPG	Exchange rate policy gap
FOB	Free on board
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
LOP	Law of one price
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
X	Exports

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.*

Table of Contents

1. Introduction

The Food and Agriculture Organization of the UN (FAO) is initiating the second phase of the Monitoring and Analysing Food and Agricultural Policies (MAFAP) program that extends from 2014 to 2019. During the first phase of the program, implemented from 2009 to 2013, the FAO worked with governments and national policy research institutes in ten African countries to create a consistent set of analyses that assess the effects of policies on prices in key agricultural value chains and on public expenditure. In addition, the FAO developed national capacity to institutionalize policy monitoring in national institutions, promoting evidence-based policymaking that is conducive to agricultural development.

Monitoring Agricultural and Food Policies and their effects is a fundamental part of the policy process. Government actions influence agricultural prices directly, through trade and price policies, and indirectly, through intervention in other sectors or macroeconomic decisions that change the relative taxation between agricultural and non-agricultural sectors. Thus, even when considering policy reforms outside the agricultural sector, knowing how this will impact incentives or taxation of that sector is essential, considering the strong impact that they will have on welfare and food security. In Phase II, MAFAP will be working even more closely with partner countries and with governments to focus on policy priorities, building on inclusive policy dialogue. Furthermore, MAFAP will support governments in the articulation of alternative policy reform options and in analysing the costs and benefits of those reforms. In this way, governments will be in a better position to assess and approve policy changes based on reliable and relevant evidence.

In countries where agriculture constitutes such a large share of trade and of the economy as a whole, agricultural trade and price policy reforms more directly affect the income and welfare of the population as well as the reallocation of production factors, such as labour and land (Magrini et al 2015 and MAFAP, 2013a). This document provides theoretical guidelines on how to conduct disaggregated analysis of the trade and market measures affecting the incentives associated with the production and marketing of key agricultural products and how to estimate the joint effect of trade and market policies (input and output) on farm gate prices through direct price comparison. Within this context, the MAFAP programme will continue producing a set of indicators that measure the impact of trade and market intervention policies on agricultural prices.

The MAFAP incentives indicators build on previous work undertaken on policy measurement related to both output and input market prices. In the former case, most of the previous efforts are based on price comparisons (Tsakok, 1990; Krueger et al. 1988 & 1991; Anderson et al. 2009: to cite just a few). Specifically, the methodology for calculating MAFAP indicators for output price incentives/disincentives stems from the OECD proposal to compute the market price differential component of the Producer Support Estimate (OECD, 2010). In the latter case regarding inputs, the literature has focused on calculating the effective rate of protection (ERP) and the corresponding effective protection coefficients, originally proposed by Barber (1955)[1], Meade (1955) and by Corden (in several papers 1957, 1958, 1962, 1963, 1966, 1968, 1971 and 1985) and extensively applied to markets in developing countries by several authors including the work done by Alberto Valdes in Uruguay (1996); Egypt (2011), Pakistan (2013) and Sri Lanka (2013).

It is important to mention that distortions can arise not only from policy factors but also implicitly as a result of market failures and underdevelopment. For example, weak port infrastructure may negatively affect incentives to producers of export crops (Plateau, 1996), while underdeveloped credit markets may limit the opportunities for small-scale farmers (Salami et al 2010). To capture the

[1] 'The distinction between apparent and effective protection was first elaborated in an important article by C.L. Barber, "Canadian Tariff Policy" in the Canadian Journal of Economics and Political Science.' Where, then, did Barber (1955) fit into this story?

effects of market distortions, MAFAP methodology introduces a new indicator: the market development gap (MDG), which attempts to measure the effects on price incentives of policy distortions in international markets, limited market integration, asymmetrical distribution of market power among agents, illicit taxes and insufficient value chain development. This new indicator separates the impact of market inefficiencies and imperfections from policy related distortions.

The MAFAP program was designed to assess the effects of agricultural price interventions and to conduct agricultural public expenditure and policy coherence analysis on agricultural and food commodities. Since 2005, the analytical focus has been on low- and middle-income countries (LMIC), where agriculture and food constitutes a larger share of the income and consumption expenditure budget and therefore, where high prices are more of a food security concern. Although indicators like the PSE provide a useful basis for comparing policies between OECD countries, these cannot capture distortions in LMICs which are mostly determined by market underdevelopment and hence, are implicit (see OECD, 2010).

This document, outlining the methodological theory behind the MAFAP indicators, should be used in conjunction with the MAFAP capacity development material and handbook, which will aid in the practical application of what is presented here.

2. The basics of the Incentives Framework.

MAFAP price incentives analysis aims to address questions that have been relevant in political economy for decades and are still relevant today: Is there still a policy bias against agricultural production? What are the political economy forces behind the more-successful reforms? How important have international forces been relative to domestic political forces in bringing about reforms since the food crisis? How important are the potential direct contributions from agricultural policy reforms relative to the indirect contributions from non-agricultural policy reforms? What policy lessons can be drawn from various country experiences to ensure enhanced growth and poverty reduction in the future through domestic reforms?

The MAFAP method for evaluating price incentives is based on the law of one price (LOP) (Blanchard , 2010) and on the border paradigm (Timmer, 1986) that together imply that there is only one prevailing price for each product in a perfectly competitive market, without government interventions into the economy, and without political concern for the impact of income distribution. In such a world, any deviation of the domestic price from the international border price of a commodity, whether import or export, reduces total welfare in the country because of deadweight loss (Gouel and Jean, 2015). Understanding the logic of the LOP and the border paradigm[2] is the essential first step in addressing any further policy concern over the implementation and impact changes in domestic prices of food and agricultural commodities.

Within the political economy of trade and price policies under the neoclassical paradigms (law of one price, border paradigm, pricing paradigm) lie a number of assumptions including perfect information, complete markets, stable border prices, market determined foreign exchange rates and an absence of political impacts that affect the lives of the citizens (Valdes, 2014). This however, is far from reality[3]. Without a robust analytical framework, accounting for such assumptions, political ideology easily dominates the decision-making process of policy makers, leading to trade and price policies

[2] This school of price policy is usually associated most closely with T.W. Schultz and his colleagues from the University of Chicago. For a review, see Theodore W. Schultz, ed, Distortions of Agricultural Incentives, Indiana University Press, Bloomington, IN, 1978

[3] An excellent review of this debate from a neo-classical perspective is to be found in Ian M.D. Little, Economic Development: Theory, Policy, and International Relations, Basic Books, New York, 1982

that are conflicting or contrary to the interest of their citizens. Any trade and price policy can be justified on some political basis (Dawe and Timmer, 2011). Analysts want to understand the 'policy potential' and therefore require a robust framework for working out the economic and political consequences of food and agricultural policies in both the short and long run. MAFAP methodology prepares the analyst to better deal with the more complex and relevant issues that will arise during a policy reform process.

Within this context and as part of the pillar on policy analysis, the MAFAP methodology on price incentives produces five commodity-specific indicators: (i) price gap; (ii) nominal rate of protection; (iii) effective rate of protection; (iv) nominal rate of assistance and (v) the market development gap. The first two are calculated at three points along the value chain: (i) retail; (ii) wholesale and (iii) farm gate, while the other three are only calculated at farm gate level. All indicators are calculated using two different types of data: (i) observed and (ii) adjusted[4]. Under the observed indicators we consider all direct taxation over the specific commodity, while under the adjusted indicators, we account for all indirect taxation and market inefficiencies. The market development gap summarizes the gap between observed and adjusted measures.

The price gap (PG), the nominal rate of protection (NRP), and the nominal rate of assistance (NRA) are the key indicators that measure absolute and relative values of outputs with and without the effects of domestic policies. These indicators can tell us the domestic value of a product versus the international equivalent value, thereby permitting an interpretation as to what is causing the difference. For example; prices received by producers may be higher than those of imported products at the border because of trade protection via tariffs or non-tariff barriers. Conversely, producers may receive lower prices than those prevailing on the world market due to export restrictions. These are examples of explicit distortions (observed). However, domestic producers may also face unnecessary or excessive access costs that have a taxation effect on potential exporters. This is an implicit distortion (adjusted), to the extent that it can be redressed by appropriate policies or by filling the development gap.

The basic indicators (NRP, NRA and PG) are relevant measurements to examine the impact of trade policy on the price paid to wholesalers, by agro-industry processors for primary products or by the final consumer at retail. However, the NRP is not always an appropriate indicator to present the entire incentives environment for agricultural producers because it does not capture the impact of price and trade policy on the domestic price of intermediate inputs (tradable inputs).

For a more accurate measure of the impact of trade and price policy on producer's incentives, the effective rate of protection (ERP) complements the other indicators by capturing the effect of interventions, such as trade barriers and price controls, (common in many LMIC countries), on tradable inputs. The ERP estimates the value added at the farm level, that is, the net returns to farming as an investment (land, capital, labour and profits). To put it another way, the denominator in the NRP and the NRA (Anderson, 2009) is gross revenues, whereas the denominator in the ERP is net revenues (Valdes, 2013), that is, value added per unit. One of the advantages of calculating both indicators lies in the ability to determine the profitability of a sector with and without intervention. A simple exercise comparing the NRA that shows the effect of interventions on the value of the final product, with the ERP that examines how intermediate inputs affect value added at farm gate for a given commodity sector, could yield very different values. For the analysis of the impact of policy changes on specific sectors relative to others, either within or between agriculture and other sectors, the ERP gives a clear picture of the impact of distortions on investments.

Finally, we attempt to describe the effects of the economic and social gaps in the incentives at farm gate level using a new indicator, the MDG. As already mentioned in the previous section, the MDG is

equal to the difference between the observed and adjusted price gaps at farm gate and is composed by three elements: i) the international markets gap ii) the access costs gaps from the border to wholesale and iii) from wholesale to farm gate. Table 1 summarizes the 15 indicators that can be calculated for each agricultural and semi-processed good (e.g. maize, rice, beef, milk, sugar, tea) using MAFAP methodology.

