Mini-Symposium / Thematic Session 7

Accessing the technology revolution and its impact on Asian agricultural productivity: opportunities and challenges

Technology progress in agriculture continues to be the most important factor to resolve global food security with constrained natural endowment supplies. While “mechanical” and “biological” technologies represent two clusters of inventions in agriculture for the past century, debates on how these two types of technologies are initiated, sequenced and interacted with each other never end. This symposium proposes to assess the impact of new wave of technology progress (i.e. mechanization, ICT and biotech) and its potential impact on agricultural productivity growth. We provide empirical evidence that recent technology breakthroughs will not necessarily continue the success of the Green Revolution. Four papers will be presented focusing on the impact of biotech and mechanical innovations on productivity, ways of production, and their side effects as well. The aim is to better understand the mechanism of agricultural growth and further promote rural development in the new era.

Paper 1: Impact of GMO Revolution on Agricultural TFP: A New Global View

Haiyan Deng

This paper examined the impact of GMO adoption on agricultural TFP across countries, with a focus on the interaction between biological and mechanical technologies in affecting agricultural productivity. Based on the TFP concept, we derive the theoretical relationship between agricultural TFP, capital deepening and the GMO technology, and apply the time-variant DID approach to a balanced panel data of agricultural input and output data for 147 countries over the period of 1961-2016 for empirical test. We show that the net productivity gains from the GMO technology since the mid-1990s averaged only at 1 percent across countries, much smaller than the prediction of the existing microeconomic literature. A further cross-country comparison analysis shows that developing countries biased to choose the GMO varieties with IR traits to save production costs which have lowered the marginal returns to mechanical innovation and thus offset the positive productivity gain of the GMO technology.

Paper 2: Green Revolution is Not Green: Overdose of Fertilizers and the Lost Gene in Rice

Moyu Chen

The overdose of fertilizer poses serious challenges to sustainable growth and agricultural resilience. With the development of the Green Revolution (GR) in the 1960s, the promotion of breeding techniques aimed at high crop yields was accompanied by a massive consumption of agricultural fertilizers. China is a representative region of over-fertilization, with fertilizer consumption per hectare of arable land about three times higher than the world's average over the past five decades. To decipher the unknown causes of over-fertilization and fill the gaps in existing fertilizer overdose studies, this paper cuts from the perspective of GR and nitrogen fertilizer overdose in China. We first use the QTL database to construct indices measuring the loss of high nitrogen-use efficiency genes in modern rice in the context of GR. Then, based on economic rationale for derived demand of inputs, we estimate their impacts on China's nitrogen fertilizer consumption in rice production.

Paper 3: Accessing Impact of the COVID-19 Pandemic on China's TFP Growth: Evidence from Region-level Data in 2020

Baodong Cheng

This paper examines the impact of the COVID-19 pandemic on region-level TFP growth in China for 2020, and assess the role of anti-epidemic lockdown policy in suppressing the pandemic and maintaining economic growth. We combine the daily statistics on accumulated numbers of infected, deceased, healed and suspected cases with region-level TFP estimates for 2020. Our results show that the pandemic has generally imposed a negative impact on region-level TFP growth in 2020, and in particular, is more likely to affect TFP growth in the regions with low resilience level. Moreover, we also show that the anti-epidemic lockdown policy imposed across regions in China succeeded to help bring the COVID-19 pandemic down. However, the regions with a higher resilience level needs a more flexible anti-epidemic policy to better mitigate the COVID-19 impacts with lower economic costs. These findings provide insights for China and other Asian developing countries to cope with its continuing episodes.

Paper 4: Mechanization Service and Land Fragmentation: Evidence from A Farm-level Analysis

Xingshuo Liu

Mechanization services, including machinery rental and technical/management services, have long been regarded as a complementary to self-owned machinery in agricultural production. Recent statistics shows that it has become popular in China since the 2010s. Despite of large amount efforts spend on examining the impact of mechanization services, little is known on how it would change the way of smallholders' production. This paper aims to investigate the relationship between mechanization services and the way of production, with a focus on land fragmentation and its impact on farmers' choice among different types of mechanization services. By using the nation-wide farm survey data between 2010-2017 conducted by RCAE, we show that mechanization services improve farm productivity through substituting labor, yet fail to increase the returns to scales. A potential explanation is land fragmentation caused by rigid land regulations.

Organisers:

Yu Sheng, China Centre for Agricultural Policy, Peking University

Discussants:

Yu Sheng, China Centre for Agricultural Policy, Peking University

Yu Liu, Institute of Science and Development, Chinese Academy of Sciences