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COMMITTEE ON COMMODITY PROBLEMS

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OPTIONS FOR HARNESSING TRADE AS AN ADAPTATION MECHANISM FOR CLIMATE CHANGE

Executive Summary

This document reviews the likely impacts of climate change on agricultural production, trade and food security and discusses the importance of trade as an adaptation mechanism to climate change. The document points at knowledge gaps and the need for more evidence-based and quantitative impact assessments of climate change on trade, and ultimately food security. The results of these assessments could be used to examine the need and directions in which the existing trade policy environment needs to be adjusted to inform policy decisions and strengthen the role of international trade as a means of adaptation to the impacts of climate change.

Suggested action by the Committee

The Committee is invited to discuss the content and key messages contained in this document, and particularly the potential role of international trade in responding to climate change.

The Committee may wish to request FAO to:

- Analyse and quantify commodity-specific impacts of climate change at country level.
- Gauge the potential and the specific options of trade as an adaptation tool to the impacts of climate change and explore the potential of trade as a means to help mitigate climate change.
- Based on the above, identify climate-smart trade policy options.
- Examine whether the trade policy space afforded by the existing trade policy environment, notably the multilateral trade agreements, is sufficient to address the challenges arising from climate change on food security.
- Explore how co-benefits from trade policy reforms can be reaped for climate change adaptation and mitigation efforts.

Queries on substantive content of the document may be addressed to:

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I. Introduction

1. There is growing evidence that climate change will have marked impacts on agricultural production. Changes in production will have indirect effects on agricultural trade, international prices and eventually on food security. Studies[1] analysing the likely impacts of climate change suggest that trade will not only be affected by climate change but that it could play a pivotal role in helping countries to adapt to the expected changes of, or mitigate climate change.

2. Most studies to date have focused on the likely impacts of climate change on agricultural production, which undergirds the availability dimension of food security. As noted by the Intergovernmental Panel on Climate Change (IPCC), there is less quantitative understanding of how the other dimensions will be affected, without quantifying the likely effects on incomes (access), food safety and nutrient content (utilization) and vulnerability (stability). A review of peer-reviewed journal articles on food security and climate change since 1990 showed that 70 percent of the studies were about availability, focusing mainly on the impact of climate change on crop yields[2].

3. In general, the results suggest that the impacts of climate change on crop productivity are expected to be negative in low altitude and low-latitude (tropical) regions and somewhat positive in high-altitude and high-latitude regions. The benefits in high latitude areas arise from the yield-enhancing effects of higher temperatures and longer growing seasons at least until mid-century[3]. The opposite holds for many low-latitude areas. Particularly hard hit will be arid and semi-arid regions, which will be even more exposed to lower precipitation and higher temperatures. Many of the areas where crop yields are expected to decrease are also areas that are already experiencing high degrees of food insecurity[4]. The Fifth Assessment Report (AR5) of the IPCC reiterates with 'high confidence' that the entire food system will be potentially affected by climate change and with it all the four dimensions of food security[5].

4. This document reviews the likely impacts of climate change on agricultural production, trade and food security. It gauges the importance of trade as an adaptation mechanism to climate change, addressing also the limits of trade to compensate for climate impacts and the trade-offs between trade benefits and environmental costs. The document points at knowledge gaps and the need for more evidence and quantitative impact assessments of climate change on trade. Such assessments could then

[1] FAO (2016), *Climate change and food security: risks and responses*, Food and Agriculture Organization of the United Nations, 2016

[2] Wheeler, T. and von Braun, J. (2013), 'Climate change impacts on global food security', *Science*, Vol. 341(6145), *cited in* FAO (2016), *op. cit.*

[3] FAO (2015), *Climate change and food systems: global assessments and implications for food security and trade.* Food and Agriculture Organization of the United Nations, Rome, 2015.

[4] FAO (2016), *op. cit*.

[5] IPCC (2014). *Climate change 2014: impacts, adaptation, and vulnerability. Part A: Global and sectoral aspects*. Contribution of Working Group II to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change. C.B. Field, V.R. Barros, D.J. Dokken, K.J. Mach, M.D. Mastrandrea, T.E. Bilir, M. Chatterjee, K.L. Ebi, Y.O. Estrada, R.C. Genova, B. Girma, E.S. Kissel, A.N. Levy, S. MacCracken, P.R. Mastrandrea & L.L. White, eds. Cambridge, UK, and New York, USA, Cambridge University Press.

be used to examine the need and directions in which the existing trade policy environment needs to be adjusted so as to inform policy decisions and strengthen the role of international trade as a means of adaptation to the impacts of climate change.