Table 1: Summary of market price incentives indicators

Level in the value chain	**Data used for the analysis**		**Decomposition of the differential between the observed and adjusted price gap**		
	Observed data	*Adjusted data*	Exchange rate	International price	Access cost
Consumer (retail level)	Observed Price Gap at Retail **PG*o*$_{rt}$**	Adjusted Price Gap at Retail **PG*a*$_{rt}$**	**ERPG$_{rt}$**	**IMG$_{rt}$**	**ACG$_{rt}$**
	Observed Nominal Rate of Protection at Retail **NRP*o*$_{rt}$**	Adjusted Nominal Rate of Protection at Retail **NRP*a*$_{rt}$**	-	-	-
Wholesale	Observed Price Gap At Point of Competition (wholesale/ex-factory) **PG*o*$_{wh}$**	Adjusted Price Gap at wholesale **PG*a*$_{wh}$**	**ERPG$_{wh}$**	**IMG$_{wh}$**	**ACG$_{wh}$**
	Observed Nominal Rate of Protection at wholesale **NRP*o*$_{wh}$**	Adjusted Nominal Rate of Protection at wholesale **NRP*a*$_{wh}$**	-	-	-
Farm gate	Observed Price Gap at farm gate **PG*o*$_{fg}$**	Adjusted Price Gap at farm gate **PG*a*$_{fg}$**	-	-	**ACG$_{fg}$**
	Observed Nominal Rate of Protection at farm gate **NRP*o*$_{fg}$**	Adjusted Nominal Rate of Protection at farm gate **NRP*a*$_{fg}$**	-	-	-
	Observed Nominal Rate of Assistance at the farm gate **NRA*o***	Adjusted Nominal Rate of Protection at the farm gate **NRA*a***	-	-	-
	Observed Effective Rate of Protection at farm gate **ERP*o*$_{fg}$**	Adjusted Effective Rate of Protection at farm gate **ERP*a*$_{fg}$**	-	-	-

Source: own elaboration

The basic condition for this type of analysis to be conducted is that the price differential between domestic and international prices is calculated for agricultural/food products which are homogeneous or perfect substitutes (marginal rate of substitution is constant). If this condition does not apply, agricultural products should be near substitutes in the local market in terms of quality, or at least simply comparable goods. In some cases, we can evaluate the substitutability of two

products by using cross-price elasticity, i.e., the change in sales quantity of one good in reaction to changes in the price of the other. If the sign of this elasticity is positive, i.e., an increase of price of one good produces an increase of the quantity purchased of the other good since now it is relatively cheaper, they are considered perfect substitutes. In short, two goods are substitutes if cross-price elasticity is positive.

It is worth noting here that this methodology is simply a static and partial equilibrium analysis that represents the initial framework for analysis of the distributional impact of trade and price policies on farmers and consumers[5]. Their dynamic and general equilibrium consequences although difficult to measure and predict, will not be neglected. Finally, concerning the type of commodities analysed, MAFAP also refers to the Balassa-Samuelson effect, which argues that the LOP is not applicable to all goods internationally, namely, it does not apply to non-tradable goods.

3. Measuring Incentives

MAFAP seeks to measure the degree of incentives/disincentives affecting the agricultural sector by providing a detailed history of policies that affect prices and by identifying the determinants behind price incentives and their effects on output markets, food security, consumption, income distribution, trade, policy coherence and budget. Comparability across countries, commodities and over time is achieved by applying a common methodology that follows the common rules and guidelines set forth by the consortium of international organisations on measuring the policy environment for agriculture (OECD, 2014). In the following paragraphs, we will focus on the measurement of price incentives and the process by which estimates are derived.

The way the indicators are designed, allow for relevant degrees of aggregation in terms of both time and types of commodities. For example, all MAFAP 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) 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. A time period average will provide a snapshot of incentives over the past decade. In many developing countries, it is normal that an import commodity may become an export, or may not be traded once price incentives are removed (Anderson and Valdes, 2009 and OECD, 2015). Given the volatility of world prices, comparatively higher than those at the domestic level (see Dawe et al 2015), products that would have been exported in one year in the absence of incentives may be imported in another year. Since changes in trade status alter the calculation of each indicator, multiple shifts in trade direction over a period can lead to results showing highly variable incentive structures. In this way, a time period average complements annual measures, which is particularly relevant for thinly traded commodities.

For the calculation of the main MAFAP indicators (NRP, NRA, ERP and MDG), relevant information regarding each commodity's value chain must be gathered; namely, trade status, market prices and price gaps (domestic producer, consumer, point of competition and border prices), access costs, adjusted access cost, quality differences and any other elements relevant to the analysis of a specific commodity's value chain.

3.1 Trade Status of the Commodity

A country's agricultural commodity trade status may derive from its comparative advantage, but it may also be an outcome of distortionary policies (Brooks and Matthews, 2015). Countries that protect their

[5] See Lance Taylor, Macro Models for Developing Countries, McGraw-Hill, New York, 1980; Paul Streeten, What Price Food? Agricultural Price Policies in Developing Countries, Macmillan, London, 1987

agricultural sectors will produce more and consume less than would be the case if resources were allocated in line with their comparative advantage, implying fewer imports and possibly exportable surpluses (FAO, 2011).

The first step is to understand if a certain commodity is tradable or non-tradable as this will determine the viability of the analysis. The distinction between tradable and non-tradable commodities in economic theory is well established (see Goldstein and Officer 1979 and Dwyer, 1992) and is particularly relevant to the analysis of price incentives derived from international trade. However, there has been little empirical analysis reflecting the direct/indirect role of trade and price policies on non-tradable goods due to a lack of reliable data.

Price interventions and their effects will differ depending on whether a product is considered an importable, exportable, or thinly-traded, and this will partly be determined by policy objectives. Taxes on agricultural exports are an important source of fiscal revenue for a number of LMICs, while taxation on domestically produced food crops is often limited in order to reduce dependence on food imports. Since a country may be an exporter of a commodity in one year and an importer the next, the policy analyst must therefore determine, for each year of the study period, whether the commodity is exportable, importable or thinly traded.

Calculating the net trade position of a country for a commodity is straightforward; imported and exported volumes are compared, and if imports are substantially higher than exports, the commodity is treated as an import. On the other hand, if exports are substantially 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 [1].

Eq. [1]
$$NT_i = X_i - M_i \begin{cases} if\ NT_i > 0\ \ the\ country\ is\ a\ net\ exporter \\ if\ NT_i < 0\ the\ country\ is\ a\ net\ importer \end{cases}$$

Where NT_i is the net trade volume, X_i is the volume of exports of commodity *i*, and M_i the volume of imports of commodity *i*.

Trade is considered minimal if the share of exported production and the share of imported consumption are each less than 2.5 percent (Anderson, 2009). If trade is minimal because of the high trade costs rather than trade restrictions in place, then the commodity is classified as non-tradable (see Anderson, 2009).

The trade status of a commodity will determine the international benchmark price used in the analysis for each year: an FOB price in the case of an export and a CIF price in the case of an import. The most appropriate border price may change for a commodity within a country over time because the net trade position has changed. The net trade position should be reassessed every year: if a country has been a net importer in two of the previous three years, it is considered as a net importer, and vice versa for the net exporting situation (OECD, 2014). However, there can be significant "noise" in annual point estimates and it may be prudent to look for a structural change in trading status before revising reference prices.

There are three main data sources that can be used to investigate the trade status of a commodity: i) national statistics; ii) FAOSTAT; and iii) UN COMTRADE. 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 is often not the case because of differences in nomenclature, updating or misreporting issues. Cross-checking several data sources is recommended in order to ensure that the net trade position is not contingent on just one source.

The concept of trade intensity is used to evaluate the degree of openness of an economy for a specific commodity. In some cases, commodities are thinly traded: a status that requires a different

approach for the selection of the benchmark price. Trade intensity evaluates the relative share of trade over apparent domestic consumption of a commodity by year, as defined in equation [2].[6]

Eq. [2]
$$TI = \frac{X_i + M_i}{Y_i + M_i - X_i} \times 100$$

Where TI is the trade intensity, 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 sources or FAOSTAT and tend to be less divergent between sources than trade figures. In general terms, if TI is above ten percent, the import or export price will play a sufficiently important role in domestic price formation. If TI is below ten percent this can still be the case, but alternative benchmark prices should be sought to test how the results differ (see below).

When trade intensity figures are low, this may indicate the presence of informal trade. Informal traders deal in small quantities without trading licenses and with no official record of their transactions. In these instances, obtaining reliable information on trade volumes is difficult; only FEWSNET collects this sort of information systematically, and only for a few countries.

3.2 Market Prices

Determining price formation along a commodity's supply chain requires reliable price data. In a developing country context, it is more common to have a long time series of price data at the wholesale and retail level. Producer prices are rarely available for food commodities. The data available and how it could be best used will be context specific. Furthermore, the use of a retail or wholesale price as a sort of proxy is problematic since farm prices do not necessarily follow the same price formation dynamics. Thus, for future work, the collection of farm price data is a key priority.

Marketing survey data may be available, linking producer to wholesale prices for one or more points in time and with details on costs and marketing margins. These surveys can be used to "anchor" some producer and retail prices. Similarly prices can be interpolated for years in which no data are available (for example by applying a CPI inflation rate). The data available, and how best to make use of it, will be context specific – what is exogenous in one exercise may emerge endogenously in another. During MAFAP phase I, much time was spent determining how to best piece together the jigsaw of price determination, given limited and sometimes unreliable data.

3.2.1 Observed benchmark price

In order to calculate reference prices, an international **benchmark price ($P_{b(int\$)}$)** must be identified**.** World market prices represent the opportunity cost to market participants of a country producing various commodities domestically. In this context, two questions must be addressed: (1) Which world/international market price is most relevant? (2) Which foreign exchange rate should be used to convert the world price into local currency units?

As discusses above, the most relevant benchmark price is usually where domestic prices compete with international prices and this is generally found at the country's own border. In the case of imported goods, it represents a price free of domestic policy interventions and domestic market influence. In the case of exported goods, the benchmark price represents the price at which the

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

country exports to the world and includes the effect of domestic policies and the influence of domestic market functioning.

