FARE Share
Sharing valuable insights
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What's Inside?

This issue of *FARE Share* takes a look at the impact of economic sanctions on food security.

Inside, we question whether personality trumps values in GMO risk perception. We also get an update on crop yield modeling research reported in previous editions of *FARE Share*.

On the back page, we've included a study from our friends at the University of Alberta who are examining the economic effect of adopting genomic technology in the forestry sector.

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The FARE Share Newsletter features research and analysis from faculty and students in the Institute for the Advanced Study of Food and Agricultural Policy in the Department of Food, Agricultural and Resource Economics (FARE).

Economic Sanctions and Food Security

Research by: Sylvanus Kwaku Afesorgbor, Assistant Professor, FARE

The imposition of economic sanctions and its consequences for targeted states has recently received major research interest because of its continuous use in diplomatic circles. Extending this interest to the consequences of economic sanctions (hereafter 'sanctions') on food (in)security is particularly relevant considering the continuous global concerns for eradicating hunger and famine. A recent Food and Agricultural Organization of the United Nations (FAO) report highlights a potential reversal in the long-term decline in food security trend in many developing countries. The report indicates that about 815 million people are undernourished, with over 100 million facing severe levels of food insecurity in 2016. It seems this situation is deteriorating faster as the number of people facing acute food insecurity increased to almost 124 million.

"…recent reports indicate an increasing crisis level and worsening food insecurity in 51 countries."

The United Nations, through its Millennium Development Goals (MDG 1) and the Sustainable Development Goals (SDG 2), has emphasized the importance of ending hunger, achieving food security and improving nutrition for all people, especially for the poor, infants and those who are vulnerable. However, the realization of these goals may not be easy as recent reports indicate an increasing crisis level and worsening food insecurity in 51 countries. Incidentally, most of the food insecure countries in the world are also sanctioned states. For instance, according to the Global Hunger Index (GHI), countries such as Burundi, Eritrea, Yemen, Afghanistan, Chad, Ethiopia, Sudan, Somalia and North Korea are some of the most food insecure – at the same time, these countries have also suffered long periods of international sanctions.

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It is not far-fetched to link sanctions to food insecurity in the target countries as any form of externally induced crisis could, in principle, take a variety of forms – e.g., lower income and consumption levels, higher unemployment, and lower investments in education by families. These could possibly result in deterioration in food and nutrition outcomes in sanctioned countries and adversely affect food security. However, any anecdotal relationship between food insecurity and sanctions may not present a sufficient ground to impute causality, thus it is imperative to employ a more rigorous econometric approach to assess whether a causal relationship exists between sanctions and food insecurity after accounting for several confounding factors.

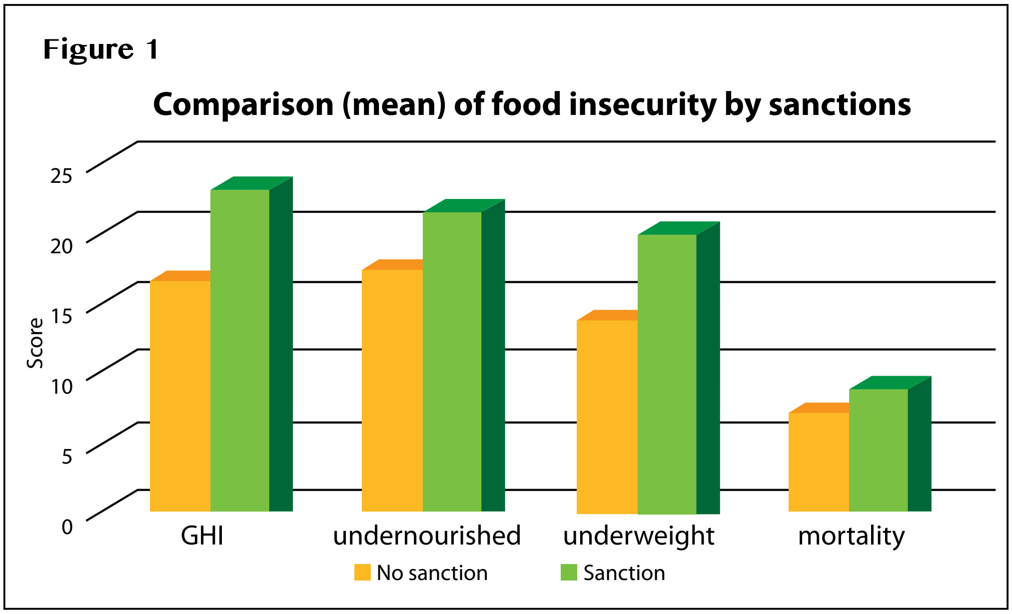

Figure 1 provides anecdotal evidence that food insecurity was higher during sanction periods compared to no sanction periods.

Using data sourced from two main sources for over 60 countries between 1990 and 2014, we examine how sanctions affect the composite index, GHI, developed by the International Food Policy Research Institute, and access, availability and stability dimensions of food security by FAO. To circumvent the major identification strategy challenge arising from endogeneity of sanctions, we employ an entropy balancing matching technique.