II. Climate change, trade and food security

Impacts on Agricultural Production and Food Availability

5. FAO has estimated that global food supply would need to increase by 60 percent from 2006 to 2050[6]. These estimates are even at the lower end of the spectrum of available projections[7] with some studies projecting a doubling of production by mid-century. However, all readily available studies foresee that climate change will raise the pressure on the natural resource base and add to upward pressure on international food prices.

6. Based on a meta-analysis of 1700 model simulations, global yields of rice, maize and wheat would decrease by between 3 and 10 percent per degree of warming above historical levels[8]. The AR5 analysed 66 yield impact studies for major cereals, showing that yields of maize and wheat begin to decline with 1°C to 2°C of local warming in the tropics, while temperate maize and tropical rice yields are less clearly affected at these temperatures. Moreover, a consolidated study on the impact of global climate change on agriculture, conducted in the framework of the Agricultural Model Intercomparison and Improvement Project (AgMIP) and Inter-Sectoral Impact Model Intercomparison Project (ISI-MIP), finds that by 2100 the impact of climate change on crop yields for high-emission climate scenarios ranges between -20 and -45 percent for maize, between -5 and -50 percent for wheat, between -20 and -30 percent for rice and between -30 and -60 percent for soybean[9]. A number of other studies have attempted to quantify the likely impact of climate change on fish and livestock production, with one recent study projecting 5–10 percent decreases in potential fish catch in tropical marine ecosystems by 2050[10].

7. Climate change will also take a toll on natural resources and growing conditions. Climate change will add to water scarcity, especially in mid-altitude and dry tropics, which will face increased droughts, while it may lead to excess precipitation in already well supplied areas. As a result, dry areas are expected to get drier, while wet areas are likely to get wetter. These changes also mean that climate change will very likely change the geography of production. In broad terms, production is expected to shift from low latitude areas to high latitudes areas, and hence, from food deficit areas to food surplus areas. This shift has motivated the calls for additional adaptation measures in two principal areas. First, affected regions need to strengthen the resilience of their agricultural production systems and second, the trade policy environment may need to change so that it better enables agricultural trade to play a more effective role in bridging supply deficits.

Impacts on Food Access

8. Climate change also affects the purchasing power of consumers, notably of the poor[11]. Impacts on production directly translate into social and economic impacts at various scales, on the farm and in the food system, through a range of different pathways that can result in changes in agricultural incomes and prices and also affect trade patterns and investment trends. At a national level, they can trigger an increase in agricultural commodity prices (food and feed), which, in turn, affects the

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[6] Alexandratos, N. and Bruinsma, J. (2012), World Agriculture towards 2030/2050, The 2012 Revision FAO, http://www.fao.org/docrep/016/ap106e/ap106e.pdf
[7] Hertel, T. et al : Predicting Long-Term Food Demand, Cropland Use, and Prices Annu. Rev. Resour. Econ., 2016. 8:18.1–18.25
[8] Challinor *et al* (2014), cited in Campbell *et al*. (2016), *op. cit*
[9] FAO (2016), *op. cit*
[10] Barange *et al* (2014), cited in Campbell et al. (2016), *op. cit*
[11] Campbell, B., et al. (2016), *op. cit.*

economic and social status of the whole population, particularly in countries and households where an important part of the available income is spent on food[12].

9. A number of studies have tried to quantify the likely impacts of climate change on food prices. On average, most model projections indicate some price increases as a result of climate change, although the magnitude and locations vary considerably across models and climate change scenarios[13]. A study that coupled scenarios for population and income growth with climate change scenarios found that international prices could rise significantly by 2050. Compared to 2010, real prices for maize, rice and wheat could rise by 87 percent, 31 percent and 44 percent respectively[14] and, unsurprisingly, price increases would rise with higher temperatures. However, these studies also suggest that the impacts of different socio-economic pathways (Shared Socio-economic Pathways, SSP), with different trade policy assumptions, could have a much more pronounced impact on food prices and food security than the agro-climatic changes as such. This underlines the importance of an appropriate policy environment in general, and a conducive trade policy environment in particular.