For an exported commodity, trade is valued as the free on board (FOB) price, which often includes some degree of processing compared to the producer price; whereas for an import, trade is valued as the cost, insurance and freight (CIF) price. The FOB price is the cost of an export good at the exit point of the exporting country, when it is loaded onto a ship or other means of transport for carriage to the importing country. The 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, storage and agents' fees. It also excludes any domestic tariffs and other taxes or fees, duties or subsidies imposed by an importing country.

The benchmark unit value 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.

In other cases however, determining the appropriate benchmark price may be more difficult. For example, when trade intensity is low (i.e. below 10 percent) or traded volumes are low (below 2.5 percent), unit values from trade data might not be representative of the opportunity cost of production for domestic market participants. In some cases, there may even be systematically incorrect reporting of the value of traded goods because of tax evasion or unreliable trade statistics. Using local sources may sometimes be misleading when trade takes place under special concessional circumstances. In such cases, it is then advisable to consider alternative approaches to calculate benchmark prices. Alternative options include, inter alia: taking implicit values for imports (or exports) from neighboring countries; constructing an FOB (CIF) price by 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 (in case of non-traded commodities). Some examples of these approaches are presented in annex 1, 2 and 3. The underlying premise to keep in mind is that the benchmark price represents the opportunity costs of the commodity to the agents in the country.

3.2.2 Domestic price at the farm gate

The domestic price, referred to as the farm gate price or producer price, is 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). In some countries, the farm gate price is reported annually as a country average (geographically and temporally), whereas in other countries, it is reported for specific production regions. However, if such prices are not available, the point in the value-chain nearest to the farm level (in major producing areas), for which prices are available, should be chosen, with an implicit assumption that the price gap measured at this level is the same as at the farm gate level.

A key factor is the geographical scope to which the farm gate price refers as this will have a major impact on the way access costs are calculated. In fact, if the country is sufficiently large, policies or

market performance may appear heterogeneous and markets weakly integrated, then differentiated analysis for specific regional markets might be needed. Relevant information that would alert us that such an analysis might be required can normally be found in existing commodity value chain analyses. Some examples of these approaches are presented in annex 4.

In line with the approach of the Consortium on Measuring the Policy Environment for Agriculture (OECD, 2014), other adaptations may be necessary: if markets are segmented (very different qualities deriving from the same raw material) with little or no substitution between them, a weighted average price may be used; or if products are highly seasonal and perishable, and if in addition, policy interventions such as tariffs are varied according to the season, the annual average price may be measured as the weighted average of the price for each season (e.g. month), using the seasonal production weights.

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).

3.2.3 Domestic price at the point of competition

If the distortion is calculated indirectly via price gaps, then the first step should be to calculate the price gap at the market level at which the domestic and foreign goods come into competition – i.e. the market level at which the law of one price holds (Consortium on Measuring the Policy Environment for Agriculture, 2014). Typically this is closer to the wholesale level than the farm gate level.

However, depending on the structure of the commodity's value chain, terms of sale or data availability, a different point of competition can be selected. 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), the main market close to the point of entry into the country, or a national average. For exported commodities, the border is typically considered to be the point of competition. However, an intermediate point in the value chain can also be considered in order to see how policy and market performance affects 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.

In cases where 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.

3.2.4 Domestic price at consumer level

If both wholesale and retail price data are available for the same quality of a commodity at the same location, we calculate indicators at each level. If no data is available, the analysis of incentives and disincentives at the consumer level is excluded.

The consumer price is generally taken from the largest and most representative domestic retail market. Incentives to consumers will depend to a large extent on the geographic location of the main consumption area in relation to that of production and import. For retail markets located near major

ports, food prices reflect only small additional distribution costs incurred on the CIF price. For a theoretical exercise, we can assume that when consumption takes place at production points in the inland or interior zones, production of that commodity earned social profits relative to the CIF price. Alternatively, when a domestically produced commodity is consumed near the border and production occurred in the most distant interior, such production incurred social losses (Timmer , 1986). The location from which prices will be selected critically determines whether the domestic producer could compete with imports. Therefore, the choice of representative market should be supported by secondary or primary references or, when this is not available, the national average price is the next the best choice.

The best data sources for consumer prices in most cases are official government sources. When data is available for multiple locations, multiple qualities or multiple marketing levels for a given commodity in a given country, a set of ordered selection criteria are needed in order to choose which data series to analyze. Our first criterion is to use, whenever possible the data for the commodity without transformation; for example, we should use data on maize grain as opposed to maize meal. Our next criterion is to use national average prices when available. When national average prices are unavailable, we use a weighted average of prices in all the markets in the given country for which data are available.

3.3 Adjustment Factors

One of the most important conditions that need to be met in order for the indicators to measure the effect of policy and market performance on various agents is that the product at different levels of the value chain must be comparable in terms of quality, quantity, space (geographic location) and time. In other words, we must compare “like with like” in order for the analysis and results to hold. If this is not the case, the price difference cannot be attributed to policy effects or market performance.

A quantity adjustment factor from the border to the point of competition (QTwh) 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 (see annex 5); for example, the physical transformation of raw products such as wheat into flour, soybeans into oil and meal, and cotton into seed and lint. Furthermore, some farm products, such as raw milk, tea and sugar cane, are only tradable once processed to some degree and thus the international benchmark would necessarily reflect the processed product and never the raw one. In such instances, more (or less) than one unit of domestically traded product is needed to obtain one unit of the product for which the benchmark price is available. In most cases, the quantity adjustment factor is a technical coefficient and may be found in studies that look at industrial processing capacity in various developing countries.

A quality adjustment factor may be required if the commodity marketed at the point of competition is of a different quality than the commodity for which the benchmark price has been obtained. There are often significant differences between domestic and traded products; for example, between domestic white maize and imported yellow maize, and between domestic and imported rice of different grades. With high margins and transaction costs, and in some cases much milder explicit policy distortions than have ever previously existed, it can be extremely challenging to isolate the policy component of price gaps. As mentioned previously, this becomes even more difficult if one is inadvertently comparing dissimilar products, thereby measuring the difference between the products rather than getting an estimate of protection.

There could also be a price premium for the domestic product that is not related to any policy (i.e. consumer preference for local products). The quality of a product traded internationally is usually

considered to be different from that of the domestically sold substitute, with consumers typically having a home-country bias (Anderson, 2009). The quality adjustment factor will remove any 'noise' associated with quality differences, assuring that the price gap accounts only for policy and general market effects. The decision as to whether a quality adjustment is required is 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, the analyst should look for indications of quality differences (see annex 5 and 6 for practical examples).

3.4 Observed Access Costs

To ensure that price gaps measure policy and market functioning impacts on prices, both the domestic and the reference prices must be compared at the same point in the value chain. In order to make the benchmark price comparable to the domestic prices, MAFAP considers all costs required to move the product from one point in the value chain to the other: from the border to the point of competition (vice versa for exports), from the point of competition to retail if the commodity is imported, and from the farm gate to the point of competition. For delivering the commodity from one point to another, it is necessary to consider all transportation and marketing costs as well as any necessary processing costs. Internal transport and related costs can be substantial and provide for a 'natural' rate of protection to producers of importables and an implicit tax to the producers of exportables.

Observed access costs cover all actual marketing costs and margins observed in the market pathway, whether these are paid for services (i.e. transportation) or not (i.e. illicit costs) and may include transportation, taxes/subsidies specific to the marketing chain, informal costs such as bribes at roadblocks, and profit margins for the involved agents. Processing costs relate to the physical transformation of primary farm products into marketable ones. 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 unloading as well as the material needed for packaging. Losses that occur from inadequate storage or failure to meet quality standards may also be considered as well as by-products from processing. Other less common marketing costs include charges for security and safe guarding commodities in transit.

3.4.1 Observed access costs from the border to the point of competition

In order to decide what to include as components of access costs, it is necessary to consider the marketing channel selected for the analysis as well as the nature of the benchmark and domestic prices used. As a general rule, when the country has port access, the access costs from the border to the point of competition (ACo_{wh}) can be divided into three main components: port charges and import/export procedures (PC), transport costs[7] (TC) and processing costs (PrC). If the country is landlocked and the benchmark price is the unit value of the commodity at the border of the country, port charges will not be relevant; however import/export procedures should be taken into account (see annex 7). Since the objective of the indicators are to measure the effects of policies, direct trade policy, such as tariffs or export taxes, should not be taken into consideration when calculating access costs. For example, if an importer has to pay a statutory tariff of US$ 200 per tonne, this should not be included in the calculation of the access costs since the impact of these policies is already captured in the domestic prices.

Generally, the observed access costs from the border to the point of competition (ACo_{wh}) are defined as follows:

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

Eq. [3] $$ACo_{wh} = PC + TC + PrC$$

As mentioned above, it is essential that the access costs between the border and 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) the analyst must ensure that the access costs are expressed in the same unit as the domestic price at the point of competition (i.e. husked rice). 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. Some examples of these approaches are presented in annex 7.

3.4.2 Observed access cost from the point of competition to the consumption level (Retail)

Following the same principle as for the access costs between the border and the point of competition, the access costs between the point of competition and the retail level include all costs involved in bringing the commodity from wholesale to retail such as the cost of processing, transportation and handling.

Domestic processing costs and wholesale and retail distribution margins can represent a large share of the final retail price and therefore should not be ignored. Estimating marketing margins at wholesale and retail levels is particularly difficult when private traders or a government marketing board has a monopoly or a monopsony on the distribution of a product.

3.4.3 Observed access costs between the point of competition and the farm gate

Following the same principle as above, the access costs from the point of competition to the farm gate allow us to make the farm gate price equivalent to the benchmark price by considering all processes and activities that a commodity must undergo after leaving the farm. It can include the costs of processing, transportation, profit margins for agents, taxes and levies, non-trade barriers and handling of a product between those two points in the value chain (see annex 8).

