

Can China Continue Feeding Itself?

The Chinese agricultural sector is only mildly vulnerable to global warming

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For quite some time, global food security issues have been in the center of policy debate. One of the major aspects of this debate has been the role of China, a giant economy with 20% of the world's population. China is also responsible for a significant share in the world's production and consumption of primary agricultural commodities — wheat, rice, maize, soybean, and cotton. With projected increases in both population and income in China, feeding larger numbers of more affluent people could become a challenge if not accompanied by increased supply.

However, will China be able to increase supply if the climate warms? Growing evidence on rising global temperatures and changes in precipitation patterns makes it ever more important to understand the impacts of global warming on China's agriculture.

We measure the sensitivity of Chinese agriculture to warming, employing farm level data and relying on the Ricardian method. The analysis is conducted on 8,405 farms sampled across 28 provinces.

Climate and Net Crop Revenue

In general, China's climate is best described as monsoonal, with clear temperature and precipitation differences that vary by region and season. From the south to the north, temperature declines steadily. In the dryer north, more than 70% of a year's precipitation is concentrated in the summer. In the wetter south, precipitation is mainly concentrated in the spring and the summer.

Not surprisingly, the net crop revenues also vary by region: they are higher in the south compared to the north and higher in the east compared to the west. Just as significantly, net crop revenues vary between villages that are irrigated and those that are rainfed. On average, the net crop revenue amounted to 10,150 yuan (US\$1,353) per hectare across all farms in 2001, however net crop revenue was 12,180 yuan in irrigated villages compared to 7,610 yuan in rainfed villages.

Effect of Warming Negative on Average

The analyses, measuring the direct effects of temperature and precipitation on crop net revenues, show that the average impact of higher temperatures on net revenues is negative and the average impact of more precipitation is positive. However, marginal increases in temperature and rainfall have very different effects on different farm types in different regions:

- Rainfed farmers are more vulnerable to warming than irrigated farmers;
- Warming is likely to be helpful to rainfed farmers in very cold places but harmful to those in most of China and especially the far south;
- More rain is likely to be harmful to rainfed farmers in the wet southeast but to be beneficial to farmers in the remaining regions;
- All irrigated farms are likely to enjoy small benefits from increasing precipitation.

Quantitatively, the mid latitude region of China could gain up to US\$127/ha/ $^{\circ}$ C from higher temperatures, while southern and northern latitudes could lose up to US\$165/ha/ $^{\circ}$ C. Additional precipitation in the wet southwest would be harmful (up to -US\$153/ha/mm/month). The rest of China would enjoy small gains (up to US\$65/ha/mm/month).

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The agricultural sector as a whole is only mildly vulnerable to global warming. This is because, first, a very large fraction of farms in China are irrigated and, second, the rainfed land in China is largely in temperate or cool regions.

The results thus suggest that the answer to the question above is in the affirmative. The likely gains realized by some farmers will nearly offset the losses that will occur to other farmers. An important caveat, however, is that our analysis does not examine the potential harmful consequences of possible reductions in water supply from climate change.

Policy Implications

As is clear from the above, the effects of climate change are not going to be uniform across the country. Warming will assist areas that are currently highly productive and will further handicap areas that have below average productivity. Chinese policy makers need to be aware that warming is likely to impose additional costs on specific regions that already have below average incomes.

The ability of Chinese farmers to change and adapt to new conditions has allowed China to outperform other agricultural economies in the world and will continue to be important with respect to climate change. However, it is critical that policies allow China to get the most out of the available factors relating to production and natural resources.

An important message of our analysis is that irrigation is critical to China's agriculture system. As nearly 60% of cultivated land in China is irrigated, part of China's ability to cope with future climate change depends on its capacity to use water for irrigation. There could be much larger harmful effects if warming forces many irrigated farms to become rainfed farms. Climate change increases the pressure to develop institutions and infrastructure in water scarce regions to treat water as a valuable resource.

China may also consider developing better management practices; adopting new varieties (crops and livestock) suitable for a warmer climate; adapting new technologies in agriculture and educating farmers about them.

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