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The State of Agricultural Commodity Markets *IN DEPTH*

Price support measurement and food security[1]

What are the issues?

A range of methods are used for measuring agricultural price distortions. The approaches are broadly similar, insofar as they calculate the extent to which prices are elevated or suppressed relative to a benchmark "undistorted" price. However, there are significant differences in the precise methods of calculation.

Two well established approaches are the OECD's calculations of producer and consumer support estimates (PSEs and CSEs) and the World Bank's calculations of distortions to agricultural incentives (DAI), which starts from the calculation of nominal rates of assistance (NRAs), but also includes a range of other derived indicators.

- The OECD calculations are available from 1986 and are updated annually for OECD countries and biennially for several emerging economies (http://www.oecd.org/agriculture/agricultural-policies/producerandconsumersupportestimatesdatabase.htm).
- The DAI indicators cover the period 1955 to 2005 for a wide range of developing countries, as well as countries covered by the OECD, with provisional updates for more recent years (http://econ.worldbank.org/external/default/main?pagePK=64214825&piPK=64214943&theSitePK=469382&contentMDK=21960058).

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More recent initiatives include the FAO's Monitoring African Food and Agricultural Policies (MAFAP) project, which provides indicators for an increasing number of African countries (http://www.fao.org/in-action/mafap/home/en/).

This note raises some methodological issues and considers the effectiveness of the measures in informing policy debates and decisions relating to food security. Because of the pervasive role of prices in determining food security status, pro-cyclical trade policies are often applied as an efficient measure to insulate domestic markets from international price turmoil (Ivanic *et al.*, 2011; Anderson *et al.*, 2013). Although justifications for such trade measures can be multiple, food security has been claimed as the dominant reason for resorting to trade measures in the recent food price crises (Rutten *et al.*, 2013). The debate about the effectiveness of these measures is therefore timely. Yet, surprisingly little hard evidence exists regarding the link between agricultural policies and potential gains or losses in food security

The available cross-country measures

The OECD's calculation of PSEs includes two components. One is a measure of transfers to producers from consumers in the form of higher prices for agricultural products. The other is a measure of budgetary transfers from taxpayers to farmers, with those transfers categorized according to "criteria of implementation", which broadly reflect their tendency to distort production and trade. The two elements are aggregated to produce an overall measure of transfers from consumers and taxpayers to producers.

The DAI method focuses exclusively on policies which affect the price incentives faced by producers and other agents in agricultural supply chains. Budgetary transfers are included to the extent that they affect prices paid and received.

The FAO's MAFAP project separates the analysis of price incentives and disincentives from the analysis of budgetary expenditures. The benefit of this distinction is that it is possible to have both an examination of how price incentives along the supply chain are altered by policies, and also how governments allocate budgetary resources across different areas (e.g. spending on subsidies as opposed to public goods), without worrying about issues of double counting. For example, in the PSE method, expenditures to maintain higher farm prices (e.g. intervention purchases and export subsidies) are excluded from the budget side because they are implicit in the calculation of price support. On the other hand, input subsidies are included on the budget side. This precludes computing an effective rate of assistance (or adjusted nominal rate of assistance) which can be aggregated with budgetary measures.

In general, the OECD's method (including budgetary transfers) is broader in terms of the range of agricultural policy interventions that are measured, whereas the DAI method has wider coverage of distortions along agricultural supply chains and between sectors. The common linchpin of the price component of the PSE calculations, and of the DAI measures, is the calculation of output price distortions. The OECD calculates market price support (MPS), which is the monetary value of pre-related transfers to producers, and a nominal protection coefficient (NPC) which is formally similar to the DAI's nominal rate of assistance (NRA). The principal behind measuring output distortions is to record the extent to which prices received by farmers (and paid by consumers) are raised or lowered relative to an undistorted "reference" price, which reflects the price that would be received or paid in the absence of policy interventions.

That calculation can be done indirectly, by calculating a price gap equal to the difference between the domestic price and the undistorted "reference" price. This approach is based on the law of one price, namely that – in the absence of policies – the prices of goods in two markets will be equal when adjusted for the transaction cost of arbitraging between those two markets. Any excess beyond transaction costs is thus a "distortion" which is deemed to reflect policy interventions.