3.5 Observed reference prices

With the price and cost data described thus far, MAFAP analysis enables the calculation of Observed reference prices, i.e., the maximum price that could be obtained in the absence of domestic market and trade policies, with overall market performance increased and with the existing access costs in the value chain. Observed reference prices are the equivalent international price, made comparable by considering access costs and conversion factors involved between various points in the value chain.

Government policy interventions may prevent the arbitrage of price differences by market forces between domestic and external markets, while inefficient overall market functioning is a typical characteristic of developing economies (FAO, 2011 and Dawe & Timmer, 2012). Markets in LMICs are characterized by various imperfections such as asymmetric information, monopolistic structures and lack of infrastructure, causing agents to incur excessive marketing costs. These factors impede the price transmission from world markets to domestic markets. The existence of a large subsistence sector further limits price transmission (Timmer et al 1983).

Observed 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. In order to calculate the observed reference price, several steps are required.

First, we need to obtain the benchmark price in local currency units ($P_{b(loc)}$) by multiplying the price of the commodity as expressed in USD per unit by the nominal exchange rate (expressed in local currency units per USD), i.e.:

Eq. [4] $$P_{b(loc)} = P_{b(\$)} \times ER_o$$

Second, quantity and quality adjustment factors as well the access costs from the border to the point of competition are taken into account in order to transform the benchmark price into an equivalent domestic price at the point of competition against which the observed domestic price at point of competition will be compared. If the commodity is imported, access costs from the border to the point of competition should be added in order to take into account the full cost of imports. If the commodity is exported, they are deducted to take into account the additional costs that are needed in order 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. [5a] $$RPo_{wh} = \left(P_{b(loc)} \times QT_{wh} \times QL_{wh}\right) + ACo_{wh}$$ [*if the commodity is imported*]

Eq. [5b] $$RPo_{wh} = \left(P_{b(loc)} \times QT_{wh} \times QL_{wh}\right) - ACo_{wh}$$ [*if the commodity is exported*]

The observed reference price at the farm gate is 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 (ACofg) as well as the quantity and quality adjustment factors between these points (see annex 8 for practical examples). Thus the observed reference price at the farm gate is determined by the following equation:

Eq. [6] $$RPo_{fg} = \left(RPo_{wh} \times QT_{fg} \times QL_{fg}\right) - ACo_{fg}$$

4. Observed Price Gaps

This is the first MAFAP indicator to be calculated and provides the first approximation of the role of explicit policies affecting prices across the value chain. After observed reference prices are calculated, they are subtracted from the domestic prices at each point in the value chain to obtain the observed and adjusted price gaps at point of competition, retail (consumer), and farm gate. Observed price gaps capture the effect of trade and price policy measures that directly influence the price of the commodity in domestic markets (e.g. subsidies and tariffs), and actual market performance. Therefore, the observed price gaps (expressed in local currency) at the point of competition (PG_{owh}), consumer level (PG_{ort}) and farm gate $\left(PG_{ofg}\right)$ are calculated as follows:

Eq. [6a] $$PG_{owh} = P_{wh} - RP_{owh}$$

Eq. [6b] $$PG_{ort} = P_{rt} - RP_{ort}$$

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

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), wholesalers (point of competition), or consumers (retail), resulting from domestic trade and market policies and overall market performance. Market performance is understood as all other factors which impede price arbitrage between domestic and international markets, such as lack of market institutions, poor information, and underdeveloped physical infrastructure. For an imported commodity therefore, a positive price gap could result from an explicit policy such as a tariff, or excessive access costs between the border and the point of competition. A positive price gap

indicates that the policy environment and overall market functioning generate incentives (support) to the domestically produced commodity.

When the observed price gaps are negative, the contrary is true, i.e., gaps are a quantitative measure of disincentives. 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, consumers or wholesalers. For an imported commodity this could be due to distortions such as subsidized sales by the government to keep domestic prices low (for descriptive examples please see annex 9).

In some cases, it is not to possible to estimate the price gap at each level of the value chain because of the lack of data sometimes related to specific market structures, market concentration (auction, monopsony, monopoly) and other limitations across the value chain. In this case, we only calculate the indicator at levels where reliable data is available. Of course, this situation will affect the calculation of the remaining indicators. The price gaps should be reported as calculated, i.e., without any additional adjustments other than those necessary to compare like with like. If there are significant elements not related to agricultural-policy-induced price distortions, these will have to be acknowledged where appropriate and clearly explained (see annexes 10 and 11 for additional practical examples).

Since the price gaps are static measures, they 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 were free of distortions. In reality, the change would be less than this since price changes do not occur simultaneously with policy reforms and the degree to which the price would change will depend on demand and supply elasticities as well as the market power of each agent.

5. Nominal Rate of Protection (NRP)

Nominal rates of protection are obtained by dividing the price gaps (PG), absolute measures of the market price incentives that producers, wholesalers and retailers/consumers face, by the reference prices (RP), providing a ratio that can be compared across time, commodities and countries.

The nominal rate of protection (NRP) allows to examine the impact of trade and price policies on the price paid by agro-processors for primary products or by the final consumer at retail. The observed Nominal Rates of Protection at the farm gate (NRP_{ofg}), wholesale (NRP_{owh}) and retail(NRP_{ort}) , are defined by the following equations:

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

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

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

While this calculation is relatively simple, it is very important to accurately select prices for each ratio, and it is essential to have a thorough understanding of the domestic market where the prices are formed. To summarize the results in three main points: a positive NRP at farm gate level means the producer is receiving a higher price for the commodity than would be possible without intervention, relative to the prevailing border prices; a negative NRP signals that the producer is

receiving less than would be possible without the intervention; finally, a zero NRP suggests that the structure of protection is neutral.

7. Nominal Rate of Assistance at Farm Gate Level (NRA)

MAFAP methodology enables the incorporation of data obtained in the analysis of public expenditure into the price incentives analysis to construct an indicator that captures public spending, in addition to policy and market performance already captured by the NRP. Combining price and budget information, the nominal rate of assistance provides a more complete picture of incentives, particularly in cases where budgetary payments may be compensating for disincentives to producers. 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 (NRA) (Brooks, 2013).

The nominal rate of assistance (NRA) is defined as the percentage by which government policies, through budget transfers, have raised gross returns to producers above what they would be without the government's intervention. The NRA includes trade and price policies affecting outputs plus public subsidies affecting both inputs and outputs. Because tariffs are not the only trade barriers, the measure of NRPs and NRAs are estimated by direct price comparison between prices received or paid by farms and border prices (see Anderson and Valdes, 2008, Appendix A).

The indicator is calculated taking on board the commodity specific budgetary transfers identified in the public expenditure analysis. The nominal rate of assistance is then calculated as follows:

Eq. [10] $$\mathrm{NRA}_o = \frac{(P_{ofg} - RPo_{fg}) + BOT}{RPo_{fg}} \times 100$$

where BOT is commodity-specific public expenditure that has been identified and measured as monetary units per tonne, and RP is the reference price. This indicator is only calculated at the farm gate level, as information on budgetary and other transfers (BOT) is taken only for transfers to producers. For a practical example see annex 11.

It is important mentioning that the public expenditure analysis under MAFAP method is defined in the methodological paper vol 2 (MAFAP, 2015).

7. Effective Rate of Protection at Farm Gate Level (ERP)

According Flaters (2003) changes in nominal protection affect the real incomes of the users of protected goods. By increasing the cost of protected goods and by forcing users to adjust their demands for these and related goods, increases in nominal protection decrease real incomes of users of these goods.

The effective rate of protection measures how much protection a tariff or other trade policy provides domestic producers. The effective rate of protection (ERP) is calculated only at the farm gate level and complements the NRP at farm gate, assessing the net effect of how a tariff structure on imported inputs affects the domestic value added per unit of output. A ranking of each commodity's ERP will shed light on the direction that protection may pull the factors of production. The main methodological divergence from traditional tariff analysis[8] is that the ERP concept captures the

[8] Although the ERP is not at odds with the purposes of the Stolper- Samuelson theorem, Lerner's symmetry theorem or other propositions in the theory of tariff.

impact of tariffs on inputs and thus does not deal solely with protection on final selling price of outputs.

Whereas the NRP is the most appropriate indicator to assess the impact of policies on consumers, the ERP measures the value added at farm gate, namely, the effects of the trade regime and other policies on costs (purchased inputs) as well as output prices, given the structure of protection on both inputs and outputs. One expects farmers' investments in and use of various inputs to respond more to changes in value added than to changes in product price because a change in value added captures the impact of policies on the net returns to farmers.

The ERP is calculated as the percentage difference between the value added per unit using the reference prices of outputs and inputs at farm gate, and the value added per unit at market prices. The calculation of the ERP requires data on the farm-level cost of production in order to estimate the share of the cost of inputs in terms of output value. In the absence of interventions, the ERP would be approximately equal to zero.

Let's define the total input values per unit at market and reference prices as:

$$\text{Eq. [11]} \qquad Input_m^{trad.} = \frac{\sum_{i=1}^{n} input_{m,i}^{trad.}}{Q} \; ; \; Input_r^{trad.} = \frac{\sum_{i=1}^{n} input_{r,i}^{trad.}}{Q} \quad for \; i = 1,2,\dots,n$$

with $input_{m,i}^{trad.}$ and $input_{r,i}^{trad.}$ the value of tradable input *i* at market and reference price, respectively, and Q the output quantity. Calculation of the ERP is very similar to that of the NRP but instead of being a ratio of the output prices, as is the NRP, the ERP is a ratio of the value-added at domestic prices (intervention) to value-added at world prices (without intervention). Value-added is defined as the value of output minus input costs. The ERP can therefore be formulated as follows:

$$\text{Eq. [12]} \qquad ERP = \frac{Output_m - Input_m^{trad.}}{Output_r - Input_r^{trad.}} - 1$$

With $Output_m$ and $Output_r$, the output unit at market price and reference price, respectively. The ERP can also be formulated as the percentage difference between production value added at domestic market price and at reference price. If the value added after and before a policy intervention on inputs were known, the ERP calculation would be a simple matter. As it turns out, we only really know the value added after the protection measure, but with the help of an input-output table and by computing each sector's level of nominal protection, we can presumably approximate the value added after the policy intervention. The range of input subsidies considered in any particular country study will depend on the degree of distortions in that country's input markets. In addition to fertilizer and seeds, other large input subsidies are likely to target electric or diesel power, pesticides, and fuel. MAFAP methodology considers only the principal purchased inputs including fertilizers, chemicals and seed. For a more detailed description of the calculation please see annex 12.