More specifically, our findings show that the imposition of sanctions increases the GHI measure of food security on average by about 1.247-2.225 points. Examining what specific components of the GHI influence our results, we find two major components – the percentage of population undernourished and the percentage of children under five years who are underweight – have significant influence on the GHI. Thus, the imposition of sanctions exacerbates the incidence of hunger and also causes malnutrition in children during the sanction periods compared to non-sanction periods.

This adverse effect of sanctions on food security also extends to different dimensions of food security on the basis of FAO data. The most severely affected dimension is availability, which we measured using food supply, food production and diet adequacy. Sanctions cause a decline in total food supply and have more significant adverse effects on food adequacy in the sanctioned countries.

"…the imposition of sanctions exacerbates the incidence of hunger and also causes malnutrition in children during the sanction periods…"

FARE Talk

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Enlightening discussions about contemporary topics relevant to food, agricultural, and resource economics

The Future of Food

In this podcast, Dr. Brady Deaton, FARE Professor and McCain Family Chair in Food Security, talks with Dr. Jayson Lusk, Distinguished Professor and Head of the Department of Agricultural Economics at Purdue University, about his George Morris AgriFood Policy Lecture: "The Future of Food." Jayson points out that since the writings of Malthus, the food sector has been characterized by increases in productivity. He notes that this increase in productivity has allowed us to escape the Malthusian trap. Despite this success, or because of it, a modern food movement has emerged with a set of concerns that doesn't always recognize the trade-off between their desired production practices and productivity. Jayson points out that desires for how food should be produced varies across income levels. The future of food depends, in part, on how these competing interests get worked out in agricultural policy. Dr. Lusk's latest book is *Unnaturally Delicious: How Science and Technology are Serving up Super Foods to Save the World*. His earlier book – *The Food Police* – is the subject of an earlier podcast on FARE Talk.

To listen to the complete conversation and other podcasts, visit the FARE website: https://www.uoguelph.ca/fare/institute/podcasts#future

GMO Risk Perception: Personality vs. Values

Research by: Nathaniel Whittingham, FARE M.Sc. Graduate, now with BEworks, and Andreas Boecker, Associate Professor, FARE

The paradigm that increasing the public's scientific understanding of modern breeding methods leads to more positive attitudes towards genetically modified organisms (GMOs) has been proven wrong. Having dominated science communication for a long time, the paradigm is difficult to let go of for many people. Kevin Folta, probably the most prolific communicator about GMOs in academia, once joked it only took him ten years to figure that out.

The new paradigm is one of engaging with and listening to the public first. More specifically, shared values-based communication approaches are recommended to provide common ground for engaging with the public about controversial issues such as GMOs. The rationale for such strategies is based on decades of psychological research. Personal values (e.g., achievement, power, security) are important life goals, or desirable end states. With the basic human motivation to achieve consistency between one's goals and decisions, personal values provide guidance for human decisions in all life contexts, from grocery shopping to political voting.

However, personal values are not the only drivers of decision making that are deeply rooted in one's self-concept. Also based on decades of research in psychology, personality traits (e.g., agreeableness, openness to experience) have been well established in explaining individual differences in basic tendencies of perceptions, intentions and behaviour. It is not entirely clear how personality traits and personal values interact in decision making, but empirical research points to a key difference – personal values are activated more in decisions involving higher levels of cognitive control, while personality traits are activated more in affect-based decisions involving less cognitive control.

The effectiveness of the new paradigm of engagement with values-based communication could be called into question if consumers' evaluation of GMO safety was more closely associated with personality traits than personal values. Our study examines the link between GMO safety perception and personality traits and personal values. We used tweets from 523 twitter accounts involved in communicating about GMOs between May 2016 and February 2017. Based on the content of the tweets, 181 accounts were unambiguously identified as perceiving GMOs as safe and 341 as unsafe. Based on word analysis, scores for five personal values and five personality traits were obtained through IBM's Watson Machine Learning Platform.

When the links of personal values and personality traits with perceived GMO safety were examined separately, the overall correlation was high in both cases, with four of the five factors being significant. However, when both values and traits jointly entered the analysis, the overall correlation of personal values with perceived GMO safety was greatly reduced, with now only two values remaining significant. Contrary to that, all four personality traits retained their high levels of significance, indicating that personality traits are more strongly linked to the perceived safety of GMOs than personal values. This suggests that GMO safety perception is predominantly affect-based and less cognition-based.

The suggestion that people put in little cognitive effort when evaluating GMO safety is not meant to accuse them of being lazy. Rather, this is in line with survey findings that most of the public knows little to nothing about agriculture. It is also reconcilable with the fact that many perceive GMO technology as complex and beyond their personal and educational experience space.

The main implication of these results, however, is that the new paradigm with shared values-based engagement strategies could be limited in reach and effectiveness because basic personal values have little involvements in the perception or evaluation of GMO safety by the public. This cannot be determined on the basis of one study and requires additional research.

A Longer Growing Season?