Across countries and time periods, governments have used a broad array of policy instruments. They include distortions to input markets (largely subsidies, plus controls on land use), production quotas, marketing

Box 1: Impacts of trade restrictions

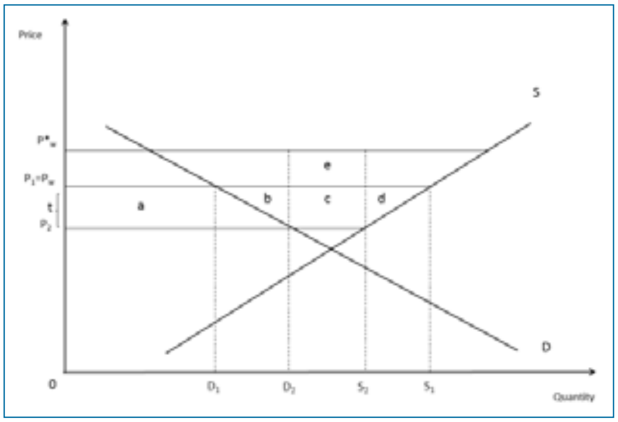
The issue of insulating policies does not refer to the level of protection *per se*, as measured by a tariff or an export tax, but implies the changing of the level of protection in response to a change in the foreign price in order to hold the domestic price constant. Hence, an insulating trade policy involves decreasing the protection received by domestic producers when the world price increases and increasing protection when the world price decreases (Grennes *et al*., 1978).

To facilitate the understanding of the impacts of trade restrictions on prices, exports, and welfare, a simple theoretical framework is shown in Figure 1. For brevity, only the economic effects of the adoption of export taxes are analyzed since this is the typical emergency measure adopted in reaction to rapid increases in international prices and aimed at safeguarding food security, both in a small and in a large exporting country trading one agricultural good with the rest of the world.

Assuming that P_1 is the "undistorted" domestic price level – equal to international price P_w - the domestic quantity demanded is D_1, the domestic quantity supplied is S_1 and the difference (S_1 - D_1) is exported. Consider first the case of the adoption of an export tax *t* by a small country. When exports are taxed by *t*, the domestic price falls from P_1 to P_2, the domestic supply falls from S_1 to S_2 and the domestic demand increases from D_1 to D_2. Hence, the single impacts of this trade policy in a partial equilibrium analysis are the following: a reduction of exports - that now equal ($S_2 – D_2$); an increase in consumption ($D_2 – D_1$) for domestic consumers that benefit from a lower price; a reduction in supply ($S_1 – S_2$) by domestic producers penalized for the price fall; an increase of public revenues given by the export tax *t*. The benefit for consumers amounts to the area a (i.e. the change in the consumers surplus). The loss for producers amounts to the area (*a*+*b*+*c*+*d*) (i.e. the change in the producers surplus). The benefit for the government amounts to the area *c*. The overall impact of export tax is given by summing the benefits and losses. The result is a net welfare loss represented by the areas *b* and *d*[2].

However, if the policy-makers have a food security objective that implies a decrease in the domestic price, export taxes are effective since they augment domestic consumption and reduce the local consumer price leading to an increase of the surplus of food consumers. When the country that imposes the export tax is a large country (i.e., large enough to affect the world price), the fall of world supply (since a large country is assumed to export a significant share of world exports) pushes the world price upwards from Pw to P*w, and there is an increase of public revenues (area e) due to the world price rise (which represents an improvement in the country's terms of trade). In this case, the implementation of this policy can lead to an increase of domestic welfare - under the usual ceteris paribus assumption - if the terms of trade gain exceeds the welfare loss (i.e. e > [b + d]). However, in terms of global food security this policy measure may imply a worsening in aggregate because of the reduction of world food supply[3].

Figure 1 – Partial equilibrium analysis of the economic impacts of export taxes



Source: Author's elaboration

2 The size of the welfare loss depends on the slope of the demand and supply curves. It means that a small exporting country is always worse off when it adopts an export tax.

3 It is noteworthy that in the long run, consequences could be different if producers in the rest of the world increased their supply in response to higher prices. As a result, the price adjusts downward from the short-run level, but still remains above the pre-restriction level. Therefore, it is quite possible that export restrictions could be beneficial in the short run while having negative consequences in the long run thanks to adjustments in the terms of trade (Mitra and Josling, 2009).

quotas, target prices, price subsidies or taxes in output markets, and especially, border measures that directly tax, subsidize, or quantitatively restrict international trade. As a consequence, we need to convert the different instruments into a common metric.

The advantage of the price gap approach is that captures a range of different policies, which are revealed through the price gap, including non-tariff measures and informal restrictions on trade. Indeed, the set of trade policy measures adopted to insulate price increases varies in many respects. They include both export restrictions adoption as well as import restrictions relaxation. These measures are different in their transparency and in the administrative burden involved in their implementation and have different distributional effects. The list of measures that has price-raising, trade-reducing and other economic effects is likely to be endless.