Interpretation of the ERP is similar to the NRP: For positive ERPs, the returns for the activity with trade policy intervention are greater than those earned without intervention; for negative ERPs, the reverse is true; for ERPs equal to zero, the protection factor is neutral and the returns are the same. Since ERPs are, in fact, NRPs which have been extended to include inputs, similar behavior between the two indicators is expected under certain conditions, as outlined by Tsakok (1990). If the government policy manipulates output prices but leaves input prices to be largely market determined, then the NRP's are likely to yield sufficient information about the policy-induced incentive structure. Alternatively, if policies target input prices as well but traded inputs are a small fraction of the value of output, calculating the EPR is of little value. But if policy significantly affects input prices and if traded inputs constitute major cost components, the information content of ERPs may be different than the NRP.

Although the ERP provides more information, it also contains biases due to input substitution possibilities. The above estimation of the ERP is based on the assumption that producers will use the same production technology whether they are faced with domestic or border prices. In other words, the inputs mix is not affected by intervention. If actual producers use different agricultural practices, more or less inputs for example, than the representative farmer, the ERP estimates will be biased. In practice, however, these biases tend to be ignored because elasticities of substitution are virtually impossible to obtain.

8. Adjusted Indicators

The observed domain measures the impact of trade and market policies and overall market functioning on prices received by agents in the value chain. The analysis is based on the actual market situation. Since in most cases, the actual market situation does not reflect the highest level of efficiency that could be achieved, MAFAP analysis introduces the adjusted domain, where excessive costs and inefficiencies are removed, allowing the measurement of the potential effects of these inefficiencies. The term "adjusted" can be applied to the exchange rate, benchmark price, access costs, reference price, price gaps, nominal rates of protection and nominal rates of assistance.

The family of adjusted indicators in the MAFAP methodology incorporates into the analysis some notion of social costs or indirect effects, sometimes referred to as the **economic costs** or the shadow price. To calculate the adjusted price, the social or economic costs are simply subtracted from the observed price.[9]

Essentially, the adjusted domain is independent of policy interventions and aims to identify whether the costs obtained in the observed domain are excessive relative to a more efficient or ideally functioning value chain. If excessive costs are identified, they are excluded in the calculation of the adjusted costs that are used in the calculation of the family of adjusted indicators. Five main concepts can be subject to revision in order to provide *adjusted* measurement:

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

So far, the MAFAP approach does not consider that quality or quantity adjustment factors can vary from the observed ones when calculating the adjusted indicators; namely, adjustment ratios are the same for observed and adjusted domain.

Thus, using this *adjusted* data, adjusted reference prices, adjusted price gaps, adjusted nominal rates of protection, adjusted effective rates of protection and adjusted nominal rates of assistance can be calculated. If an adjusted exchange rate is considered this is done for all commodities.

[9] 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. In the case of the exchange rate, adjusted values can be higher or lower than observed ones depending on whether the exchange rate is undervalued or overvalued. However, adjusted indicators may not reflect total deviation of the domestic prices from their comparable reference counterparts due to the presence of other factors such as functioning of the value chain and policy and non-policy factor affecting the marketing costs and margins.

8.1. Adjusted Exchange Rate (ER_a)

An adjusted exchange rate is the price of one country's currency expressed in the terms of another, but with the impact of any distortive exchange rate policy removed. Some countries apply specific policies to maintain the exchange rate at certain levels, or within certain bands, which therefore differs from the exchange rate that would result from the free interactions of supply and demand. An over- or under-valued currency will affect the incentives to domestic agents and therefore is a relevant measure. Since this is not captured in the observed indicators, which are constructed using the observed exchange rate, they are captured in the adjusted domain.

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 used as a proxy for the adjusted exchange rate (ER_a). The most common situation is that of an overvalued exchange rate (i.e. $ER_o < ER_a$). For those countries where there is no evidence of potential distortions in the exchange rate either from national institutions (Ministry of Finances or Central Banks) or international institutions such as the regional banks and the country office of the International Monetary Fund (IMF), it is not necessary to estimate an adjusted exchange rate. Nevertheless, we suggest consulting at least one of the above mentioned sources. In annex 13, additional information and one example of calculations by Schiff and Valdes (1991) can be found.

Another flow-on consequence is the effect of trade distortions on the real exchange rate, which is the price of traded goods relative to non-traded goods. A misalignment in the real exchange[10] rate alters both the prices of exportables and importables relative to the prices of non-tradable goods and services.

8.2 Adjusted access costs

Observed access costs reflect the current functioning status of the domestic value chain for a specific commodity, which may often not be the most efficient that could be achieved. Moreover, observed access costs might include informal charges and taxes that have an impact on the prices received by farmers. In the adjusted domain, access costs are revisited and the estimated excessive costs of the value chain are removed in order to show the potential situation that could prevail if the necessary actions to improve efficiency were taken.

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

The calculation of adjusted access costs should be driven by the objective of reflecting the social or economic 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).
b) Processing, Handling, Transportation
c) Margins

[10] Such a change can arise for many reasons, including changes in the availability of capital inflows, macroeconomic policy adjustments, or changes in the international terms of trade. When the economy receives a windfall—such as a greater inflow of foreign exchange from remittances or foreign aid or a commodity boom—the community moves to a higher indifference curve (Collier and Gunning, 1998).

Government authorities, especially local government authorities may resort to taxing an economic activity to generate revenue. For example, they may levy taxes on goods in shipment. A social cost is a cost for the society as a whole. Taxes do not destroy nor move wealth outside the society. Taxes are just transfers within the society. Conversely, fees for government services (i.e. phyto-sanitary inspections) are not considered as a tax or transfer. However, even in such cases, the fees charged can be high and affect the final price of the commodity. In such cases, the social cost[11] 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 included in the observed but not in the adjusted domain.

In the calculation of the adjusted access costs: processing, handling or transport costs can be reduced if the observed ones are considered too high or are resulting from sub-optimal functioning of the value chain. For this type of adjustment, global or regional data sources, information found in value chain studies, or values from other commodity's value chains which are more efficient, can be used. The first option is to use regional or international indicators that provide information about the logistic performance of the country such as the Logistics Performance Index (LPI) of the World Bank. Using the index for the country concerned, it is possible to adjust based on that of South Africa since it is considered the most logistically efficient in the region (World Bank, 2015). Please see annex 15 example 1 for a practical calculation.

Finally, 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 domain. If specific margins are available, the analyst should evaluate whether these are excessive and if so, reduce the margins in the adjusted domain, based on the information available. 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 and 5 percent for the adjusted margin.[12]

Based on the above, the following relationship regarding the movement from observed access costs to adjusted access costs will always hold:

Eq. [13] $$ACo_{wh} > ACa_{wh}$$

Eq. [14] $$ACo_{fg} > ACa_{fg}$$

The decision of how to move from the observed to the adjusted access costs is 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.

For the sake of unit consistency, the access costs have to be multiplied by the quantity adjustment factor if there is one. Please see annexes 14 and 15.

[11] For the most influential statement of the role of border prices in social cost-benefit analysis, see Ian M.D. Little and J.A. Mirrlees, Manual of Industrial Project Analysis in Developing Countries. Vol 2: Social CostBenefit Analysis, OECD, Paris, 1969

[12] It should however be ackgnowledged that percentage changes in prices can be different at different levels of the marketing system (Dawe and Maltsoglou, 2014)

8.3 Adjusted reference prices

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 and exchange rate policy distortions were removed, and overall market performance enhanced.

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 adjusted benchmark price (expressed in local currency per tonne) ($P_{b(loc\$)a}$).

Eq. [15] $$P_{b(loc\$)a} = P_{ba} \times ER_a$$

In order to transform the adjusted benchmark price into the equivalent of the domestic price at the point of competition, we must consider any quantity and quality adjustment factors and all adjusted access costs from the border to the point of competition. As is the case with the observed indicators, If the commodity is imported, 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 the case of exports, 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. [16a] $$RPa_{wh} = \left(P_{b(loc\$)a} \times QT_{wh} \times QL_{wh}\right) + ACa_{wh}$$ [*if the commodity is imported*]

Eq. [16b] $$RPa_{wh} = \left(P_{b(loc\$)a} \times QT_{wh} \times QL_{wh}\right) - ACa_{wh}$$ [*if the commodity is exported*]

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

Eq. [17] $$RPa_{fg} = \left(RPa_{wh} \times QT_{fg} \times QL_{fg}\right) - ACa_{fg}$$

9. Market Development Gap (MDG).

The Market Development Gap (MDG) is the portion of the price gap that can be attributed to "excessive" or inefficient access costs within a given value chain (see Anyango, 1997) and imperfect functioning of 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. The MAFAP MDG will reflect only part of the overall market development gap that could exist in a country and will depend on what has been taken into account to construct the adjusted variables.

A substantial body of literature has attempted to measure market development gaps in terms of market integration in order to answer broad policy reform and market performance questions. The empirical methods have evolved from simple price correlation between market locations from the 1970s to early 1980s, to lagged regression methods in the late 1980s and 1990s (Ravallion, 1986), to

co-integration methods in the 1990s (Alderman, 1992; Goletti and Babu, 1994). According to Rashid and Minot (2010), market locations across space often lack integration due to inadequate provision of public goods (such as infrastructure), inefficient flow of information, imperfect competition, and incomplete or missing institutions for risk management like credit and insurance—all of which qualify as sources of market failures. Historical evidence (Sen, 1981) suggests that these forms of market failures have been important causes of food insecurity, including famine in extreme cases.

Similar to the price gaps, the MDG is an absolute measure, which is also expressed as a ratio to allow for comparison across time, commodities and countries. The Market Development Gap (MDG) is computed as the difference between the observed and adjusted price gaps at different levels of the value chain.