Research by: Qin Xu, PhD Student, FARE; Glenn Fox, Professor, FARE; Dan McKenney, Chief, Geospatial Tools and Economic Analysis, Great Lakes Forestry Centre, Natural Resources Canada; John Pedlar, Forest Landscape Biologist, Natural Resources Canada

Is the growing season getting longer in Southern Ontario? This article is an update on crop yield modeling research included in previous editions of *FARE Share*. As reported in Issue #17, one reason suspected for increases in both planted soybean area and yields is a longer growing season.

This work, based on recent spatial analyses of climate data across Canada (Pedlar *et al*., 2015), offers new opportunities to examine plant/climate interactions. Four different growing season definitions (based on temperature thresholds) can be used for analysis: Five Consecutive Day Average Temperature, Short, Medium and Long.

We examined evidence for the Medium Growing Season (starting the day following the last occurrence of -2.2°C in spring and ending the day preceding the first occurrence of - 2.2°C in fall) for 29 counties in southern Ontario from 1950 to 2013. When we fit a

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Growing Season

linear and a quadratic time trend to the data, linear results show the length of the growing season increased from 172 days in 1950 to 181 days in 2013, at an average rate of 1.45 days per decade. The quadratic results indicate an initial decline in length of growing season followed by an increase, but the difference from the linear results is relatively minor.

To check the sensitivity of our results to the choice of definition, we also used the Long Growing Season (starting the day following the last occurrence of -4.4°C in spring and ending the day preceding the first occurrence of -4.4°C in fall). In this scenario, we find more pronounced differences between linear and quadratic results. The linear estimation shows growing season length increased from 200 days in 1950 to 209 days in 2013, at an average rate of 1.52 days per decade years. However, the quadratic estimation shows growing season length declined in the first half of the period, then increased after that.

So, is growing season getting longer in Southern Ontario? It appears to be in the study period, but the magnitude of our findings depends on the choice of definition. In *FARE Share* Issues #14 & #17, we used precipitation and heat units as biophysical variables in crop yield models. Increased heat units and precipitation were observed, contributing to greater yields. But one reason for more heat and rain is that there has been a gradual increase in the length of the growing season in Ontario. In addition, studying long-term change in growing season length allows us to distinguish it between the effects of technological progress in the form of better varieties in explaining yields.

Genomic Tech & Trees

Research by: Henry An, Associate Professor, Department of Resource Economics & Environmental Sociology, University of Alberta (on sabbatical leave at FARE)

Tree improvement is one of the key silviculture activities that forest companies can use to increase the productivity of forestland and ultimately harvest. Traditional tree breeding takes about 30 years to finish one breeding cycle, making it difficult to respond quickly to external changes (e.g., climate change, new regulations and changes in the market). With the use of genomic technology, the tree breeding cycle can be significantly shortened: by up to 20 years in some cases. While genomic technology offers numerous improvements upon traditional methods, it comes with higher upfront R&D costs and it is unclear exactly how much it can improve upon traditional methods regarding quantity and quality attributes. The primary objective of this study is to estimate the economic effect of adopting genomic technology in the forestry sector.

In Alberta, essentially all forestlands are publicly owned, which means that while most production is organized and carried out by private firms responding to market incentives, they are strongly influenced and constrained by the decisions and regulations of the provincial government. To represent current practice in Alberta, we construct a linear programming-based timber supply model where the objective is to maximize harvest volume for pine and spruce subject to regulatory policies and resource constraints. We use forest inventory data from the Government of Alberta as our starting values, and then simulate the annual timber supply under different breeding scenarios.

As 90% of the pine and spruce are used for the production of softwood lumber (SWL) in Alberta, we focus on the SWL industry in this study.

We estimate the economic effects of the supply shifts due to the use of genomic technology using a dynamic spatial partial equilibrium model. We use a positive mathematical programming approach to calibrate the initial equilibrium and project future consumption, production, price, and trade flows of SWL in all regions. We first project a baseline forecast from 2016 to 2036 and then compare these results with two alternative genomic scenarios.

Our results show that a genomics-assisted tree breeding research program can yield an increase in total economic surplus of $400 million in present value, which is large relative to an estimated (discounted) cost of $9.2 million. Most of the surplus gain accrues to SWL producers in Alberta while SWL consumers are slightly better off as Alberta only produces about 2% of world SWL and therefore has a negligible impact on world prices.

The benefit-cost ratio of the research program is 43.5, indicating that the economic return of genomic technology in the forestry sector is very high, and therefore, more resources should be allocated to the forestry genomic research program. The expected lower genotyping cost in the future may provide more incentives for tree breeders to adopt genomic technology.

Our results suggest that genomics can be tremendously beneficial to the forestry sector in Alberta, but these gains may be curtailed due to regulatory issues. For example, if the deployment of improved seeds is highly restricted by the government, the adoption of genomic technology may not be feasible.

This work is based on the M.Sc. research of Shuo Wang (UofA), and also includes contributions from Wei-Yew Chang (UBC), Chris Gaston (UBC), and Barb Thomas (UofA). This project receives financial support from Genome Canada.

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