AgEcon SEARCH
RESEARCH IN AGRICULTURAL & APPLIED ECONOMICS

The World's Largest Open Access Agricultural & Applied Economics Digital Library

This document is discoverable and free to researchers across the globe due to the work of AgEcon Search.

Help ensure our sustainability.

Give to AgEcon Search

AgEcon Search
http://ageconsearch.umn.edu
aesearch@umn.edu

*Papers downloaded from **AgEcon Search** may be used for non-commercial purposes and personal study only. No other use, including posting to another Internet site, is permitted without permission from the copyright owner (not AgEcon Search), or as allowed under the provisions of Fair Use, U.S. Copyright Act, Title 17 U.S.C.*

Sit down at the ballgame: How trade barriers make the world less food secure

MARTINE RUTTEN; GERDIEN W. MEIJERINK; LINDSAY CHANT
LEI Wageningen UR; martine.rutten@wur.nl

Paper prepared for presentation at the EAAE 2011 Congress
Change and Uncertainty
Challenges for Agriculture,
Food and Natural Resources

August 30 to September 2, 2011
ETH Zurich, Zurich, Switzerland

Copyright 2011 by Rutten, Meijerink & Chant. All rights reserved. Readers may make verbatim copies of this document for non-commercial purposes by any means, provided that this copyright notice appears on all such copies.

1 INTRODUCTION

This paper[1] examines the role of trade policy measures in perpetuating high food prices. In particular it considers what effect trade measures have on food security: to what extent it protects domestic food security but damages food security in other countries. The paper also takes into account the effect on domestic farmers and farmers in other countries. We compare the results of protectionist reactions to a shock in the wheat sector to the consequences of the same shock in a fully-liberalised world.

Various factors contribute to high prices. A peak in prices such as the one in 2007-08 as well as 2010-11 is caused by various supply and demand events that come together at the same time. World market prices are sensitive to relatively small quantity moves as only a small share of cereal production is traded internationally, compared to domestic production. World market prices serve as a signal to both importing and exporting countries about changing scarcity. Most countries aim to keep their domestic grain markets stable and may react to international price changes with trade measures. Early research into the causes of high food prices placed little importance on the role of trade events and policies. Recently there has been more emphasis placed on the role of trade policy measures. As Headey (2010) states: 'we find that trade events potentially provide an explanation for how a tightening of the world food situation rapidly turned into a full-blown crisis.'

During the food price crisis of 2007-08, many countries implemented trade measures to limit the export of foods, including export bans or taxation and cuts in import tariffs. Of 61 developing countries covered in a recent survey, 25 implemented export bans and 43 reduced import tariffs (Demeke et al. 2009). It must be noted, however, that implementing export tariffs or bans impose restrictions on world trade, while reducing or removing import tariffs actually opens up trade. Thus while they are in a sense opposite measures, they both lead to higher prices.

2 DATA AND MODELING APPROACH

In this section we describe of the data used to calibrate the model. The model is calibrated to the GTAP database, version 7, which is a fully documented, publicly available global database containing complete bilateral trade information, transport and protection linkages among 112 regions for all 57 GTAP commodities for a single year (2004 in the case of the GTAP 7 database).[2]

The list of commodities covered in the GTAP database have been aggregated into seven categories, distinguishing the most important types of grains, i.e. rice, wheat, and other grains (including maize), other primary and processed food, manufacturing and services sectors. The resulting sectoral aggregation is shown in Table 2.1.