Eq. [18] $$MDG_{wh} = PGa_{(mdg)wh} - PGo_{wh}$$

Eq. [19] $$MDG_{fg} = PGa_{(mdg)fg} - PGo_{fg}$$

The relative value of the MDG is only computed at the farm gate level and is calculated in relationship to the adjusted reference price at the farm gate level, taking the following expression:

Eq. [20] $$MDG_{\%} = \frac{MDG_{fg}}{RPa_{fg}}$$

As shown above, the market development gap is the aggregate impact on incentives of value chain inefficiencies including market performance (excessive access costs) and poor governance (illicit taxes) between the border and the point of competition and between the point of competition and the farm gate.

The main evolution in the MDG's calculation as proposed in the context of MAFAP phase II (2014-2019) is that we separate the exchange rate policy gap from the calculations of the MDG but not from the calculations of the adjusted price gap. Therefore, the adjusted price gap used in the calculation of the MDG contains the observed exchange rate instead of the adjusted exchange rate (see Eq. 18 and Eq. 19). The main reason for this change is that the difference between the observed and the adjusted exchange rate is due to macroeconomic policy, not market development issues.

The MDG depends on what has been taken into account to construct the adjusted variables (adjusted benchmark price, adjusted access costs). As mentioned above, the observed indicators also capture policy distortions as well as a broader 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. again, the existence of a large subsistence sector further limits the price adjustments (Timmer, 1986). 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.

10. Analytical decomposition of the difference between the observed and adjusted price gap

The adjusted price gap adds (or subtracts) four possible components to the observed price gap: the adjusted benchmark, exchange rate, and access costs for each segment. 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.

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

As the changes in the benchmark price and the exchange rate in the equations [2a] and [2b] are not infinitely 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 values 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].

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 added to the following expressions need to be used.

Eq. [21] International markets gap (IMG) $\left[\left(P_{b\,\text{int}\,\$} - P_{ba}\right)\times\left(\frac{ER_a + ER_o}{2}\right)\right]\times QT_{wh}\times QL_{wh}$

Eq. [22] Exchange rate policy gap (ERPG)

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

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

Eq. [23] Access cost gap to point of competition [ACG_{wh}] = ACo_{wh} - ACa_{wh}

Eq. [24] 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. [25] $$ACG_{fg} = \left(ACa_{fg} - ACo_{fg}\right) + \left[\left(RPa_{wh} - RPo_{wh}\right)\times\left(1 - \left(QT_{fg}\times QL_{fg}\right)\right)\right]$$

11. Interpreting the difference between the observed and adjusted price gap

The difference between the observed and the adjusted reference price at point of competition generates two different effects:

I. Considering only the access costs component; the lower adjusted access costs, if compared with the observed ones from the border to the point of competition, will result, in the case of imported commodities, in an 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[13] means that the adjusted reference price at point of competition is higher than the observed reference price at point of competition.

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

The total effect will depend on the relative size of both effects. 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.

12.Aggregate indicators

Building on the commodity specific indicators, 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 aggregate 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. 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. [26] $$MPS = PG_{fg} * Production\ volume$$

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 analyst therefore must pay special attention to ensure 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: i) the agricultural sector as a whole, covering all commodities analysed, which according to MAFAP commodity selection criteria should at least represent 70 percent of the value of agricultural production; ii) imported commodities; iii) exported commodities and iv) commodities important for food security (commodities representing an important size of the country's diet).[14] 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 each product groups is as follows:

Eq. [45] $$NRP_g = \frac{\sum_{i=1}^{i=n} NRP_i * PROD_i * RP_{fgi}}{\sum_{i=1}^{i=n} PROD_i * RP_{fgi}}$$

[13] 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.
[14] For a more detailed description of the commodity groups please refer to Barreiro-Hurlé (2011).

where NRP_g is the aggregate 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[15].

The same in the case of aggregate NRA an MDG:

$$NRA_g = \frac{\sum_{i=1}^{i=n} NRA_i * PROD_i * RP_{fgi}}{\sum_{i=1}^{i=n} PROD_i * RP_{fgi}} \; ; \quad MDG_g = \frac{\sum_{i=1}^{i=n} NMDG_i * PROD_i * RP_{fgi}}{\sum_{i=1}^{i=n} PROD_i * RP_{fgi}},$$

with NRA_i and MDG_i is the NRA and the MDG for commodity *i*.

References

Anderson, K. and Masters, W.A., eds. 2009. Distortions to agricultural incentives in Africa. World Bank, Washington DC.

Anderson, K and Valdes, A. 2008. "Distortions to Agricultural Incentives in Latin America and the Caribbean," Agricultural Distortions Working Paper 48575, World Bank.

Balie, J., Conforti, P., MoralesOpazo, C., Bellu, L., Maetz, M., Tortora, P. & Komorowska, J. 2011a. Monitoring African Food and Agricultural Policies (MAFAP): project methodology concept paper. MAFAP Technical Notes Series, FAO, Rome.

Balie, J., Battistelli, F., Jern, P., Komorowska, J., Maetz, M., Morales-Opazo, C., Tortora, P. & Tran, H. 2011b. A review of relevant policy analysis work in Africa. Main document. MAFAP Technical Notes Series, FAO, Rome.

Barber, C.L. 1955. 'Canadian tariff policy', Canadian Journal of Economics and Political Science 21, November, pp. 513-30

Barreiro-Hurle, J. 2011. Regional and Africa wide considerations on product selection for price incentives and disincentives calculations. MAFAP Technical Notes Series, FAO, Rome.

Blanchard O. 2010. Macroeconomics, 5th edition, Pearson Prentice-Hall, Upper Saddle River, N.J., 2010.

Brooks, J. 2013. Policy coherence and food security: The effects of OECD countries' agricultural policies. Food Policy 44 (2014) 88–94

Brooks, J. and Matthews, A.2015. "Trade Dimensions of Food Security", OECD Food, Agriculture and Fisheries Papers, No. 77, OECD Publishing. http://dx.doi.org/10.1787/5js65xn790nv-en

Corden, W.M. 1957. 'The calculation of the cost of protection', Economic Record 33, April, pp. 29-51. Reprinted in abridged form in Corden, The Road to Reform, South Melbourne: Addison-Wesley, 1997, pp. 8-30

Corden, W.M. 1958. 'Import restrictions and tariffs: a new look at Australian policy', Economic Record 34(69), December, pp. 331-46. Reprinted as 'The case for a uniform tariff' in Corden, The Road to Reform, South Melbourne: Addison-Wesley, 1997, pp. 31-46.

15

Corden, W.M. 1962. 'The logic of Australian tariff policy', in Planned and Unplanned Development (Economic Papers No. 15). Sydney: Economic Society of Australia and New Zealand, pp. 38-58. Reprinted in abridged form in Corden, The Road to Reform, South Melbourne: Addison-Wesley, 1997, pp. 47-58.

Corden, W.M. 1963. 'The tariff', in A. Hunter (ed.), The Economics of Australian Industry, Melbourne: Melbourne University Press, pp. 174-214.

Corden, W.M. 1966. 'The structure of a tariff system and the effective protective rate', Journal of Political Economy 74(3), June, pp. 221-37. Corden, W.M. 1967. 'Australian tariff policy', (Joseph Fisher Lecture at the University of Adelaide), Australian Economic Papers 6, December, pp. 131-54. Reprinted in abridged form as 'Options for reform: a pragmatic program' in Corden, The Road to Reform, South Melbourne: AddisonWesley, 1997, pp. 82-101.

Corden, W.M. 1968. Australian Economic Policy Discussion: A Survey. Melbourne: Melbourne University Press; also published as 'Australian economic policy discussion in the post-war period: a survey', American Economic Review 58(3: Part 2), Supplement, June 1968, pp. 88-138.

Corden, W.M. 1969. 'Effective protective rates in the general equilibrium model: a geometric note', Oxford Economic Papers 21(2), July, pp. 135-41.

Corden, W.M. 1971a. 'The substitution problem in the theory of effective protection', Journal of International Economics 1(1), February, pp. 37-57. Corden, W.M. 1971b. The Theory of Protection. Oxford: Oxford University Press.

Corden, W.M. 1985. 'Effective protection revisited', in Corden, W.M., Protection, Growth and Trade: Essays in International Economics. Oxford: Blackwell, pp. 141-53

Dawe, D and Timmer, P. 2011. Food Crises Past, Present (and Future?): Will We Ever Learn? In Dawe, D. (ed.), The Rice Crisis: Markets, Policies and Food Security, FAO and Earthscan, London and Washington D.C., pp. 123-142.

Dawe, D and Timmer, P. 2012.Why stable food prices are a good thing: Lessons from stabilizing rice prices in Asia. Global Food Security vol 1 issue2.

Dawe and Maltsoglou, I. 2014. Marketing margins and the welfare analysis of food price shocks Food Policy, 2014, vol. 46, issue C, pages 50-55

Dawe. D; MoralesOpazo, C and Balie,J. 2015. How much have domestic food prices increased in the new era of higher food prices?. Global Food Security. Vol 97.

Demeke, M., Pangrazio, G. & Maetz, M. 2009. Country responses to the food security crisis: Nature and preliminary implications of the policies pursued. FAO's Initiative on Soaring Food Prices, FAO, Rome.

Etta-Nkwellea, M.; Jeonga, J.G. & Fanaraa, P. 2010. Misalignment of the real exchange rate in the African Financial Community (CFA zone) and its policy implications. Applied Financial Economics 20(15):1205-1215.

FAO. 2011. Guide for policy and programmatic actions at country level to address high food prices. FAO's Initiative on Soaring Food Prices, FAO, Rome.

Gouel C. and Jean, S. 2015. Optimal food price stabilization in a small open developing country. World Bank Economic Review, 29(1), 72–101.

Jones, D., Kwiecinski, A. 2010. Policy Responses in Emerging Economies to International Agricultural Commodity Price Surges. OECD Food, Agriculture and Fisheries Working Papers, No. 34, OECD Publishing. doi: 10.1787/ 5km6c61fv40w-en.