10. Apart from the overall economic conditions, incomes of farmers and rural households will be directly affected by changes in agriculture outputs, their volumes and their quality. All of these factors are subject to changes brought about by climate change. Agricultural producers who are net food buyers are particularly vulnerable. At the macro level, low-income, resource-poor and net importing countries with limited potential for increased supply responsiveness could experience significant losses in access to food through a doubly negative effect stemming from reduced domestic production and increased food prices on the international markets[15].

Impacts on Food Utilization

11. Climate change affects food trade and utilization primarily through two dimensions: food safety through the supply chain, and health impacts from climate change that mediate nutritional outcomes[16]. In general, climate change is likely to reduce food safety through a higher incidence of food-borne diseases. Several studies have focused on individual factors, such as mycotoxins, pesticide residues and ciguatera fish poisoning (CFP)[17]. A recent, broader study on climate change impacts on food safety concluded that climate change could reduce food safety and that more research is required to get a better understanding of the issues[18].

12. Policies and institutions dedicated to the prevention and management of specific risks and vulnerabilities that can be influenced by climate change, such as pests and diseases, invasive species, wild fires, etc., are mainly local, but they can be effectively supported by international cooperation and tools. For instance, global cooperation to combat plant pests is facilitated by International Plant Protection Convention (IPPC), the main international standard-setting body for plant health. The increased pest and disease pressure expected with climate change would warrant increased international cooperation to prevent and manage transboundary risks. Developing countries in particular may need additional support in dealing with related trade restrictions under the World Trade Organization's (WTO) Agreement on the Application of Sanitary and Phytosanitary Measures (the SPS Agreement).

13. Climate also affects health via a myriad of pathways, including vector-borne diseases, heat stress and natural disasters, which in turn affect the nutrition of people plus their ability to provide care

[12] FAO (2016), *op. cit.*
[13] Campbell, B., et al. (2016), *op. cit*.
[14] Nelson *et al.* (2010), cited in FAO (2016), *op. cit.*
[15] IPCC (2014), *op. cit*.
[16] Campbell, B., et al. (2016), *op. cit*.
[17] Schmidhuber, J., and Tubiello, F. N. (2007), *op. cit.*; IPCC (2014), *op. cit.*; FAO (2016), *op. cit.*
[18] Uyttendaele, M. & Hofstra, N., eds. 2015. Impacts of climate change on food safety. *Food Research International*. Vol 68, No. 1, cited in FAO (2016), *op. cit.*

for their children and dependents' food security[19]. Potential impacts of climate change on nutrition have been much less studied, though several impact pathways can be identified. As mentioned above, climate change will impact the livelihoods and incomes of small-scale food producers. Furthermore, through food price increases and increased volatility, it will also affect the livelihoods of poor net food buyers, constraining them to reduce health expenditures with potential effects on nutrition[20].

14. In terms of direct climate impact on the nutritional content of foods, a summary of recent literature is given in the report by the High Level Panel of Experts (HLPE)[21] of the Committee on World Food Security (CFS). Research on grains, for instance, generally shows lowering of protein content with elevated temperature and CO2 levels[22]. Climate-induced loss of pollinators poses significant implications for the viability of crop production and, therefore, dietary diversity – a key element of nutrition[23]. In addition to these impacts on nutrition, droughts and floods severely impact the reliability of drinkable water supply[24].

Impacts on commodity markets and price stability

15. With climate change, the risks to food and nutrition security are exacerbated by the expected increase in the frequency and intensity of climate-related events. Shocks and crises caused by extreme weather events such as drought, floods and hurricanes destroy crops, livestock and fish resources, as well as agriculture, livestock and fishing/aquaculture infrastructure and productive assets, reducing overall food production capacity. They can disrupt markets and trade, reduce incomes, deplete savings and erode livelihoods. At the same time, disasters contribute to ecosystem degradation and loss, including increased soil erosion, declining rangeland quality and salinization of soils. In turn, increasing environmental degradation reduces the availability of goods and services and adversely affects economic opportunities and livelihood options.