Table 2.1 Sectoral Aggregations

Commodity/sector	Description
Pdr	Paddy rice
Wht	Wheat

[1] For the full paper with more results contact the authors or download from http://ssrn.com/abstract=1769745

[2] For more information see https://www.gtap.agecon.purdue.edu/databases/default.asp

Gro	Other grains (including maize)
FoodPrim	Other primary food categories
FoodProc	Processed food categories
Mnfcs	Manufacturing industry
Serv	Services

For the purpose of this study, the 112 regions in the GTAP database have been further aggregated into fifteen countries and/or regions. The regional aggregation distinguishes the most important net exporters and importers on the world markets for rice, wheat and other grains (including maize), many of which acted in view of the price hikes of 2007-2008. Tanzania was isolated to analyse impacts of high grain prices and alternative policy responses for a 'typical' African country that is both a major grain importer and a small grain producer[3].GTAP accounts for bilateral export and import taxes, which are calculated ex-post from the model by comparing values of respectively exports and imports at market and world prices. These taxes are relevant for our analysis as they are important trade policy instruments by which exports and imports, and therefore domestic, as well as world supply and prices of grains can be influenced. Export taxes are zero in the base year, apart from export taxes charged by the Netherlands and the rest of the EU. The Netherlands charges 2% on exports going to the rest of the world. The rest of the EU also levies an export tax of 2% apart from exports going to India and the Rest of Africa, in which case the EU charges 1%. Import taxes for rice, wheat and other grains vary by source and destination country or region.

2.1 Modelling Approach

We employ a Computable General Equilibrium (CGE) framework to study the various impacts of higher grain prices and subsequent policy responses. This approach is most suited to analysing economic impacts, taking into account the behaviour of the various actors in the economy and how they interact in markets. The CGE approach allows for counterfactual analysis, i.e. answering 'what if' questions, and is not just restricted to 'learning from the past' like econometric studies are. A CGE model is numerically specified using consistent and balanced macroeconomic accounts data for one year, with some of the parameters (most notably elasticities) being imposed onto the model. Whilst advantageous from the point of view of data requirements, this procedure implies that statistical validation of the model is not possible. Sensitivity analysis can be used to minimise potential errors from using parameters not acquired through econometric methods.[4]

As the impacts of rising food prices and subsequent policy responses are felt throughout the world, the chosen scope of the analysis is global. The model which we use is GTAP (Global Trade Analysis Project)[5], a widely used tool for global trade analysis.

The focus is on wheat, being an important food crop throughout the world. Other grains crops such as maize and rice are also important food crops and may have different

[3] Additional information can be found on http://ssrn.com/abstract=1769745. The regional aggregation includes information on the net trading position on the rice, wheat and other grains (including maize) markets of the countries/regions distinguished, using GTAP 2004 data. Associated information on the value of worldwide exports, imports, net exports and production is included.

[4] See Francois and Reinert (1997) for more information on the CGE modelling technique.

[5] https://www.gtap.agecon.purdue.edu/

market dynamics. However, the conclusions drawn for wheat are generally applicable to maize and rice as well: trade barriers negatively affect food security.

3 RESULTS: THE IMPACTS OF HIGH PRICES IN THE WHEAT SECTOR

The results of the negative supply shock, export tax, import tax and full liberalisation scenarios for the wheat sector are presented in this section. In each scenario, the domestic impacts and the global impacts are measured using the four effects of changes in export and import taxes identified in Bouet and Laborde (2010). These are: (i) the food security effect, (ii) the anti-farmer effect, (iii) the terms-of trade effect and (iv) the tax income effect. A detailed explanation of each effect is given in Box 3-1. As many of the effects operate in opposite direction, the overall welfare effect, which is the sum of all effects, is also papered.

Box 3-1: Different effects explained

The food security effect is the effect on domestic prices and domestic consumption of wheat. In the case of rising export taxes and falling import tariffs, the food security effect is expected to be positive; indeed, the aim of these government interventions is to ensure increased domestic consumption through lower domestic prices.

The anti-farmer effect is the effect on the domestic producer price and domestic production of wheat. Both higher export taxes and lower import taxes keep the domestic producer wheat price lower than the world wheat price which reduces supply.

The terms of trade effect is the change in the ratio of export to import prices. For a large exporting country, an export tax reduces the supply to the world market, which in turn raises the world price and improves the terms of trade. Similarly, for a large importing country, an import tariff reduces the demand on the world market, which reduces the world price and improves the terms of trade, whilst a reduction of the import tariff, as simulated here, has the opposite effect.

