



**THE OHIO STATE UNIVERSITY**

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# More than nine billion people to feed in 2050

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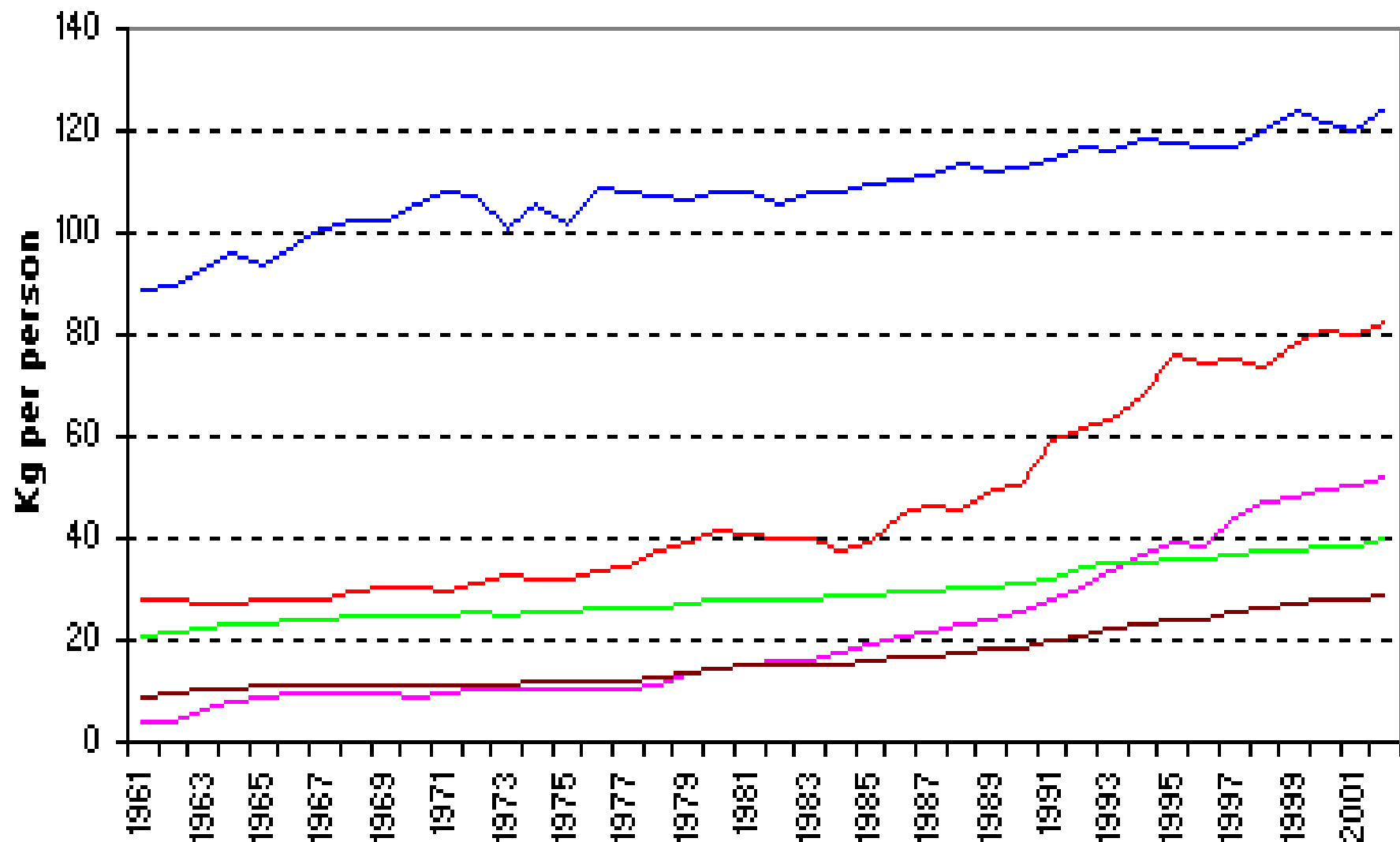


# Global Trends in the Food Economy since the Middle 1900s

- Human population rose from 2.5 billion in 1950 to 7.2 billion in 2013.
- Per-capita consumption of food, especially livestock products, has increased because of improved living standards – in China after the late 1970s, in India starting about ten years later, and more recently in other parts of the world.
- Increases in agricultural land use: Area planted to crops up by 45 percent and grazing land up by 10 percent since the early 1960s.
- Cereal yields have more than doubled since the early 1960s, from 1.5 metric tons per hectare (equivalent to 25 bushels of corn per acre) 55 years ago to nearly 4.0 metric tons per hectare today.
- Food is now much less scarce than it used to be: Real grain prices declined by 75 percent between 1950 and middle 1980s.

