The AfCFTA and Climate Change

Abstract

Background

The Africa Continental Free Trade Agreement (ACFTA) will soon be one of the largest free trade areas in the world once fully operational – connecting 1.3 billion people across 55 countries with a combined gross domestic product (GDP) valued at US$3.4 trillion. As such, its potential impact on African (and global) agriculture could be huge. African economies have grown in the past two decades, as a result, the appetite for processed agricultural products has also grown – offering a great opportunity for agriculture, agri-business growth, and trade in the region. The agreement's success has important implications for future trade and investments in the region. By producing positive outcomes of income growth and development, it offers countries outside of Africa the opportunity to expand its own agricultural and food industry investments, expertise, and trade with the region. If the outcome includes more inclusive income growth, poverty reduction, and food security, many countries around the world would also benefit as donors in sub-Saharan Africa.

If successfully implemented, some studies have estimated significant welfare gains that could be had under the agreement due to reduced tariffs and non-tariff barriers. For example, one such study estimates millions could be lifted out of extreme poverty by 2035, total exports from the region could rise by as much as $560 billion, the continent's income could grow by 7 percent, and wages could rise by 10 percent (World Bank, 2020). Despite the enormity of the challenges of implementing a trade agreement, there are clearly important gains that can be had from greater trade integration in Africa so long as improvements can be made in transportation infrastructure, communications, services, and mobility between countries. Improving our understanding of how the AfCFTA can be harnessed to help grow African agriculture and economic growth through greater trade integration is key. Climate change, however, threatens to reduce these potential gains, both directly through reductions in agricultural productivity and indirectly through terms of trade effects.

Within global agriculture, there is a general consensus among scientists that crop yields in tropical regions such as Africa will be hardest hit by climate change (Challinor et al., 2014). In particular, maize and soybeans will be especially affected (Porter et al., 2019). According to one estimate, yields for maize in Africa for example could decline between 5 and 13 percent by the second half of the 21st century (Knox et al., 2012), soybeans as much as 17 percent (Porter et al, 2019). Yields from livestock production systems are also expected to be severely affected in Africa, especially as pastoralist communities across Africa supply the bulk of livestock products on the continent. Although there is less information on the direct effects of climate change on livestock yields, it is generally understood that the impact of climate change on the productivity of African rangelands for livestock will be negative (Herrero et al., 2016). There is also a general agreement of the disruptive nature of climate change on pastoralist systems in Africa – affecting herd dynamics, stocking density, productivity, and even a rise in farmer-herder conflicts due to competition for increasingly scarcer rangelands and farmlands over time (McGuirk & Nunn, 2020).

Trade can partially offset climate change's effects on productivity by allowing countries in the region, and the rest of the world, to rely on specialization based on the varying impacts on yield reductions and henceforth changes in the comparative advantage between regions (Nelson et al., 2010).

The yield reductions due to climate change can also lead to large price shocks that can affect the allocation of resources (such as land use) and trade flows. One recent study estimates such changes, when incorporated with a more open trade environment, can help reduce the full impact of climate change – without it, global welfare losses due to climate change could be 76 percent higher (Gouel & Laborde, 2018). For the AfCFTA, we expect many countries to be very sensitive to yield shocks from climate change as agriculture accounts for a large share in GDP, making them especially susceptible to any large productivity shocks. Another is that many rely on agricultural imports (especially cereals and livestock products) which exposes them to large terms-of-trade shocks that would occur from rising world prices also due to climate change.

Methodological approach

This study proposes to use a computable general equilibrium (CGE) model, specifically GTAP, to estimate the potential implications of climate change on the potential benefits to be derived from the AfCFTA. Given that there is already literature estimating the impacts of tariff (and non-tariff barrier (NTB)) removal, we seek to understand how sensitive those results are to climate-change induced agricultural productivity shocks. This study, will thus, help improve our understanding of the future threats and opportunities posed by the realities of climate change and the potential gains and losses from trade for Africa and the rest of the World following the successful implementation of the agreement in this context. To the best of our knowledge, few studies have yet to examine the potential implications of climate change on agriculture under the context of a fully operational AfCFTA.[1]