The tax income effect is the change in tax receipts which result from changes in trade taxes that have an impact on real income and spending, and therefore tax receipts. The introduction of an export tax may increase tax receipts, which increases income and spending, which in turn increases tax receipts. Conversely, reducing import tariffs may reduce tax revenues and income and thus spending. The tax income effect is therefore likely to be positive for an export tax and negative for a reduction in import tariffs. We paper the change in trade tax revenues as a proxy for the tax income effect.

The results of the scenarios papered below include changes in the overall terms of trade and trade tax revenues for all countries and/or regions included in the model (and thus include impacts of price changes on other markets), whereas the food security and anti-farmer effect are papered for the wheat market specifically. Overall food security is assessed by considering the impacts on the entire food bundle, in the context of economy-wide impacts associated with underlying changes in real incomes. Where necessary, such macroeconomic impacts are also included in the discussion of domestic and global welfare changes.

3.1 Impacts of a Negative Supply Shock on the Wheat Market in Oceania

An increase in the world price of wheat is simulated by imposing a 25% reduction in the productivity of land in the wheat sector in Oceania in 2010. Oceania is one of the world's largest exporters of wheat and as such, reductions in production and exports from this region are expected to lead to increases in the world price.

An evaluation of how the four effects work out at the country level requires the introduction of an overall welfare measure. The welfare measure included in GTAP and most commonly used in welfare analyses is Equivalent Variation (EV). The EV is a measure of how much money (US$ million) should be taken from or given to consumers to be as well off as before a (policy) shock, in this case a production shock. A positive (negative) EV implies a welfare gain (loss). Table 3.1 shows the results. The US & Canada, important wheat producers and exporters, experience the largest welfare gain in absolute terms (69 million US$), whereas Oceania, struck by a harvest loss, experiences the biggest welfare loss (118 million US$). The second and third biggest losers are Rest of South East Asia and the EU, big consumers of wheat, with losses of 68 million US$ and 24 million US$ (EU including Netherlands) respectively. Welfare changes relative to GDP in the baseline are small (<0.1% in absolute value), but show that relative gains (losses) are highest for Argentina (Oceania). In sum, the results show that a harvest loss in Oceania, whilst benefiting a few high income and emerging wheat exporting economies, has detrimental effects for the rest of the world, including poor countries.

Table 3.1 Welfare Effects of a Negative Supply Shock on the Wheat Market in Oceania

	Absolute change (million US$)	Change relative to GDP in 2010 (%)
Oceania	-117.62	-0.01438
EU26	-22.82	-0.00018
US & Canada	86.58	0.00065
Argentina	9.44	0.00493
Rest of Latin America and Caribbean	-15.99	-0.0007
Middle East	-17.9	-0.00126
Former Soviet Union	-0.61	-0.00007
China	-12.28	-0.00047
India	4.99	0.00055
Asian Rice Producers	-12.55	-0.00353
Rest of South East Asia	-68.31	-0.001
Tanzania	-0.94	-0.00629
Rest of Africa	-14.56	-0.00175
Rest of the World	-1.39	-0.00018
World	-185.11	-0.00042

3.2 Impacts of an Export Tax Response in the Wheat Market by India

Higher wheat prices lead to lower consumption in all countries which is of particular concern to countries with many poor citizens. India is an example of a large exporting country that is concerned about food security. Higher world wheat prices increase the domestic price for the Indian consumer by 0.092 per cent and reduce wheat consumption by 0.008 per cent. India's status as a large exporting country affords it the opportunity to introduce an export ban to protect domestic prices in the face of rising world prices. In the export tax simulation, a destination-generic export tax of 1.15% on wheat by India ensures that the domestic supply price for wheat is maintained at the same level as before the productivity shock.

