POSSIBLE BREAKTHROUGHS
MAKING USE OF TRADE

Factors that may influence global food markets are the evolution of the structure of the private sector, the uncertainties associated with competition for energy (especially through oil prices and biofuel demand) and water and the effects of climate change.[1] Both water and energy are key inputs into any economy. So countries without these basic resources will depend on other countries that do have them. North Africa and the Middle East, but also countries like Mexico and Japan, are heavily dependent on the import of water-intensive commodities.[2] The export of a product from a water-efficient region (relatively low virtual water content of the product) to a water-inefficient region (relatively high virtual water content of the product) saves water globally. This is the physical point of view. Whether trade of products from water-efficient to water-inefficient countries is beneficial from an economic point of view depends on a few additional factors. These include the character of the water savings (blue or green water savings) and the differences in productivity with respect to other relevant input factors, such as land and labor, technology, the costs of engaging in trade, national food policies and international trade agreements.[3]

[1]Godfray 2010, [2]Hoekstra and Chapagain 2008, [3]Ibid.

Geography

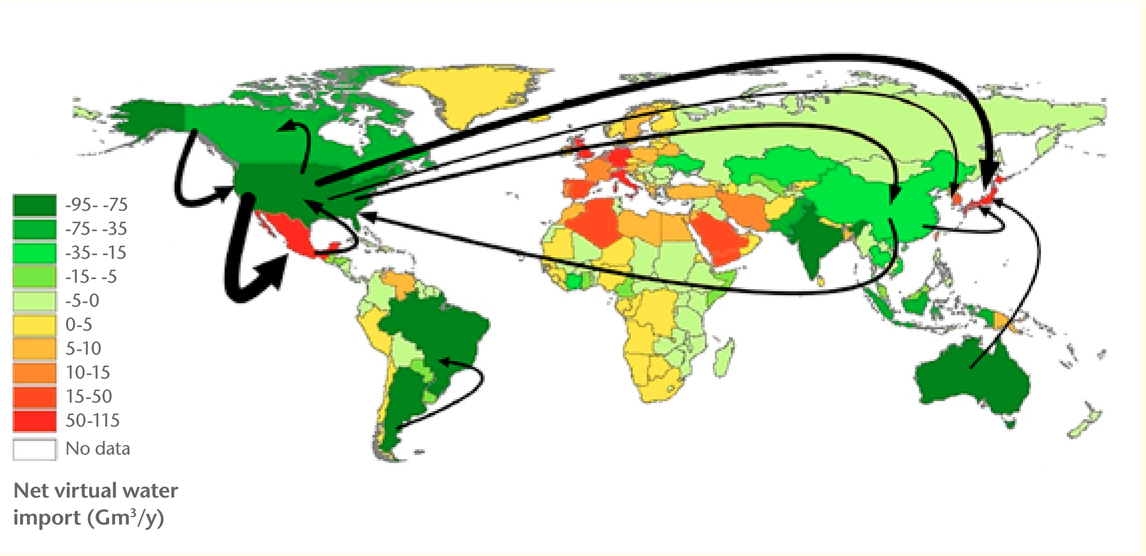
The increase in trade appears not to be pulled by efficiency gains but more pushed by land and water scarcity. The international trade of water-intensive products (e.g., agricultural commodities) or virtual water trade has been suggested as a way to save water globally.[4] However, a number of economists have expressed reservations regarding whether virtual water trade is a legitimate economic concept and whether it accords with longstanding knowledge about the international economy and comparative advantage.[5] Ansink[6] argues that relative water abundance does not make a good predictor of trade flows in water-intensive products. That is why it is important to take into account results from these two different viewpoints on food trade: virtual water trade (water footprint) and food trade according to comparative advantage.

