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Global Food Security—Introduction

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The United Nations Millennium Declaration involved member nations in seeking to reduce extreme hunger and poverty measured against targets set for 2015. There *may* have been some success to date,[1] with the estimated total number of undernourished people falling by 17 per cent since 1990–1992 (FAO 2013). But there remained around one in eight people in the world who suffered from chronic hunger in 2011–2013. While the measured progress shows marked regional differences, sub-Saharan Africa remains the region with the highest prevalence of undernourishment. Progress has been slow in South Asia although the experience appears more positive in East and South-East Asia and Latin America.

As the 21st century unfolds, concerns about the adequacy of global agricultural production and food systems to feed and properly nourish the world's population have resurfaced – echoing some similar (but also different) concerns that prevailed in professional and popular thought half a century ago. The similarities lie in uncertainty about looming global imbalances in the pace of growth in food (or more broadly agricultural) demand versus supply (Erlich 1968; Meadows *et al*. 1972; Brown 2012), but now coupled with concerns about rising obesity alongside the persistence of large scale undernutrition. The other notable differences are the relative sizes of the planet's population – a projected threefold increase in population between 1960 and 2050 – and where the rate of growth in population to 2050 is expected to be roughly half the rate observed for the past 50 years. The world's population is now ageing and becoming increasingly urbanised and increasingly concentrated in today's low- and middle-income countries.

Agriculture is taken to have large effects on the global climate and in turn is sensitive to weather events. Fifty years ago, substantial (but minority) scientific attention was being given to global cooling (Kukla and Matthews 1972); now the focus is squarely on global warming in the context of climate changes that are envisaged to proceed in a more rapid and more volatile fashion compared with past trends.

Our understanding of the present reality and future prospects of global food security issues sits at the nexus of science, economics, policies, politics and environmental concerns. This volume comprises seven papers from leading economic scholars that tackle different dimensions of food production, consumption, trade and nutrition. Most of the papers have a

[1] Svedberg (2002) and the references cited therein speak to the fragility of and biases in the FAO prevalence of undernutrition estimates.

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forward-looking perspective, focusing on the likely trajectories of global agriculture and food systems and the food security consequences of those prospective futures.

While recognising the huge potential to raise farm productivity worldwide, especially in developing-country agriculture, Pinstrup-Andersen asserts that the major impediments to increased agricultural output lie beyond the farmgate. Therefore, an imperative is for policies that improve rural infrastructure and markets and that promote efficiencies in postharvest value chains and input markets. Without such policies, it will remain difficult for smallholders to respond to incentives to raise output and productivity. This author sets out and discusses five food policy challenges: to reduce rural poverty and increase food production by smallholders; to endogenise environmental externalities into production costs; to improve human health and nutrition (just producing more food is not sufficient); to adjust to continuing price volatility and to ensure real food prices do not trend upwards in future. Several examples of successful projects and policy approaches are given, along with policy failures.

The paper of Warr examines some drivers of food security and subsequent implications for policy. He presents and clarifies the meaning and various dimensions of food security while emphasising the need for more quantitative assessments, not least to assess progress towards achieving 'full food security.' In this spirit, the paper presents data on the prevalence and depth of undernourishment in several developing regions and the relationship between undernourishment and poverty. Warr's assessment supports the findings of FAO (Food and Agriculture Organization of the UN) and others, revealing that, in some regions at least, economic growth is neither necessary nor sufficient to decrease undernourishment. The paper describes a two-edged sword effect on household (and regional) food security from lowering food prices. Lower food prices reduce undernourishment for net buyers of food, while increasing it for net food sellers. He concludes by describing two broad policy thrusts to reduce food insecurity; one involves propping up prices (by various policy interventions) that benefit net sellers of food, but hurt net purchasers, and the other, and preferred approach, is increasing investments in infrastructure and research to increase productivity. Both approaches increase agricultural output, but the latter does so without raising food prices and may lower them.

Wright continues the focus on food (and other) prices but with an emphasis on the volatility as well as the level of prices, where the effects of (rapidly) rising rather than falling prices tend to garner more popular and policy attention and have especially detrimental consequences for the poor and food insecure. He evaluates the empirical and theoretical veracity of a number of stylised facts and opinions concerning the drivers of food price volatility. These include the widely held notions that the spikes in real grain prices in 2008 had no historical precedent during the previous quarter of a century and that recent harvest shortfalls, climate change or fluctuations in petroleum

prices (or energy prices more generally) are among the principal drivers of food price volatility. Against these supply-side factors, Wright puts his bets on two demand-side factors as being the more significant sources of volatile food prices over more recent years. One is the growth in demand for biofuels (linked more closely, it seems to a rise in oil prices and accommodating government fuel-blend rules in those instances when the capacity constraints in biofuel plants were not binding). The other is the growth in demand for animal-derived foods in rapidly growing middle-income countries, including China, which has dramatically increased its imports of soy-based feed products, thus diverting land from cereal production elsewhere in the world.