The incremental impact of the introduction of the Indian export tax on wheat on welfare across regions is presented in Table 3.2. The general pattern is that the major net exporters of wheat gain, whereas net importers lose out from India's trade measures. Specifically, India, which imposes the export tax, US & Canada and Oceania, big wheat producers and exporters, experience the greatest welfare gains, whereas Rest of Latin America and Caribbean, EU26 and the Middle East experience the greatest losses in absolute terms. Welfare changes relative to GDP in the baseline are small (<0.007% in absolute value), but show that relative gains (losses) are highest for Argentina (Tanzania). These results imply that the negative food security and terms-of-trade effects outweigh the positive farmer effect in Tanzania.

The results seem to suggest that overall, the world is slightly better off if India imposes an export tax on wheat when worldwide wheat prices are rising due to a negative event (i.e. a negative supply shock). It remains to be seen if this conclusion, representative of a second-best world with protected wheat markets, holds compared to the first-best solution of fully liberalised trade in wheat (see section 6.4). Although the world may be slightly better off, the results also show that India's export tax has a negative effect on poor countries such as Tanzania.

Table 3.2 Welfare Effects of an Indian Export Tax on Wheat

EV	Absolute change (million US$)[a]	Change relative to GDP in 2010 (%)[a]
India	6.44	0.00071
EU26	-1.04	-0.00001
US & Canada	5.63	0.00004
Argentina	0.88	0.00046
Rest of Latin America and Caribbean	-1.14	-0.00005
Middle East	-1.01	-0.00007
Former Soviet Union	0.01	—
China	-0.41	-0.00002
Asian Rice Producers	-0.14	-0.00004
Rest of South East Asia	-0.98	-0.00001
Oceania	1.99	0.00024
Tanzania	-0.94	-0.00629
Rest of Africa	-0.79	-0.00010
Rest of the World	-0.08	-0.00001
World	8.39	0.00002

[a] in differences from supply shock results — close to 0.0000

3.3 Impacts of an Import Tax Response in the Wheat Market by Tanzania

If food security is a key priority, developing countries such as Tanzania may respond to export taxes in large exporting countries by reducing import tariffs to protect domestic prices, despite the boost to the wheat sector from higher producer prices. In the import tax simulation, a 1.18% source-generic reduction in import tariffs on wheat by Tanzania ensures that the domestic supply price for wheat is maintained at the baseline level.

The reduction in the price of imports and the accompanying increase in demand for imports would increase the world price in the case of a large country; worsening its

terms of trade. However, the import response here is implemented for a country which does not have a large enough share of total imports to affect the world price. Tanzanian imports of wheat representing only 0.5% of global imports, i.e. Tanzania is a 'small country' in terms of wheat imports. Trade tax revenues are expected to decrease after the reduction of import tariffs but the size of the effect depends on how trade quantities are affected.

The incremental effects of Tanzania lowering its import tariffs on wheat on welfare across regions are presented in Table 3.3. Effects are small, but as before, US & Canada and India experience the largest welfare gains in absolute values, and gains are highest for Argentina in relative terms. Tanzania is worse off from lowering import tariffs (welfare loss of 0.32 million US$) and experiences the highest welfare loss in absolute and relative terms across the globe. These results reveal that the positive food security effect is insufficient to compensate for the negative farmer, tax income and terms of trade effects in Tanzania. Lowering import tariffs so as to stabilise domestic wheat prices is thus relatively costly. This implies that a small importing country such as Tanzania, which is little integrated in world markets, cannot (unilaterally) use trade policy to fight the rising prices in contrast with large exporting countries such as India that have the means to do so (see previous scenario). Overall the world is slightly worse off.