The OECD calculations of output market distortions are based predominantly on the calculation of price gaps. The same is true of the DAI's calculations of NRAs for agricultural products. NRA measures distortions imposed by governments that create a gap between current domestic prices and the prices that would exist under free markets. Under the "small-country" assumption, this rate has been computed for each commodity product as the percentage by which government policies have raised gross returns to farmers above what they would have been had the government not intervened (or the percentage by which government policies have lowered gross returns). The focus is on border and domestic measures that are due exclusively to governments' actions, and as such can be altered by a political decision and have an immediate effect on consumer choices, producer resource allocation, and net farm incomes (Anderson and Valenzuela, 2008). In practice, there are divergences among farmer, processor and wholesaler, consumer, and border prices for reasons other than policies. These costly value chain activities need to be explicitly recognized and netted out when using comparisons of domestic and border prices to derive estimates of government policy-induced distortions. More specifically, NRA is computed as follows:

$$NRA=[EP(1+d)-EP]/EP$$

where *E* is the exchange rate, *d* is a distortion due to government interventions and *P* is the foreign price of an identical product in the international market (Anderson, 2006). Positive values of NRA denote a rise in domestic producers' gross return (the distorted price is higher than the undistorted equivalent because of the presence of an output subsidy and/or a consumption tax, e.g. a tariff), while negative values denote a lower gross return for domestic producers (the producers receive less than the price would be for a like product in the absence of government interventions, e.g., an export tax).

However, the price gap approach raises a number of measurement and interpretation issues. On the measurement side, the key challenge is to compare like with like domestic and international products, and to accurately make adjustments for transaction costs. In terms of interpretation, arbitrage between markets does not occur instantaneously.

The DAI method allows for the computation of NRAs in non-agricultural tradable sectors, and hence the derivation of a relative rate of assistance (RRA) which captures distortions to incentives between tradable sectors:

$$\mathrm{RRA} = \left[\frac{1 + \mathrm{NRAag}^{t}}{1 + \mathrm{NRAnonag}^{t}} - 1\right]$$

where NRAs for the agricultural and nonagricultural sector are provided by Anderson and Nelgen (2012).

Both the OECD and DAI approaches order agricultural products according to their contribution to the gross value of production and include the most important products, with the aim being to cover at least 70% of the gross value of agricultural production in each country. The OECD assumes that outstanding production has the same price distortion as the average for commodities that are covered. The DAI approach calculates separate NRAs for exportables, importing-competing products and non-tradables by multiplying each primary industry's value share of production (valued at the farmgate equivalent undistorted prices) by its corresponding NRA and adding across industries. In addition to the mean, it is important to provide a measure of the dispersion or variability of the NRA estimates across the covered products. The WB database provides such a measure: a simple indicator of dispersion is the standard deviation of industry NRAs within agriculture.

Trade-policy instruments such as export and import taxes and subsidies or quantitative restrictions, along with multiple exchange rates are the major vehicles responsible for distortions. They account for no less than three-fifths of agricultural NRAs globally. In contrast, internal domestic agricultural policies that directly subsidize or tax outputs and inputs contribute only minimally to NRAs (Anderson *et al.*, 2013). As a consequence, it is worth looking also at the trade bias index (TBI):

$$TBI = \left[\frac{1 + \mathrm{NRAag}_X}{1 + \mathrm{NRAag}_m} - 1\right]$$

indicating the changing extent to which a country's policy regime has an antitrade bias within the agricultural sector. The higher the NRA to import-competing agricultural production () relative to that for exportable farm activities (), the more incentive producers in that subsector will have to bid for mobile resources that would otherwise have been employed in export agriculture, other things equal.

Are these policy measures effective?

The approaches discussed above seek to capture the incidence of price policies. The assessment of their final impacts is left to subsequent modelling work which uses the support measures as inputs. This section summarizes some of the most recent evidence provided by the literature.