The remaining four papers in this volume use various modelling approaches to assess various dimensions of global food security and food policy. The papers by Baldos and Hertel and Pardey *et al*. used different but relatively parsimonious approaches to projecting aspects of the global food economy to the middle of this century. Anderson and Strutt and Ivanic and Martin both deploy general equilibrium (GTAP) models, in the first instance to assess the trade and food security consequences of growth in emerging economies looking to 2030, in the second instance to assess the impacts of special safeguard mechanisms intended to protect farmers (in developing countries) from undue competition triggered by higher than baseline import volumes.

Using a partial equilibrium model, Baldos and Hertel assess the effects of alternative agricultural productivity and climate change scenarios on food security outcomes in 2050, emphasising the consequences on the number of malnourished worldwide. Their study demonstrates that changes in malnutrition prevalence and headcounts can be substantial even when changes in average consumption levels are comparatively small. A focus is on the distribution of caloric consumption levels across a population, which is critical to their measures of food security. The study highlights the crucial importance of continued agricultural productivity growth to improved food security in developing regions of the world. The impacts of climate change are analysed with and without the crop yield improving effect of atmospheric CO_2 fertilisation. Climate change alone leads to lower global crop yields and therefore an increased global malnutrition count, although it is a less important driver of malnutrition than is population growth. Accounting for the crop fertilisation effects of increased atmospheric CO_2 reverses this outcome and improves food security, especially in the poorest regions.

Pardey *et al*. form projections of agricultural consumption, differentiating between calories consumed from plant versus animal sources – driven by prospective changes in population, per capita income and demographics (ageing) – and the demand for crops used in biofuel (and joint animal feed) production. They then assess if projected production can meet consumption given a set of region- and crop-specific yield trajectories and a spatially sensitive deployment of land in agriculture. Contrary to common claims of a doubling in the demand for food by 2050, they find in favour of a more

modest growth in consumption, even allowing for plausible variations in the projected, but generally slowing, rate of growth in population. By 2050, average global per capita demand for calories is likely to be similar to that observed today in high-income countries, with the majority of the increased demand being for meats and other animal products. Notwithstanding a general (but not equally everywhere) continuation of the slowdown in the rate of crop yield growth, they also project that crop land per capita may actually decline over this period, negating the argument that global growth will require further deforestation to meet future food demands. Allowing spatial comparative advantages to drive the agricultural use of land, they envisage cropland expanding in high-income countries, Latin America and Africa, but contracting somewhat in Asia. These results ought not to indicate that efforts to increase R&D funding for agriculture can be curtailed. Simply sustaining, let alone still increasing, crop yields in the face of co-evolving disease, and pest pressures and the effects of prospective (but difficult to measure) changes in climate is likely to be harder going forward than it has been in the past.

In a final forward-looking assessment, Anderson and Strutt make projections out to 2030 to explore the trade and food security implications of a continuance in the relative rapid economic growth in emerging economies like China and India and a slower growth in the industrial, and notably the natural resource rich, economies such as Australia and New Zealand. Food security, measured by real per capita private consumption of agricultural and processed food products, is projected to increase substantially over all developing countries between 2007 and 2030. A scenario of slower than baseline Asian growth and lower primary sector productivity growth worldwide would retard this improvement in food security. In either case, these countries' populations can expect to be better fed by 2030. The authors warn that the fall in developing-country food self-sufficiency implied by their results (with increasing food imports) could give rise to pressures to increase agricultural protection as observed in some Asian economies over recent decades.

A theme running through some of the papers in this issue is that policies, while implemented *inter alia* to lessen food insecurity, may actually work in the opposite direction. Ivanic and Martin explore a specific example of this – the quantity-based special safeguard proposed during the Doha Round of global trade negotiations, wherein an import duty may be applied when imports increase above baseline. The argument for such an approach might be to protect domestic producers and encourage local food production. While safeguard mechanisms were initially designed to protect farmers in industrial countries, who by and large are net sellers of food, such policies may produce different outcomes in developing countries where many farmers may be net purchasers of food. Using CGE modelling and data on crop yield variability along with household data from a sample of low- and middle-income countries, they conclude that such a volume-based safeguard would likely be implemented frequently, raising consumer food prices. As a result, the global

poverty headcount would increase due to the importance of food in the expenditure patterns of the poor and the tendency of low-income farmers to be net buyers of food. Hence, a protectionist policy designed to help farmers may in fact increase poverty.

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