Table 3.3 Welfare Effects of Lowering Tanzanian Import Tariffs on Wheat

EV	Absolute change (million US$)[a]	Change relative to GDP in 2010 (%)[a]
Tanzania	-0.32	-0.00214
EU26	0.07	—
US & Canada	0.14	—
Argentina	0.07	0.00004
Rest of Latin America and Caribbean	-0.04	—
Middle East	-0.02	—
Former Soviet Union	—	—
China	-0.01	—
India	0.13	0.00001
Asian Rice Producers	-0.02	-0.00001
Rest of South East Asia	-0.06	—
Oceania	0.06	0.00001
Rest of Africa	-0.02	—
Rest of the World	—	—
World	-0.01	—

[a] in differences from Export Tax results — close to 0.0000

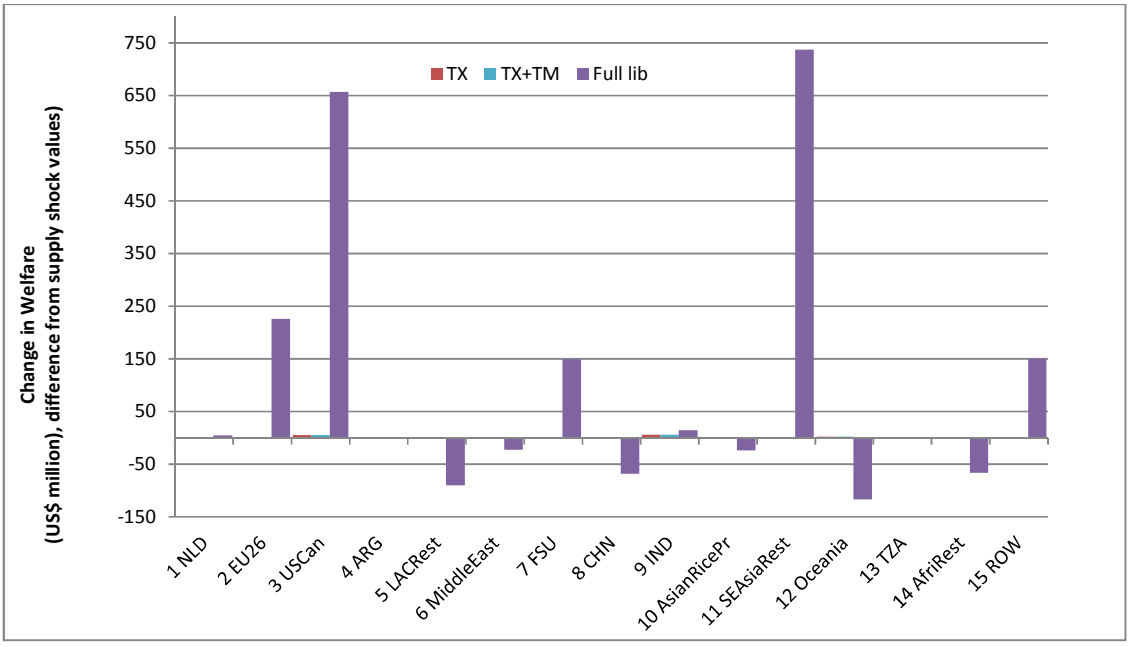
3.4 Comparison with Full Trade Liberalisation of the Wheat Market

Large exporting countries have the option of increasing export taxes in the face of higher world prices. An alternative option is for all countries to fully liberalise trade and remove all import and export taxes, with the argument that by removing all obstacles to trade, resources will move where they are most needed thus mitigating the impact of higher world prices. We are interested in analysing what would happen when grain prices suddenly rise in a world in which trade was fully liberalised. The effects on food (wheat)

security, on wheat farmers, on terms of trade and the tax income effect are considered in turn. The results are presented in graphical form in percentage point changes from the supply shock results.

The welfare effects of all policy responses relative to the supply shock in absolute and relative terms are shown in Figure 3.1. Absolute welfare gains (and losses) of full wheat trade liberalisation exceed that of the unilateral responses to the wheat supply shock many times. Overall, the world is many times better off in absolute terms compared to the unilateral responses. Rest of South East Asia, US & Canada, EU26, the FSU and Rest of World gain, whereas the Rest of Latin America and Caribbean, Oceania, China and Rest of Africa are the biggest losers. In relative terms, the FSU, Rest of World and Rest of South East Asia are best off, whereas Oceania, Africa and Asian Rice Producers are worst off. Both India and Tanzania would have been better off in terms of overall welfare if all countries had liberalised their trade in wheat.