Kaminsiki, J., Heady, D. & Bernard, T. 2010. The Burkinabé cotton story 1992-2007: sustainable success or Sub-Saharan mirage. World Development 39(8): 1460-1475.

Kenya National Bureau of Statistics (KNBS) 2011. Kenya Consumer Price Index, 2005-2011 [Data File]. Online Database. www.knbs.or.ke/consumerpriceindex.php

Krueger, A., Schiff, M. & Valdés, A. 1988. Agricultural incentives in developing countries: measuring the effect of sectoral and economywide policies. The World Bank Economic Review, Vol. 2(3): 255-271.

Krueger, A., Schiff, M. & Valdés, A. eds. 1991. The Political Economy of Agricultural Pricing Policy. Volume 3:Africa and the Mediterranean. World Bank, Washington DC.

MAFAP 2013. Review of food and agricultural policies in the United Republic of Tanzania. MAFAP Country Report Series, FAO, Rome, Italy.

MAFAP.2015. Methodological Paper on Public Expenditure. Vol 2

Meade, J.E. 1955. Trade and Welfare. Oxford University Press, London, pp 162-163.

Meyer, C. & Duteurtre G. 1998. Equivalents lait et rendements laitiers : modes de calcul et utilisation. Revue d'Élevage et de médicine vétérinaire des pays tropicaux, 51(3) : 247-257.

Magrini, E., Morales-Opazo, C., Jean Balié., 2015. Price Shocks, Volatility and Household Welfare: A Cross-Country Inquiry, Working Paper 11, ULYSSES project, EU 7th Framework Programme, Project 312182 KBBE.2012.1.4-05, http://www.fp7- ulysses.eu/ , 51 pp

OECD, 2006. Agricultural Policy and Trade Reform: Potential Effects at Global. National and Household Levels, Paris.

OECD. 2010. OECD'S Producer Support Estimate and related indicators of agricultural support. Concepts, calculations, interpretation and use (the PSE manual). OECD, Paris.

OECD, 2012a. Policy Framework for Investment in Agriculture, Paris.

OECD, 2012b. Agricultural Policies for Poverty Reduction. OECD Publishing, Paris.

OECD, 2013. Agricultural Policy Monitoring and Evaluation 2013: OECD and Emerging Economies.

OECD. 2014. Third meeting of the IO Consortium on Measuring the Policy Environment for Agriculture. Paris

Pauw, K., Dorosh, P. & Mazunda, J. 2013. Exchange rate policy and devaluation in Malawi. IFPRI Discussion Paper 01253, Development Strategy and Governance Division, IFPRI, Washington DC.

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

Salami, P., Keyhani, A., and Rafiee, S. The impact of farm size on energy use and profitability of red bean production in Iran: A case study in Kurdistan province. Nature and Science. 2009; 7(9): 95-104.

Stryker, D. 2012. Study on policy options for increasing Tanzania exports of maize and rice. Report to the USAID Feed the Future SERA policy project. Dar es Salaam.

Timmer, C. P. (1986). Does BULOG stabilize rice prices in Indonesia? Should it try? Bulletin of Indonesian Economic Studies, 32, pp. 45–74.

Tsakok, I. 1990. A practitioner's guide to partial equilibrium analysis. Cornell University Press, Ithaca (NY).

United Nations (UN) 2009. System of National Accounts 2008. United Nations, New York.

Valdes, A; Schaeffer, B; Martin, J., 1996. "Surveillance of Agricultural Price and Trade Policies: A Handbook for Uruguay," Papers 327, World Bank - Technical Papers.

Valdes, A and Foxter. W. 2011. A profile of border protection in Egypt: An Effective Rate of Protection approach adjusting for energy subsidies. Policy Research Working Paper 5685.

Valdes, A. 2013. Agriculture Trade and Price Policy in Pakistan Policy Paper Series on Pakistan PK 17/12. March 2013.

Valdes, A. 2014. Personal emails by 30/09/2014

Valdes, A. 2013. WHAT IS THE COST OF A BOWL OF RICE? The Impact of Sri Lanka's Current Trade and Price Policies on the Incentive Framework for Agriculture. AGRICULTURE AND ENVIRONMENTAL SERVICES DISCUSSION PAPER 02

World Bank. 2009. Eastern Africa: A study of the regional maize market and marketing costs. Report No. 49831-AFR. Agriculture and Rural Development Unit, World Bank, Washington DC.

Annex 1: 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, 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 type 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.

Annex 2: Using prices in destination or origin markets to construct benchmark prices

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.

[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).

Annex 3: 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

Annex 4: Selecting farm gate prices in Phase II 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)

Annex 5: 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.

Annex 6: 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.

Annex 7: 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.

$$RPo_{wh} x\ QT_{fg} = RPo_{wh}\ in\ sugar\ cane\ equivalent$$

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.

$$RPo_{wh} x\ QT_{fg} = RPo_{wh}$$

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.

Annex 8: 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.

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.

$$P_{b(int\$)} x\ QT_{wh}\ = P_{b(int\$)}$$

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.

$$ACo_{wh} x\ QT_{wh}\ = ACo_{wh}$$

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**

Annex 9: 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	156 070	167 747	169 939	152 993	176 400	227 181

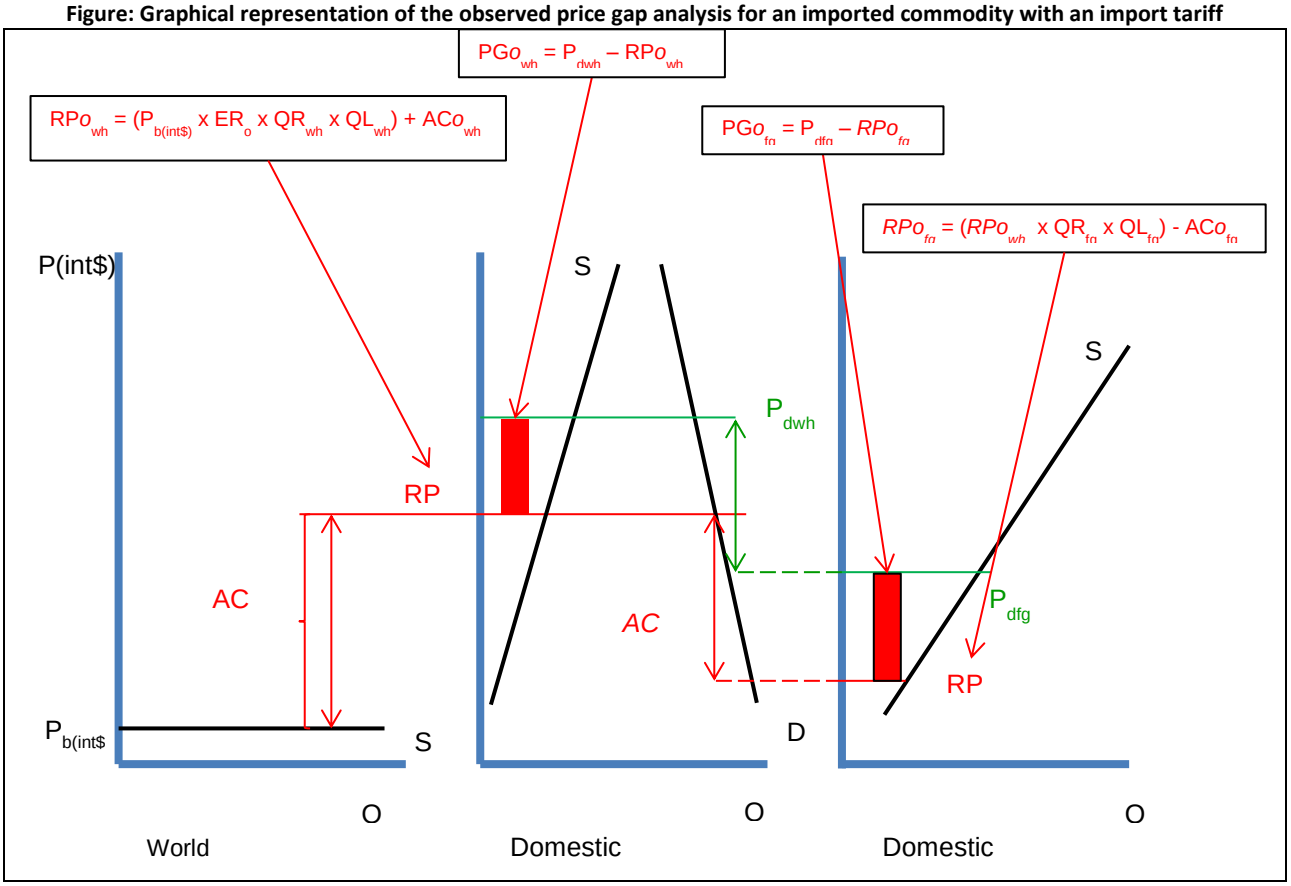
sugar)						
Milling refining and processing (TSh per tonne of sugar cane) [previous row multiplied by 0.1]	15 607	16 775	16 994	15 299	17 640	22 718
Margin (TSh per tonne of sugar cane)	2 143	2 324	3 044	3 372	3 504	4922
Transport (TSh per tonne of sugar)	43 474	48 202	47 933	46 046	50 832	54 247
Transport (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)

Annex 10: Observed price incentives and disincentives for imported commodities: two examples

EXAMPLE 1: 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: 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[16], in these access 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.

[16] 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.

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: 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: 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%

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.

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.

EXAMPLE 2Sugar 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.