Some scholars state with empirical evidence, that countries which imposed trade measures following the 2007-2008 food price increases were effective in making domestic prices raise significantly less than those which did not intervene (Abbott 2011; Dawe and Timmer 2012; Demeke *et al.*, 2009; Jones and Kwiecinski 2010; McCalla 2009). McCalla (2009) warns against the fiscal sustainability of this kind of measures, since countries that maintain low domestic food prices as a safety net have experienced rising fiscal costs of domestic feeding programmes and emphasizes the differentiated impact across countries. Abbott (2011) and Jones and Kwiecinski (2010) - analyzing maize, rice, soy-beans and wheat price changes in a wide set of countries - conclude that most of the countries that restricted exports experienced significantly lower price increases than those who did not. From a geographic perspective, greater price stabilization was achieved by Asian rice exporters than by export restricting countries in Latin America and Eastern Europe (Abbott, 2011; Demeke *et al.*, 2009). Dawe and Timmer (2012) underline how during the world rice crisis of 2008, China, India and Indonesia successfully insulated their domestic rice economies from the turmoil on world markets. Their analysis also shows how the impact on the volumes exported varies significantly across the countries that intervened to restrict them. Jones and Kwiecinski (2010) find that China, India, and Ukraine registered significant reductions of their wheat exports, the same is true for China and Ukraine for maize, and for China and India for rice.

Other scholars (Rutten *et al.*, 2013; Anderson *et al.*, 2013; Anderson and Nelgen, 2012c) highlight that if many countries adopt the same measures, these measures may be ineffective because the impact of price insulation depends on both the actions taken by the single country and the collective impact of interventions by all other countries. They emphasize how trade insulating measures push world food prices to even higher levels and, in a domino-like effect, drive more countries to follow, thereby perpetuating high food prices, reducing both the impact of each country's initial action on its domestic price and the ability of the policy reaction by each country to yield the desired effect and exacerbating food insecurity around the world (Martin and Anderson, 2011, 2012; Mitra and Josling, 2009). In the case of small countries, these measures are likely to reduce national economic welfare too. If the country is a large country, its policy intervention will affect not only the domestic price but the international one as well leading to other distortive effects (see Box). In their analysis of wheat market, Rutten *et al.*, 2013 find that major net exporters are generally better off when implementing export taxes for food security purposes. Large exporting countries export price instability causing world food prices to rise further. Net importing countries lose out and have limited room to reduce tariffs or subsidize imports. When wheat trade is liberalised, it mitigates rising prices and contributes to food security, but to the detriment of production in other countries (mainly of Africa and Asia), making them more dependent on and vulnerable to changes in the world market.

According to Anderson and Nelgen (2012), domestic market insulation using trade measures is also inefficient and possibly inequitable. The traditional national government trade policy reactions to food price spikes would be undesirable also because, collectively, they are not very effective in stabilizing domestic prices, and not least because they add to international price volatility by reducing the role that trade between nations can play in bringing stability to the world's food markets. Some scholars (Martin and Anderson, 2011; Anderson and Nelgen, 2012c,a; Rutten *et al.*, 2013; Anderson *et al.*, 2013; Timmer, 2008; Gotz *et al.*, 2013) even say that trade policies adopted by countries in order to stem the recent price spikes have even amplified both price spikes and volatility and exacerbated the already negative consequences of high prices for the food security of the population in the developing countries. Anderson *et al.*, 2013 estimate how much the observed insulating actions of more than 100 countries in the period of 2006-2008 have affected international and domestic food prices of for four food items: rice, wheat, maize and edible oils. They find that the adoption of price insulation caused substantial increases in international prices that completely offset the benefits and that the actual poverty-reducing impact of insulation is much less than its apparent impact. Furthermore, they find developing countries as a group insulated more than developed countries and, as a result, parts of the price increases were "exported" to developed countries. In Martin and Anderson (2012) the authors examines the role of trade policies (particularly export and imports restrictions) as stabilization policies in the agricultural market. They state the use of these measures by all countries is ineffective in stabilizing domestic prices for the key staple foods of rice and wheat, while magnifying international price instability associated with exogenous shocks to food markets. Their analysis shows that in the 2006-08 surge, insulating policies affecting the market for rice explain 45 percent of the increase in the international rice price, while almost 30 percent of the observed change in the international price of wheat during 2006-08 can be explained by the changes in border protection rates. Mitra and Josling (2009) emphasize the negative effects caused by the adoption of export restrictions as a response to the dramatic increase in commodity prices in 2007-08. They state these measures led to further price increases by placing limits on global supply and undermining the level of buyer confidence with a consequent harmful impact on domestic food security. Gotz *et al.*, 2013 analyze the impact of export restrictions on price volatility in the Ukrainian wheat market during the commodity price peaks 2007-08 and 2010-11. They find the export controls have not significantly reduced price volatility on the domestic wheat market. On the contrary, these policy measures have substantially increased market uncertainty which led to pronounced additional price volatility in the market.

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