16. Increased food price volatility is another potential impact of climate change. Recent international food price spikes often followed climate extremes in major producing countries, and have become more likely as a result of climate trends. Recent experience indicates that weather-related effects on food price volatility can be exacerbated by trade policy, with export restrictions contributing to price fluctuations. Another threat to the stability of food markets is that agricultural prices are becoming more and more coupled with energy prices. On the input side, modern food systems are heavily reliant on fossil fuel energy, either directly as fuel (for pumping water, field mechanization or processing) or indirectly as a key input into the manufacture of nitrogen fertilizers. On the output side, the recent episode of high energy prices (2007–2013) suggests that food and agricultural produce can become competitive feedstocks in the energy market. At high energy prices, demand from the energy market can siphon off large amounts of agricultural produce from the food market into the energy market. This creates a de facto floor price for food and agricultural products[25] and passes price changes from the energy market onto the food market. This also means that climate-related volatility in energy markets could further add to volatility in food markets[26].

17. Market stability is also affected by changes in seasonality, increased variance of ecosystem productivity, higher supply risks and reduced supply predictability. These effects could be

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[19] Campbell, B., et al. (2016), *op. cit*.
[20] FAO (2016), *op. cit*.
[21] HLPE (2012). *Food security and climate change*. A report by the High Level Panel of Experts on Food Security and Nutrition of the Committee on World Food Security, Rome.
[22] IPCC (2015), *op. cit*.
[23] Potts, S., et al. (2010), Global pollinator declines: trends, impacts and drivers. *Trends in Ecology and Evolution* Vol.25, No.6.
[24] FAO (2016), *op. cit*.
[25] Schmidhuber, J. Biofuels: An emerging threat to Europe's Food Security? Impact of an increased biomass use on agricultural markets, prices and food security: A longer-term perspective. http://www.institutdelors.eu/media/policypaper-schmidhuber-en.pdf?pdf=ok, Notre Europe, 2007
[26] FAO (2016), *op. cit*.

compounded in some regions, particularly in landlocked countries and small island states by reduced physical access, and be further aggravated in the case of extreme events[27].

18. Moreover, one important potential consequence of climate change may be a change in investment patterns in such a way as to reduce long-term productivity and resilience of agricultural systems. Greater uncertainty reduces the incentives to invest in agricultural production, which could offset positive impacts resulting from higher prices. This is particularly true for poor family farmers and smallholders with limited or no access to credit and insurance[28].

19. A critical question is whether trade can make markets less volatile by expanding the market size and the traded volumes or whether it adds to volatility by introducing greater uncertainty with regard to exportable availabilities and prices, all of which affect access to food. In the short term, imports can mitigate the likelihood of shortages resulting from climate-related local production risks, yet obligations with regard to trade agreements may reduce the policy space to deal with such market shocks with negative impacts on the poor's incomes, employment and livelihood strategies[29].

The role of international agricultural trade under Climate Change

20. One of the main conclusions of the AR5 is that this shift in the production potential could result in substantially higher trade flows from mid- to high latitude areas to the low latitudes areas. The preceding analysis highlighted that many factors will eventually affect the volumes and the composition of trade flows under climate change. They include yields and yield potentials under new agro-climate conditions, changes in the suitability of arable land, the availability of precipitation and water for irrigation, developments in energy markets, population growth and changes in consumption patterns. They also include policies, with an obvious role for trade policies at the global and regional level.

21. Trade can play a stabilizing role in compensating for regional changes in productivity and food price volatility by shifting supplies from food surplus to food deficit regions and by shifting production to those regions where food can be produced more efficiently, partially compensating for losses in other parts of the world[30]. Whether the likely shifts are large enough to bring about fundamental change in the global trading system for food and agriculture is, however, less clear. Model-based projections suggest that the net trade positions of key trading blocs would remain largely unchanged in the long-run, to 2050 (FAO, 2016). For instance, the United States of America and the former Soviet Union will remain net exporters in wheat, and the United States and Latin America will remain exporters of coarse grains. In the case of rice, Southeast Asia, the United States of America and India are projected to remain net exporting regions. The main net importers of wheat, rice and coarse grains are likely to be countries in the Middle East, North Africa and sub-Saharan Africa. The United States of America and Latin America are projected to remain net exporters in oilseeds, with China a net importer. Many important policy questions are concerned with identifying how much, where, and how different these responses will be, and there is no clear consensus that has yet emerged in this regard[31].

