

PURDUE

AGRICULTURAL ECONOMICS REPORT

Article title:	Food Production and Population Growth: A Cautionary Tale
Author:	Mario Ortez
Summary:	This article explores the potential effect of the dynamics of population growth on food and agricultural industries.

In the late 1700's Thomas Malthus famously worried that food production would not keep up with population growth. Here in his own words: "*The power of population is indefinitely greater than the power in the earth to produce subsistence for man*" (Malthus, 2010). Thereafter, Fr. Gregor Mendel, O.S.A. laid the foundation of modern genetics, Louis Pasteur pioneered Pasteurization, Nitrogen fixation from the atmosphere was perfected in Norway, Norman Borlaug fathered the "Green Revolution" among many other developments that revolutionized the ways we produce, process and store food. And the rest of the story is sometimes called "the miracle of modern agriculture". But, is it possible that we will ever produce "too much" food? In other words, we have historically successfully expanded the food production apparatus in part to respond to the historical sustained population growth experienced. But, what happens if sustained population growth is no longer the norm?

The prospect of sustained decline in global population could shape the future of the U.S. agricultural sector in a direction different from what we have seen over the past few centuries. The long-held view in many food and agricultural industries, as well as government and non-profit organizations, is that there is need for further food production in the future for a larger and richer world population. The Food and Agriculture Organization (FAO) estimated that by 2050 the world's population will reach 9.1 billion (34% higher than today) and that income levels will be "many multiples" of what they are now and that food production (net of food used for biodiesel) must increase by 70% to meet those needs (FAO, 2009).

But what happens after 2050? A 2021 article in the New York Times titled "*Long Slide Looms for World Population, With Sweeping Ramifications*" highlighted a potentially different view. The article said that "Demographers now predict that by the latter half of the century or possibly earlier, the global population will enter a sustained decline for the first time" (Cave, Bubola and Sang-Hum, 2021). Vollset et al. (2020) estimated that 183 countries and territories

(out of 195 total in the world) will have fertility rates below replacement level by 2100. Of particular relevance to U.S. agriculture Vollset et al.'s (2020) model predicts China's population to fall from 1.41 billion in 2021 to about 730 million in 2100.

Is this of concern to American Food and Agricultural industries?

Overly optimistic demand scenarios for food have gotten us in trouble in recent history. While there is a myriad of ways in which population decline would shape American agriculture, I'd like to propose to focus on U.S. exports of grains as a case study. Earl Butz, who earned a Doctorate in Agricultural Economics from Purdue University and went on to serve as Secretary of Agriculture under U.S. Presidents Richard Nixon and Gerald Ford, is remembered telling American farmers to plant "fence row to fence row" when serving as Secretary (Escaping 1980). This in light of the market exuberance brought about by Russia starting to buy American grains back in the 1970's, such exuberance is considered a contributing factor to the 1980s farm financial crisis (Escaping 1980). More recently, consider the case of China, which is a key source of demand for grains and recently helped push the price of crops to record highs (Sirtori-Cortina and Bradham, 2021). The U.S. exported \$ 26.5 billion of agricultural goods in 2020 to China, making it the number one among U.S. export markets for agricultural goods (USDA, FAS 2020). Both, opening of Russian markets and increase in prominence of China as outlets for American exports, could serve as cautionary tales and perhaps call for strategical allocation for American investments in Food and Agriculture.

Can American farmers cope with global demographic decline?

Dr. Nicholas Eberstadt, the Henry Wendt Chair in Political Economy at the American Enterprise Institute (AEI), proposed that "In theory, it should be perfectly possible for a modern society not only to maintain prosperity but to increase it steadily in the face of pervasive population aging and demographic stagnation or depopulation" (Eberstadt, 2021). Eberstadt (2021) went on to say that for this to happen we need "advances in research and knowledge creation, deepening of human capital, and an auspicious business climate, with incessant innovation in the business sector, labor markets, and the policy realm. I think this can be said for a "modern and post-modern agricultural industries" as well. The focus of the endeavors of the agricultural industry ought to include the possibility of a world where population declines and the need to devise strategies for the industry to strive, should this potential materialize.

In summary:

Though there is an expectation for world population to grow over the next 30 years, there are at least some indicators at present that this may not be the case beyond the 30 years timeframe. This possibility of pervasive population decline towards the later part of this century should be taken into consideration by the Food and Agricultural industries in long-term strategic planning. The targeting on increased value added and differentiation in food and agricultural goods over volume production, and taking into consideration serving a considerably higher share of older consumers (than that of today), could be two examples of how the industry can prepare. One last consideration is education, one would hope that the intuitions of higher learning, many of them in the front lines of development of modern agricultural systems, fulfilling their land grant missions, are meaningfully engaging with this possibility in ways that influence the human capital that will then be in the front lines of food production, processing, distributions, and marketing.

Postface:

This short piece is intended to be a mental exercise to start thinking what could be the future of food production over the next century. As such, I have bracketed very important concerns regarding certain aspects of some modern agricultural systems that do not offer safe and affordable food to certain segments of the population, or that do not take proper care of our environment and resources. Those considerations should be of the utmost concern to our food production community and should continue to play a key role in the development of the post-modern ways to produce, process, distribute and market food and to other agricultural goods.

Sources Cited:

Malthus, Thomas Robert (18 January 2010). *An Essay on the Principle of Population*. Oxfordshire, England: Oxford World's Classics. p. 13. ISBN 978-1450535540.

Sirtori-Cortina, D. & Bradham, B. (2021). China Has Bought 37% of Next Year's Corn Imports Just From U.S. *Bloomberg*.

Eberstadt, N. (2021). Can America cope with demographic decline? *American Enterprise Institute*.

Vollset SE, Goren E, Yuan CW, Cao J, Smith AE, Hsiao T, Bisignano C, Azhar GS, Castro E, Chalek J, Dolgert AJ, Frank T, Fukutaki K, Hay SI, Lozano R, Mokdad AH, Nandakumar V, Pierce M, Pletcher M, Robalik T, Steuben KM, Wunrow HY, Zlavog BS, Murray CJL. Fertility, mortality, migration, and population scenarios for 195 countries and territories from 2017 to 2100: a forecasting analysis for the Global Burden of Disease Study. *Lancet*. 2020 Oct

17;396(10258):1285-1306. doi: 10.1016/S0140-6736(20)30677-2. Epub 2020 Jul 14. PMID: 32679112; PMCID: PMC7561721.

Escaping 1980, “Episode 2 – The Boom”, accessed December 2, 2021. Transcript available online: <https://aei.ag/wp-content/uploads/2021/02/The-Boom.pdf>

U.S. Department of Agriculture, Foreign Agricultural Service, 2020. *China*. Available online: <https://www.fas.usda.gov/regions/china>

Food and Agriculture Organization (FAO). 2009. How to Feed the World in 2050. Available online: https://www.fao.org/fileadmin/templates/wsfs/docs/expert_paper/How_to_Feed_the_World_in_2050.pdf

Malthus, Thomas Robert (18 January 2010). *An Essay on the Principle of Population*. Oxfordshire, England: Oxford World's Classics. p. 13. ISBN 978-1450535540.