Virtual water trade and water footprint

The biggest net exporters of virtual water are found in North and South America (the United States, Canada, Brazil, Argentina), Southern Asia (India, Pakistan, Indonesia, Thailand) and Australia. The biggest net virtual water importers are North Africa and the Middle East, Mexico, Europe, Japan and South Korea. Figure 1 shows the virtual water balance per country and the largest international gross virtual water flows. Countries shown in green have a negative balance, meaning net virtual water exports. The countries shown in yellow to red have net virtual water imports.[7]

Figure 1

Virtual water balance per country and direction of gross virtual water flows related to trade in agricultural and industrial products over the period 1996–2005



Note: Only the biggest gross flows (>15 Gm³/year) are shown.

[4]Dalin et al. 2012, [5]Reimer 2012, [6]Ansink (2010), [7]Hoekstra and Mekonnen 2012

Food trade according to comparative advantage

Over the period 1990-2001, only 7% of world agricultural exports were from developing countries. Despite the growth of intra-developing country agricultural trade, agricultural exports only accounted for about 20% of world exports in 2006/07. Developing countries still export a greater amount to industrialized countries than to other developing countries. Despite these changes in the shares, nearly half of world agricultural trade still takes place between industrial countries.[8]

The outlook is that developing countries will become significant net importers, with a trade deficit of almost US$ 35 billion by 2030. This is because of the current rapid growth in imports of temperate-zone commodities by developing countries.[9]

Bruinsma[10] argues that a main driver of shifts in trade patterns at the detriment of developing countries was the difficulty competing with subsidized surpluses of temperate-zone commodities from Organisation for Economic Co-operation and Development (OECD) countries. Then the overall economic development contributed to higher imports of temperate-zone commodities.

The increased trade flow may affect commodity prices. The high prices in 2008 and 2011 coincided with high fuel prices, reduced grain stock and increased demand on the world market because of the emergence of bioethanol and the adverse natural and political conditions affecting food supplies. Global stocks versus use in 2010 stood at 20% of global use, a drastic reduction from 40% in 1986.

C&A and the Water Footprint Network

C&A has developed methods to invest in more sustainable use of water. A study in cooperation with the Water Footprint Network (WFN), of which C&A is a sponsoring partner, concluded that C&A's increasing commitment to the sourcing of organic cotton fiber had led to an improvement in the grey water footprint in organically farmed areas in relation to areas where the cultivation of cotton still takes place in more conventional ways. From a quantitative perspective, and in partnership with Cotton Connect, C&A invested financially in supporting various ways to enable marginal farmers to purchase drip irrigation equipment and therefore, to substantially reduce their water use while increasing yields at the same time.

For more information about the water footprint go to www.waterfootprint.org

[8]Aksoy and Ng 2010, [9]Bruinsma 2003, [10]Ibid.

Energy

- Non-CO_2 emissions will mostly shift to China due to comparative advantages in livestock production and rising livestock demand in the region.[11]
- Deforestation, mainly in Latin America, leads to significant amounts of additional carbon emissions due to trade liberalization.[12]
- Under the International Energy Agency (IEA) Alternative Policy Scenario (APS), the global biofuel water footprint will increase more than ten-fold in the period 2005-2030. The U.S., China and Brazil together will contribute half of the global biofuel water footprint.[13, 14]
- Brazil, the world's pioneer in the production of ethanol, remains the largest exporter with 5.1 billion liters exported in 2008 to more than 40 countries.[15]
- Gerben Leenes et al.[16] show that the water footprint of energy from biomass is 70 to 400 times larger than that of a mix of energy from non-renewable sources.

Water

- The volume of virtual water that is traded globally is 68,125 m^3 per year, which accounts for approximately 10% of the global freshwater used in agriculture or 8% of total global water use.[17]
- Global water savings are modest. Global water use in the period 1997-2001 for the production of agricultural products for export equaled 1,250 billion cubic meters (Gm^3)/year. If the importing countries had produced the imported products domestically, they would have required a total of 1,600 Gm^3/year to do so, which means savings of just 5%.[18]
- The largest savings are from international trade of crop products, mainly cereals (222 Gm^3/year) and oil crops (68 Gm^3/year).[19]
- It is estimated that Egypt saved 5.8 billion m^3 of water from national allocation in 2000 through maize imports, i.e., about 10% of its annual allocation. Additionally, a global saving of 2.7 billion m^3 of real water was generated thanks to the differential of productivity between maize-exporting countries and Egypt.[20]
- Fraiture et al.[21] point out that without trade, global crop water use in cereal production would have been higher by 6% and irrigation depletion by 11%.