22. Trade plays an important equilibrating role between resource rich and resource poor regions, especially water. Countries facing water or land scarcity face critical trade strategy choices. On the export side, products like fruits and vegetables are significant sources of income and employment, but they are also high in water requirements. On the import side, climate-induced rising water scarcity

[27] FAO (2016), *op. cit*.
[28] IPCC (2014), *op. cit*.
[29] FAO (2015) *The State of Agricultural Commodity Markets (SOCO) 2015-16: Trade and food security: achieving a better balance between national priorities and the collective good*, Rome, 2015
[30] Julia, R. & F. Duchin. 2013. Land Use Change and Global Adaptations to Climate Change. *Sustainability*, 5: 5442-5459.
[31] Ahammad, H. *et al*, (2015). 'The role of international trade under a changing climate: insights from global economic modelling'. *In* A. Elbehri, ed. *Climate change and food systems: global assessments and implications for food security and trade*. Rome, FAO.

means more dependence on imports which may raise new sources of risk and food supply dependability[32]. For regions facing water scarcity problems, for example, a water-smart trade policy that prioritizes food imports of highly water-intensive food sourced from water-abundant regions could provide an important element of its adaptation strategy. These policies could be combined with appropriate domestic policies, including investments in enhancing water productivity and related infrastructure, and improved pricing and non-pricing measures.

The limits of trade

23. While trade can play an important role both as a means of adaptation and mitigation, there are also important trade-offs associated with a greater role of trade under climate change. First, there are trade-offs between trade and the environment. Trade can exacerbate resource scarcity, particularly where the effects of overuse of environmental resources is not appropriately reflected in the price of the resources (excess demand on land, water or biodiversity stemming from external demand for commodities produced with these resources). Second, trade itself requires transportation and hence energy resources that may not be fully reflected in the price of a product, embodied in the 'food miles' concept, even if in reality, transportation represents only a small part (estimated at 11 percent) of global food systems' emissions[33]. Third, dependence on imports to meet food needs may increase the risk of exposure to higher market and price volatility that is expected under climate change[34]. Finally, the ability to realize the compensating potential of international trade depends, in any case, on a well-functioning international trade architecture[35].

III. Strengthening the role of trade in addressing climate change induced food security challenges

24. There is a broad consensus that trade can play an important role in alleviating climate-induced food security challenges. Trade allows food products to flow from surplus to deficit areas, enlarges market volumes, and lowers price swings. Trade can also help compensate for local losses that may arise from increased pest and disease pressure. The current trade policy environment, however, has been shaped by pressures to reduce market distorting policies and past conditions and trends, including existing weather patterns and the overall agro-climatic environment. This has given rise to concerns that the current trade policy environment may not offer enough space to accommodate the challenges arising from climate change. It has also given rise to concerns that climate change policies pursued by national governments could be at odds with the existing multilateral trade rules, triggering calls for additional flexibilities to cope with climate change impacts. While this paper does not address these concerns or provide answers to related questions, it tries to stimulate a discussion which could add to an agenda that examines these issues in greater detail.

Global climate change and multilateral trade negotiations

25. In principle, there should be no fundamental conflict between international climate change policies and trade rules. For instance, the United Nations Framework Convention on Climate Change (UNFCCC) explicitly states that measures taken to combat climate change should not constitute a means of arbitrary or unjustifiable discrimination or a disguised restriction on international trade. The recently adopted 2030 Agenda for Sustainable Development reinforces the idea that an open, non-discriminatory, multilateral trading system and actions that protect the environment and promote sustainable development can and must be mutually supportive.

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[32] Gilmont (2015), *op. cit.*
[33] FAO (2013), *op. cit*.
[34] Elbehri, A., Elliott, J. & Wheeler, T. (2015) Climate change, food security and trade: an overview of global assessments and policy insights. *In* A. Elbehri, ed. *Climate change and food systems: global assessments and implications for food security and trade.* Rome, FAO.
[35] FAO (2013), *op. cit*.

26. In practice, however, explicit negotiations on trade and environment already constitute an important part of the WTO Doha Development Agenda with the mandate to reach a better coordination between these two policy areas. It calls for a clarification of the relationship between existing WTO rules and specific trade obligations set out in multilateral environmental agreements (MEAs) and potentially for a reduction or elimination of tariffs and non-tariff barriers on environmental goods and services. The lack of a universally agreed definition on environmental goods and services has also led to discussions on the scope of steps that could be taken towards liberalization. These discussions have not yet rendered any conclusions, not even for the so-called 'climate-friendly' sub-group of products.