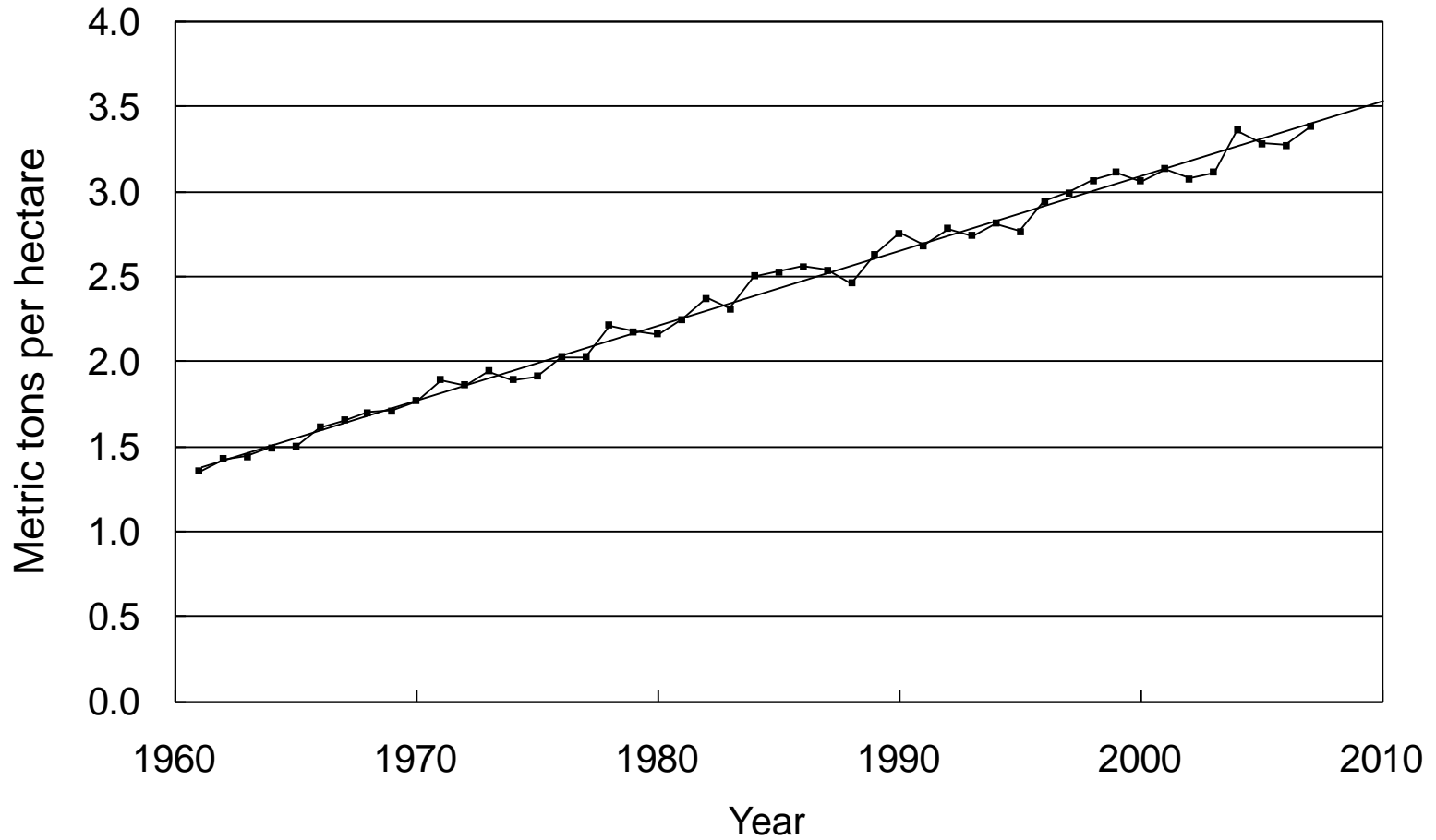
# Global Meat Consumption per capita

— Brazil — China — Developing Countries — World — USA





# Global Cereal Yields





# The Economist

OCTOBER 31ST–NOVEMBER 6TH 2009

[Economist.com](http://Economist.com)

Obama's paradoxical first year

Capital floods into India

Are functional foods the future?