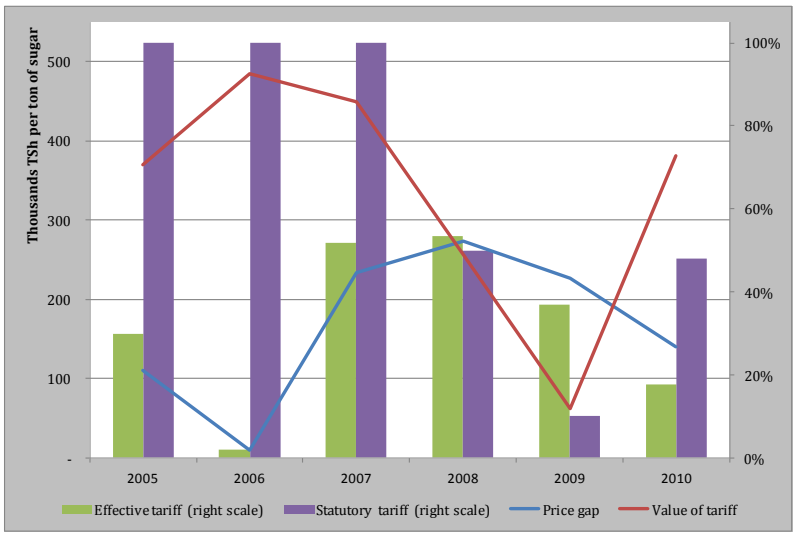
Observed price gaps at the point of competition for sugar in the United Republic of Tanzania and ad valorem tariff equivalents.

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).

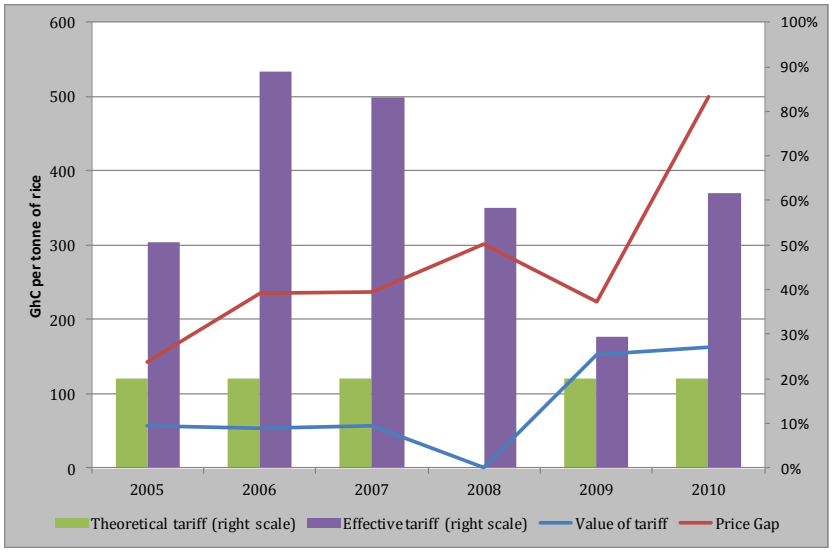
Using the data reported in Angelucci *et al* (2012) the following observed price gaps at point of competition and monetary value of tariffs were obtained.

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.



Annex 11: Observed price incentives and disincentives for exported commodities: an example

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)

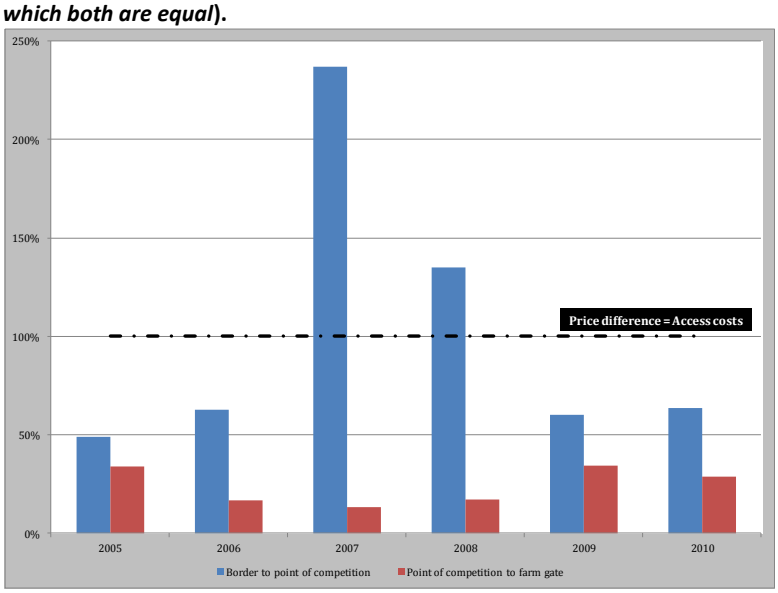
Concept	2005	2006	2007	2008	2009	2010
I. Domestic price at farm gate	132 000	129 076	164 234	201 174	235 429	237 338
II. Reference price at farm gate	223 776	252 882	260 894	292 380	327 674	339 725
III. Benchmark price in domestic currency	296 332	329 055	345 903	381 684	417 610	431 118
IV. Access costs 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).

Annex 12: 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.

Annex 13: Adjusted benchmark prices

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.

Annex 14: Adjusted exchange rates

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.

Annex 15: 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

Annex 16: 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)

Annex 17: 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].

Annex 18. Deriving the basic ERP formula

Notation	Name
VA_g^{Ref}	Value added at reference prices in the production of g.
VA_g	Observed value added in the production of g.
R_g	Gross revenues in industry g.
y_g	Quantity produced of good g
p_g	Reference price of good g.
p_i	Unprotected price of input i.
NRP_g	Nominal rate of protection on good g.
NRP_i	Nominal rate of protection on input i.
C_{gi}	Individual cost of input i of good g.
x_{gi}	Quantity of i used in the industry g.
a_{gi}	Observed cost share of input i in good g.
a_{gi}^{Ref}	Cost share of gross revenues that would otherwise prevail without protection for individual input I of good g.

The observed value added in the production of good g, VA_g, is defined as gross revenues less the costs of tradable inputs; and this net is therefore the fund available for payments to non-tradable inputs (labor and capital) used in the activity. Gross revenues in the production of good g, R_g, are simply the quantity produced of the good, y_g, sold at its reference domestic price, p_g, adjusted by the nominal rate of protection, $(1+NRP_g)$, that accounts for the ad valorem equivalent of domestic protection and any net subsidies per unit of output; that is, value added at observed prices might be less to the degree subsidies are positive (a negative subsidy would be a tax). The "formal" tariff as stated in the tariff schedules should be distinguished from the nominal rate of protection. In what follows the tariff adjustment factors, $(1+NRP_i)$ includes the formal applied tariffs and subsidies on output and inputs as well as the ad valorem tariff equivalents due to NTBs.

The value added at reference price for the industry – the value added which would otherwise prevail without any protections and subsidies whatsoever on the revenue or cost sides – can be at least approximated under the assumption that the industry technology is of the fixed-coefficient type (that is, the average input use is unresponsive to marginal relative price changes). In that case, the cost share of gross revenues that would otherwise prevail without protection for an individual input, a_{gi}^{Ref}, can be written in terms of the observed cost share, a_{gi}, and the nominal protection rates:

$$a_{gi}=\frac{p_i x_i(1+NRP_i)}{p_g y_g(1+NRP_g)}=a_{gi}^{Ref}\frac{(1+NRP_i)}{(1+NRP_g)}\Leftrightarrow a_{gi}^{Ref}=a_{gi}\frac{(1+NRP_g)}{(1+NRP_i)}$$

The costs of tradable inputs obtained over the individual costs, C_{gi}, of inputs i used in the production of g, $(i\in I_g)$; the cost of a specific tradable input, i, is its quantity used in the industry, x_{gi}, purchased at its reference price, p_i, adjusted by an appropriate nominal rate of protection $(1+NRP_i)$. That is,

$$\mathrm{VA}_g=\mathrm{p}_g(1+NRP_g)\mathrm{y}_g-\sum_{i\in I_g}\mathrm{p}_i(1+NRP_i)\mathrm{x}_{gi}=\mathrm{R}_g-\sum_{i\in I_g}C_{gi}$$

which can be rewritten in terms of tradable input costs as shares of gross revenue, a_{gi}:

$$\mathrm{VA}_g=\mathrm{p}_g(1+NRP_g)\mathrm{y}_g\left(1-\sum_{i\in I_g}\frac{\mathrm{p}_i(1+NRP_i)\mathrm{x}_{gi}}{\mathrm{p}_g(1+NRP_g)\mathrm{y}_g}\right)=\mathrm{R}_g\left(1-\sum_{i\in I_g}\frac{C_{gi}}{R_g}\right)=R_g\left(1-\sum_{i\in I_g}a_{gi}\right)$$

Value added at reference prices – the value added which would otherwise prevail without any protections and subsidies whatsoever on the revenue or cost sides

$$VA_g^{Ref}=p_g y_g\left(1-\sum_{i\in I_g}\frac{p_i x_i}{p_g y_g}\right)=R_g^{Ref}\left(1-\sum_{i\in I_g}a_{gi}^{Ref}\right)=R_g^{Ref}\left(1-\sum_{i\in I_g}a_{gi}\frac{(1+NRP_g)}{(1+NRP_i)}\right)$$

The calculation of the ERPs is facilitated by noting that the observed value added (at factor costs, without deducting subsidies on outputs) can be rewritten in term of these cost shares at reference prices:

$$VA_g=p_g(1+NRP_g)y_g\left(1-\sum_{i\in I_g}a_{gi}^{Ref}\frac{1+NRP_i}{1+NRP_g}\right)=p_g y_g\left[(1+NRP_g)-\left(\sum_{i\in I_g}a_{gi}^{Ref}\frac{1+NRP_i}{1+NRP_g}\right)(1+NRP_g)\right]$$

But the cost shares at reference prices are not directly observable and so, the practical formula for calculating the ERPs uses observed cost shares relative to gross revenue, adjusted by tariffs and subsidies:

$$ERP_g=\frac{VA_g}{VA_g^{Ref}}-1=\frac{NRP_g-\sum a_{gi}^{Ref}NRP_i}{1-\sum a_{gi}^{Ref}}=\frac{NRP_g-\sum a_{gi}\left(\frac{1+NRP_i}{1+NRP_g}\right)NRP_i}{1-\sum a_{gi}\left(\frac{1+NRP_g}{1+NRP_i}\right)}$$

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