The study will use both crop and livestock simulation models to estimate potential impacts of climate change on yields. For crop simulations, the best available data comes from the Global Gridded Crop Model Intercomparison Group (GGCMI) associated with the AgMIP project. We will use the mygeohub data tool that aggregates the output from the GGCMI archive from its native resolution of 5 arc min gridcells to larger areas defined by the user. These data cover thirteen crops, by seven leading crop models, run under the temperature and precipitation trajectories of a suite of five CMIP5 global climate models and four representative GHG concentration pathways. For livestock, a livestock-rangeland simulation model called G-Range will be used. Prior studies have used G-Range to examine the impacts of climate change on forage availability for livestock in rangelands globally (Boone et al. 2017, Godde et al., 2020). The model divides landscapes into a series of square spatial cells, and for each cell, models ecological processes – including data on soil properties, CO2 concentration, and weather data such as temperature and precipitation. Plants are represented as functional groups that compete for soil moisture, light, space, and nutrients.. Model outputs include the herbaceous net primary production, which can be translated into forage availability. This, in turn, can be used to calculate the number of livestock that can be supported on the landscape. When comparing two scenarios, such as a baseline and a climate change scenario, the percentage change in livestock that can be supported by the landscape can be calculated. For instance, Boone et al. (2017) estimate that under Representative

[1] One recent exception that addresses climate change in the context of the AfCFTA using GTAP is the recent study by (Bengoa et al., 2021). However, the authors here only examine the potential effect of the AfCFTA in mitigating climate change, i.e. its impact on CO2 emissions. On aggregate, they find that the agreement will lead to only a marginal increase in CO2 on the continent (about 0.3%) and an even greater decline in air pollutants (more than 20%).

Concentration Pathway 8.5, the number of grazing livestock will decline by 28.7 to 37.1 million livestock units, equivalent to 7.5 to 9.6% of the total stock of livestock in rangelands.

<u>References</u>

Bengoa, M., Mathur, S., Narayanan, B., & Norberg, H. C. (2021). Environmental Effects of the African Continental Free Trade Agreement: A Computable General Equilibrium Model Approach. *Journal of African Trade*.

Challinor, A. J., Watson, J., Lobell, D. B., Howden, S. M., Smith, D. R., & Chhetri, N. (2014). A meta-analysis of crop yield under climate change and adaptation. *Nature Climate Change*, *4*(4), 287–291.

Collier, P., Conway, G., & Venables, T. (2008). Climate change and Africa. *Oxford Review of Economic Policy*, *24*(2), 337–353.

Gouel, C., & Laborde, D. (2018). *The Crucial Role of International Trade in Adaptation to Climate Change*

Herrero, M., Addison, J., Bedelian, C., Carabine, E., Havlik, P., Henderson, B., Van De Steeg, J., & Thornton, P. K. (2016). Climate change and pastoralism: Impacts, consequences and adaptation. *OIE Revue Scientifique et Technique*, *35*(2), 417–433.

Knox, J., Hess, T., Daccache, A., & Wheeler, T. (2012). Climate change impacts on crop productivity in Africa and South Asia. *Environmental Research Letters*, *7*(3).

McGuirk, E. F., & Nunn, N. (2020). *Transhumant Pastoralism, Climate Change, and Conflict in Africa* (No. 28243; NBER Working Paper Series).

Nelson, G. C., Rosegrant, M. W., Palazzo, A., Gray, I., Ingersoll, C., Robertson, R., Tokgoz, S., Zhu, T., Sulser, T. B., Ringler, C., Msangi, S., & You, L. (2010). *Food Security, Farming, and Climate Change to 2050: Scenarios, Results, Policy Options*. International Food Policy Research Institute.

Porter, J. R., Challinor, A. J., Henriksen, C. B., Howden, S. M., Martre, P., & Smith, P. (2019). Invited review: Intergovernmental Panel on Climate Change, agriculture, and food—A case of shifting cultivation and history. *Global Change Biology*, *25*(8), 2518–2529.

Rivera-Ferre, M. G., López-i-Gelats, F., Howden, M., Smith, P., Morton, J. F., & Herrero, M. (2016). Re-framing the climate change debate in the livestock sector: mitigation and adaptation options. *Wiley Interdisciplinary Reviews: Climate Change*, *7*(6), 869–892.

World Bank. (2020). *The African Continental Free Trade Area: Economic and Distributional Effects*. World Bank.

Zhao, C., Liu, B., Piao, S., Wang, X., Lobell, D. B., Huang, Y., Huang, M., Yao, Y., Bassu, S., Ciais, P., Durand, J. L., Elliott, J., Ewert, F., Janssens, I. A., Li, T., Lin, E., Liu, Q., Martre, P., Müller, C., … Asseng, S. (2017). Temperature increase reduces global yields of major crops in four independent estimates. *Proceedings of the National Academy of Sciences of the United States of America*, *114*(35), 9326–9331.