[11]Schmitz et al. 2012, [12]Ibid, [13]Gerbens-Leenes et al. 2012, [14]Food-fuel competition is likely to continue in the future. Any analysis must address the eventuality of such competition intensifying, with adverse effects on the food security of some countries and population segments. If this happens, the purchasing power of those demanding more energy could easily overwhelm that of the poor demanding food. See Alexandratos 21995. [15]Kutas 2010, [16]Gerben Leenes et al. (2008), [17]Hoekstra and Chapagain 2008, [18]Chapagain et al. 2006, [19]ibid, [20]Renault 2003, [21]Fraiture et al. 2004

Costs and benefits

Trading strategies based on the virtual water perspective are not consistent with the economic concept of comparative advantage. Optimal trading strategies can be determined only by considering the opportunity costs of production within countries, evaluating comparative advantages and considering other social, economic and environmental dimensions of public policy objectives.[22]

Productivity

- International trade is currently estimated to account for 16-25% of all food crop production.[23]
- Projections are that by 2025, water-scarcity induced cereals trade will increase by 60%.[24]
- Arable land will expand by 70 million ha (less than 5%), an expansion of about 120 million ha (12%) in developing countries being offset by a decline of 50 million ha (8%) in developed countries.[25]
- Developing countries' share in world agricultural exports increased from 32% in 1990/91 to only 42% in 2006/07. Most of this gain came from the expansion of exports to other developing countries (about 12%).[26]
- For low-income countries, other developing countries accounted for 51% of their exports and 69% of imports in 2006/07, up from 27% and 57% respectively in 1990/91.[27]

Climate change

- Climate change and increasing demand for water resources will have an impact on growing conditions, significantly affecting food production in the future. Integrated assessment models have shown that climate change effects on temperature and rainfall will have positive yield effects in cooler climates and negative effects on cereal yields in low-latitude regions, where most developing countries are located.[28]
- To overcome agricultural productivity losses associated with climate change, a well-functioning international trade flow system that is responsive to price signals will be needed to balance production and consumption between and within nations. Increased agricultural output in a region where agricultural production improves can then be used to compensate potential losses in other regions.[29]

[22]Wichelns 2010, [23]Bruinsma 2010, [24]De Fraiture et al. 2004, [25]Bruinsma 2010, [26]Aksoy and Ng 2010, [27]Ibid, [28]Easterling et al. 2007, [29]Juliá and Duchin 2007

References

Aksoy, A., F. Ng, 2010. *The evolution of agricultural trade flows*. World Bank Policy Research Working Paper 5308. Available online http://library1.nida.ac.th/worldbankf/fulltext/wps05308.pdf.

Alexandratos, N. ur., 1995. *World Agriculture: Towards 2010*. Food and Agriculture Organization of the United Nations, Rome, Italy.

Ansink, E., 2010. "Refuting two claims about virtual water trade". Ecological Economics 69, 2027–2032.

Bruinsma, J., 2003. *World agriculture: towards 2015/2030: an FAO perspective*. Earthscan/James & James. Available online at http://www.fao.org/fileadmin/user_upload/esag/docs/y4252e.pdf

Bruinsma, J., 2010. "The resources outlook: by how much do land, water and crop yields need to increase by 2050?" In Conforti, P. (ed.). *Looking ahead in world food and agriculture: perspective to 2050*. Food and Agriculture Organization of the United Nations, Rome, Italy. Available online at http://www.fao.org/docrep/014/i2280e/i2280e00.pdf.