Domestic climate change policy and border measures

27. Conflicts between the trade and climate frameworks can also arise when, for instance, countries pursue unilateral policy choices to reduce emissions through regulatory regimes, including carbon taxes and border measures. Reconciling climate change objectives and multilateral trade policies can prove particularly difficult[36] where trade is seen to undermine national mitigation efforts. For instance, importing countries may be inclined to introduce import restrictions on imports of goods produced with deep carbon footprints to avoid "carbon leakage". Such border measures could take the form of import fees levied by carbon-taxing countries on goods manufactured in non-carbon-taxing countries. Whether such import measures are compatible with the existing WTO rules remains subject to an ongoing debate; currently no agreement exists that provides additional and climate change-specific flexibilities, which means that additional tariffs to avoid carbon leakage would need to be accommodated within existing bound rates.

28. The desire to differentiate products according to their carbon intensity has also given rise to labelling and the proliferation of standards. Most notably, it has led to a glut of private standards, frequently applied in the retail sector of high-income countries. A point in case is the requirement of carbon footprint labelling introduced by some European supermarket chains. While such labels can help improve market transparency and thus help consumers make informed choices, they can also add to costs for producers; this is an issue of particular concern for small-scale producers in developing countries, operating within an environment of underdeveloped marketing and processing infrastructures.

29. Moreover, different methods used to calculate the carbon intensity of production (lifecycle analyses) can result in largely different carbon footprints and hence a different labelling of imported versus domestically produced products. For example, depending on the method used, emissions associated with refrigerated fruits and vegetables in Europe can be higher or lower than the emissions from offseason fruit shipped from Africa. This means that not only the labelling rules would need to be standardized, but also the methods underlying the calculations of the emission intensity. These issues may also require extra training and capacity development for developing countries' exporters.

30. Overall, climate change related trade regulations are likely to be guided by the treatment of environmental measures in the multilateral trade agreements, which remain somewhat ambiguous. Article XX of GATT provides some exceptions to the rules on border measures that are "necessary to protect human, animal or plant life or health". Exceptions from the agreement are granted in relation to "the conservation of exhaustible natural resources if such measures are made effective in conjunction with restrictions on domestic production or consumption". Under the current WTO rules, any such tariffs cannot be discriminatory, meaning that importers cannot differentiate in their application of import duties among exporters with variable degrees of emissions per unit of output (Blandford, 2013).

[36] ICTSD-IPC (2009), ICTSD-IPC Platform on Climate Change, Agriculture and Trade: Considerations for Policymakers

Agricultural subsidies and climate change

31. Not only trade, but also domestic policies play an important role in affecting the ability of trade as a means of adaptation to climate change. Globally, to meet the growing demand, food production is expected to rise by 60 percent to 2050 and by nearly 80 percent in developing countries. The additional production plays a pivotal role in reducing hunger and enhancing rural incomes. Incentives to promote agricultural production can play a critical role in accelerating this process, but they may also add to greenhouse gas emissions associated with the additional outputs. Promoting products such as milk, beef, rice, or sheep and goat meat can play a particularly important contribution to improved nutrition and development outcomes, their production is often labour-intensive, the derived food products are nutritious, and they allow to harness otherwise difficult to use resources such as roughages, marginal pastures or low productivity cropland. But it is exactly these activities that also cause particularly high greenhouse gas emissions. The challenge to reconcile increased food production, improved nutrition and higher incomes with lower carbon emissions has given rise to a proliferation of proposals to make agriculture more climate-smart. Less advanced, however, is the debate about whether and to what extent such proposals require or justify additional policy space.

32. In addition to payments that promote production, there are an increasing number of schemes that compensate farmers for foregoing production or for complying with environmental programmes. Also here, WTO rules are relatively unspecific. Payments under climate-related schemes, for example for the adoption of new technologies or providing environmental services, such as carbon sequestration by avoiding deforestation, are likely to fall under the green box measures that are not subject to reduction in domestic support[37] (Blandford, 2013), although it will depend on the exact specifications of each policy measure.

33. Making trade more climate-smart also means improving its ability to buffer shortfalls and absorb surpluses. This may require additional investments, notably in transportation and storage infrastructure. As there are no climate-specific regulations to allow for or even promote such additional investments, the existing policy space may need to be examined more carefully. Within the existing regulations, investment and input subsidies for low-income or resource-poor producers in developing country WTO members are exempted from domestic support calculations by WTO rules under Article 6.2. Other types of measures, which do not fit within the Green Box or Article 6.2, would have to be within the limits of the existing domestic support commitments.