Figure 3.1 Effect of a supply shock and higher wheat prices on welfare in a (non) liberalised world



3.5 Discussion

The results obtained from the three scenarios (supply shock in Oceania, trade ban in India and import subsidies in Tanzania) may not seem very big. The supply shock in Oceania 'only' increases world wheat prices by 0.25 per cent. However, when we take into account that a supply shock in one country usually coincides with other supply shocks elsewhere, we can imagine that such events combined will have a significant impact on world wheat markets. We did not simulate different supply shocks in this research, but this may be a line of further research. Especially in the context of global climate change in which more extreme weather patterns are expected, this may be useful.

Our measure of food (wheat) security is rather coarse. It measures the total amount of wheat consumed in a country of region. The household in the model is representative of all households in economy, i.e. average household, whereas impacts may differ quite a lot across poor vs. rich households and rural vs urban households A

more detailed study could take into account the impacts across different types of households and get a better grip on what effect a supply shock and related trade measures have on vulnerable people.

Our analysis shows that liberalising trade is effective in reducing the effects of supply shortfalls on price rises as well as food security. Wheat prices rise only half as much in a liberalised world after a major supply shock in e.g. Oceania. Absolute welfare gains (and losses) of full wheat trade liberalisation well exceed that of the unilateral responses to the wheat supply shock. But overall, the world is many times better off in absolute terms compared to the unilateral responses. Interestingly, wheat consumption in India and Tanzania, the two countries in our study that imposed trade measures, would be *higher* in a liberalised world where neither of them would impose any measure.

However, full liberalisation will not benefit all regions. Full liberalisation implies large shifts in the global production of wheat. Production shifts away from Asia and Africa into US & Canada, Rest of Latin America and Caribbean and Former Soviet Union. While wheat *consumption* in Africa and Asia is higher in a fully liberalised world, wheat *production* in these regions falls. Thus whilst food security in wheat is strengthened in the liberalisation scenario, food sovereignty in wheat and the aim of some countries to be self-sufficient in wheat is weakened. The idea of food sovereignty is that people have the right to define their own food, agriculture, livestock and fisheries systems, in contrast to having food largely subject to international market forces[6]. Being dependent on the world market may make a country more vulnerable to changes in the world market that may affect food security.

In this line of reasoning, high export tariffs combined with tightness on the world markets are said to have had a wider negative effect by reducing the faith in the multilateral trading system. Demeke et al (2009, p.24) point out that many countries that previously put their faith in the world market as a reliable source of food supply have shifted their position since the food price crisis by:

- Insulating domestic prices from world prices (exporting countries) by imposing protectionist measures such as export taxes or outright bans;
- Moving from a food security based strategy to a food self-sufficiency based strategy; Bypassing 'normal' international trade processes, either by acquiring land abroad for securing food and fodder procurement or by engaging in trade agreements at the regional level;
- Showing distrust towards the private sector (via price controls, anti-hoarding laws, government intervention in output and input markets).

Thus paradoxically, the export restrictions have led to a reduced enthusiasm for (further liberalising) the world market. At the same time, however, the export restrictions were matched by calls to ban such trade measures in the WTO: Switzerland and Japan submitted this at the WTO, but also the High Level Task Force on the Global Food Crisis, a combination of various UN and other multilateral organisations (e.g. World Bank and IMF) have called for minimizing use of export restriction[7] to meet food security needs of vulnerable populations.

[6] See for instance http://www.foodsovereignty.org/

[7] See the Comprehensive Framework for Action, available at http://bit.ly/e74aFo

Export bans, restrictions or taxation are technically legal under the WTO rules; there are only a few weak restraining provisions. Two WTO agreements (GATT and AoA[8]) deal with this issue.