Chapagain, A.K., A.Y. Hoekstra, H.H.G. Savenije, 2006. "Water saving through international trade of agricultural products". *Hydrology and Earth System Sciences* 10(3), 455-468.

Dalin, C., M. Konar, N. Hanasaki, A. Rinaldo, I. Rodriguez-Iturbe, 2012. "Evolution of the global virtual water trade network". *Proceedings of the National Academy of Sciences* 109(16), 5989-5994.

Fraiture, C. de, X. Cai, U. Amarasinghe, M. Rosegrant, D. Molden, 2004. "Does international cereal trade save water? The impact of virtual water trade on global water use". In *Comprehensive Assessment of Water Management in Agriculture*, 2007. International Water Management Institute, Colombo.

Easterling, W.E., P.K. Aggarwal, P. Batima, K.M. Brander, L. Erda, S.M. Howden, A. Kirilenko, J. Morton, J.-F. Soussana, J. Schmidhuber, F.N. Tubiello, 2007. "Food, fibre and forest products. Contribution of Working Group II to the Fourth Assessment Report of IPCC". In Parry, M.L., O.F. Canziani, J.P. Palutikof, P.J. van der Linden and C.E. Hanson (eds). *Climate change 2007: Impacts, adaptation and vulnerability*, pp. 273–313. Cambridge, UK, Cambridge University Press.

Gerbens-Leenes, P.W., A.Y. Hoekstra, Th.H. Van der Meer, 2008. *Water footprint of bio-energy and other primary energy carriers*. Available online at http://doc.utwente.nl/59998/1/Gerbens08water.pdf.

Gerbens-Leenes, P.W., A.R. Van Lienden, A.Y. Hoekstra, Th.H. Van der Meer, 2012. "Biofuel scenarios in a water perspective: The global blue and green water footprint of road transport in 2030". *Global Environmental Change* 22, 764-775.

Godfray, H. C. J., I. R. Crute, L. Haddad, D. Lawrence, J.F. Muir, N. Nisbett, R. Whiteley, 2010. "The future of the global food system". *Philosophical Transactions of the Royal Society B: Biological Sciences* 365(1554), 2769-2777.

Hoekstra, A.Y., A.K. Chapagain, 2008. *Globalization of water: Sharing the planet's freshwater resources*. Blackwell Publishing, Oxford, UK.

Hoekstra, A.Y., M.M. Mekonnen, 2012. "The water footprint of humanity". *Proceedings of the National Academy of Sciences* 109(9), 3232-3237.

Julia, R., F. Duchin, 2007. "World trade as the adjustment mechanism of agriculture to climate change". *Climatic Change* 82(3-4), 393-409.

Kutas, G., 2010. *The Challenges of Trading Alternative Energy*. Pawelyn (ed.). Available online at http://graduateinstitute.ch/webdav/site/ctei/shared/CTEI/events/Energy%20Conf/Panel%202%20Gkutas.pdf.

Reimer, J.J., 2012. *On the Economics of Virtual Water Trade*. Available online at http://ir.library.oregonstate. edu/xmlui/bitstream/handle/1957/36147/ReimerJeffreyAgricultural ResourceEconomicsOnEconomicsVirtual.pdf?sequence=1.

Renault, D., 2003. *Value of virtual water in food: Principles and virtues*. Hoekstra, A.Y. (ed.). Available online at ftp://ftp.fao.org/agl/AGLW/ESPIM/CD-ROM/documents/5M_e.pdf.

Schmitz, C., A. Biewald, H. Lotze-Campen, A. Popp, J. P. Dietrich, B. Bodirsky, I. Weindl, 2012. "Trading more food: Implications for land use, greenhouse gas emissions, and the food system". *Global Environmental Change* 22(1), 189-209.

Wichelns, D., 2010. "Virtual Water: A Helpful Perspective, but not a Sufficient Policy Criterion". *Water Resources Management* 24(10), 2203-2219.