34. Financing of storage facilities will also be an important prerequisite for ensuring stable food supplies, particularly in situations of elevated risks of crop disruptions or spreading of pests. In this context, the WTO stockholding provisions may receive additional attention, as countries are likely to make greater use of public resources to maintain and manage stocks in the face of heightened price and production volatility.

Sanitary and phytosanitary measures

35. Climate change is also expected to increase the pest and disease pressure in agriculture and to stimulate the migration of weeds, insects and pathogens into new areas. Higher trade volumes in the presence of increased pest and disease pressures may pose extra challenges to the national SPS systems. Particularly developing countries could be faced with the growing burden to ensure compliance with SPS requirements[38]. This is likely to add to discussions about the setting and application of SPS standards, their stringency, and the need to balance the legitimate interests of food

[37] Annex II of the Agreement on Agriculture refers to payments under environmental programmes that are exempted from reduction commitments under the Green Box. Such payments have to be part of a clearly-defined government environmental or conservation programme and be dependent on the fulfilment of specific conditions under the government programme, including conditions related to production methods or inputs. Moreover, the amount of payment shall be limited to the extra costs or loss of income involved in complying with the government programme.

[38] http://www.standardsfacility.org/sites/default/files/STDF_Briefing_No2_EN_web_0.pdf

safety, plant and animal health concerns and a reduction in trade barriers to harness the role of trade as an adaptation measure. Overall, rising trade volumes in conjunction with rising pest and disease pressure are likely to keep SPS measures at the forefront of the international trade policy debate.

Stronger global governance on trade as a tool for climate change adaptation

36. Climate change is expected to cause more and more extreme weather events, which in turn will contribute to more frequent and more significant price swings. The heightened price volatility of the past decade could be a harbinger for even larger swings under climate change. More worrisome perhaps, the policy measures triggered by past price volatility could be a harbinger for policy reactions under climate change. To ensure stable domestic supplies, some countries have chosen to restrict their exports, particularly when prices spiked in 2008 or 2010[39]. While such a reaction is understandable from a domestic perspective, it added to price hikes on international markets. Such policy responses may cause even larger price swings under climate change. Past experience in dealing with export restrictions suggests that it may be difficult to reach a consensus; but it also confirms that a multilaterally agreed regulatory framework governing the use of export restrictions would be useful to mitigate price volatility. This is particularly the case, if and when price fluctuations increase under climate change.

37. Increased price volatility has also given rise to calls for greater market transparency. Under the initiative of the G20, the Agricultural Market Information System (AMIS) has made important progress in enhancing market transparency through the provision of more, better and more timely market information. Importantly, it fostered improved collaboration and an intensive dialogue among main producing, exporting and importing countries. Climate change may mean that additional efforts are warranted in bringing more countries and in engaging the private sector more fully in these endeavours.

38. Improved market transparency can help better prepare for, and possibly even avoid, increased price volatility. Such measures may need to be supplemented with efforts that allow to better cope with the remaining challenges from increased volatility. Here, an important area of international action is the mitigation of financial risks that high and volatile food prices pose to the net food-importing developing countries (NFIDCs). Under climate change the access to financial mechanisms by NFIDCs in time of emergencies may need to be strengthened, possibly through the International Monetary Fund's (IMF) facilities.

39. Finally, also the international architecture for food aid donations could be made more responsive to the challenges arising from climate change. Some ideas[40] in this area that could be considered under the Food Assistance Convention (FAC) include, inter alia: (i) broadening the FAC donor base; (ii) earmarking and prioritizing FAC resources to emergency operations and nutrition intervention programmes; (iii) fully incorporating donations in agricultural inputs into the FAC; and (iv) providing more flexibility in annual donor contributions, recognizing the very nature of emergency requirements, being variable from year to year[41].

[39] See for example FAO, IFAD, IMF, OECD, UNCTAD, WFP, World Bank, WTO, IFPRI and UN HLTF. 2011. Price Volatility in Food and Agricultural Markets: Policy Responses. Inter-agency report. June 2011. Available at: https://www.oecd.org/tad/agricultural-trade/48152638.pdf

[40] Konandreas, P. (2010, Promoting agricultural inputs under the Food Aid Convention to increase food production in emergency-prone developing countries, FAO. Available at: http://www.fao.org/emergencies/resources/documents/resources-detail/en/c/171067/

[41] This would necessitate amending Article VI of the 1999 FAC on carry-forward and carryover, to give donors a degree of flexibility in inter-year shifting of their contributions to better respond to variable needs.