Although our analysis shows that export restrictions are damaging to world food security, constraining or even forbidding the use of export restrictions is probably not feasible. However, clarification and sharpening of the rules in the WTO is warranted. Making explicit the trade offs of using export measures and a regular discussion of the situation in the markets will help restore trust in the multilateral trading system, which, in the end is so crucial for many food insecure countries.

4 CONCLUSIONS

Trade measures can be compared to standing up in a crowd at a ballgame. If one person stands up he will have a better view, but his action will trigger other people to stand up as well to get a better view. When global wheat prices rise, it makes sense for a large exporter to impose trade measures (e.g. increased export taxes) that stabilise prices because it has a positive effect on domestic food security. In this case, a net importer can react by lowering import tariffs to achieve the same aim. Countries that do not implement trade measures (increasing export or lowering import tariffs) face higher world wheat prices as well as lower welfare as a result of such unilateral policy actions. In a sense, domestic food insecurity is exported to the rest of the world.

The results show that changes in wheat prices are not the only determinant of food security. Household income matters as well in determining the impact of shocks on food security. Household incomes are affected by changes in the economy through changes in wage rates as well as capital returns. Large exporters that protect domestic consumers from high global wheat prices do so at a cost: domestic farmers face lower producer prices. Net importing countries that lower import tariffs will see a reduction in their trade tax revenues. Trade tax revenues can be an important source of income. We observe that these trade tax revenue effects dominate in the case of Tanzania and lead to unforeseen reductions in overall food security.

When trade tax revenues fall, the poorest wheat importing countries may need support to find alternative sources of government revenues. Otherwise they may run into serious problems of not being able to finance expenditures on basic needs.

Liberalisation of international markets may be a solution. Our analysis shows that a wheat supply shock occurring in a world where all nations have liberalised, leads India and Tanzania to be more food secure in wheat and to experience an improvement in welfare, compared to if these countries were to take unilateral trade measures. Globally, more wheat is produced at lower cost, as a result of which world wheat prices rise less and world food security in wheat improves. in such a scenario, global welfare is higher.

Impacts across regions are, however, highly uneven. Specifically, when all countries liberalise, production is expected to shift away from Asia and Africa into US & Canada, Rest of Latin America and Caribbean and Former Soviet Union, whereas wheat

[8] The General Agreement on Tariffs and Trade (GATT) and the Agreement on Agriculture (AoA). The AoA was established because agricultural goods were not integrated into GATT. However, the AoA represents an important improvement towards increased liberalisation of the trade rules in the agricultural sector.

consumption in the Africa and Asian regions is expected to rise. Thus the Africa and Asian regions have become more food secure, but less food sovereign and less food self-sufficient. This may be unacceptable in political terms. A clear concern in this respect is the volatility of world food prices and the associated risk for domestic food security that comes with being more import dependent. In addition, trade tax revenues mostly fall in a fully liberalised world, which may again be politically undesirable, especially in developing countries that largely depend on import tax revenues as a source of income.

To achieve that no country imposes export bans or that 'everyone sits at the wheat market ballgame', a concerted and co-ordinated action is required. Such concerted action in avoiding export bans will need to be done at the WTO forum trough clarification and sharpening of the rules in the WTO. Making explicit the trade offs of using export measures and a regular discussion of the situation in the markets will help restore trust in the multilateral trading system, which, in the end is so crucial for many food insecure countries.

References

Bouet, A. & Laborde Debucquet, D., 2010. The economics of export taxation in a Context of Food Crisis: a theoretical and CGE-approach contribution, Washington D.C.: IFPRI.

Demeke, M., Pangrazio, G. & Maetz, M., 2009. Country responses to the food security crisis: Nature and preliminary implications of the policies pursued, Rome: Food and Agriculture Organization.

Francois, J. & Reinert, K., 1997. Applied Methods for Trade Policy Analysis: A Handbook, Cambridge, United Kingdom: Cambridge University Press.