Let prisoners vote

Van Gogh's luminous letters

# Falling fertility

How the population problem is solving itself





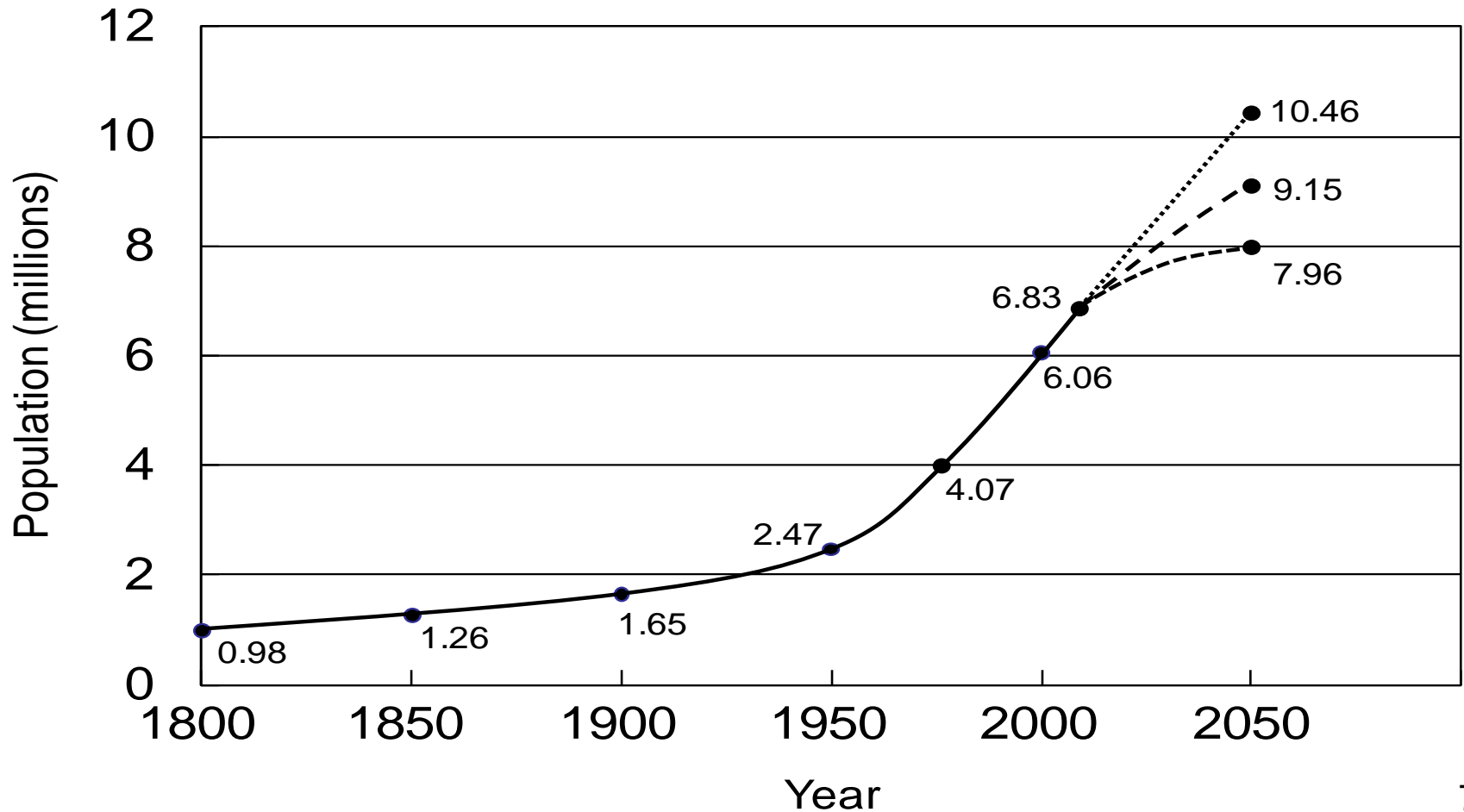
# Human Fertility Revolution

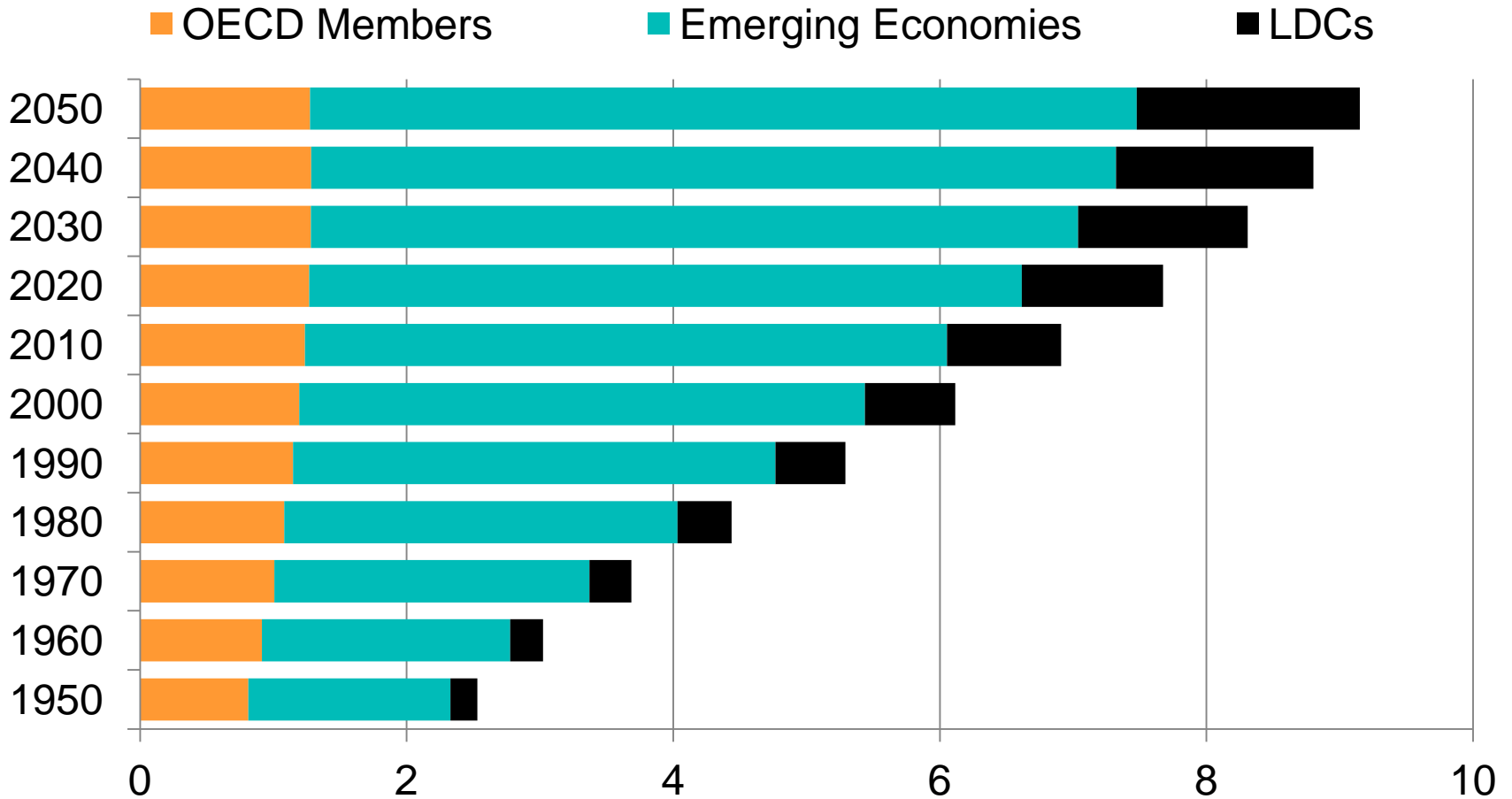
Between 1982 and 2007, total fertility rates (TFRs) declined throughout the world – to and even below the replacement level ( $2.1 \pm$  births per woman) in many places:

- from 2.5 to 1.7 in Eastern Europe and the Former Soviet Union;
- from 3.1 to 1.9 in East and Southeast Asia;
- from 5.2 to 2.9 in South Asia;
- from 4.2 to 2.4 in Latin America and the Caribbean;
- from 6.2 to 2.8 in the Middle East and North Africa;
- from 6.7 to 5.1 in Sub-Saharan Africa; and
- from 1.9 to 1.8 in high-income nations belonging to the Organization for Economic Cooperation and Development (OECD).



# Global Population, 1800-2050









# Food Demand Trends up to 2050: OECD Members

- Combined population in 2013: 1.3 billion (out of 7.2 billion for the world as a whole).
- TFRs fell to or below the replacement level at least a generation ago and now average 1.7 births per woman. Natural increase (births minus deaths) has ended or will do so soon, although some population growth will continue because of immigration.
- Engel's Law, which holds that food demand grows less sensitive to income growth as living standards improve, certainly applies.
- Bottom Line: Modest growth in food demand for the foreseeable future.



## Food Demand Trends up to 2050: Emerging Economies

- Combined population in 2013: 5.0 billion (69 percent of the global total).
- TFRs now average 2.4 births per woman and have fallen to or below the replacement level in many countries. There is still natural increase, although human numbers will peak and then decline – first in China (by 2030) and then in Thailand, Vietnam, Iran, Brazil, etc. Russia's population is already contracting.
- Consistent with Engel's Law, growth in the demand for livestock products, feed grain, and other edible goods will decelerate as living standards rise in these economies.
- Bottom Line: Substantial increases in food demand during the next few decades.



## Food Demand Trends up to 2050: Least Developed Countries (LDCs)

- Combined population in 2013: 0.9 billion (still behind the OECD subtotal) in four dozen countries, primarily in Sub-Saharan Africa.
- In spite of recent declines, TFRs remain well above the replacement level, averaging 4.5 births per woman. Natural increase is elevated and will continue to be so well after the middle of this century.
- Living standards in “bottom billion nations” (as economist Paul Collier characterizes them) are miserable, which implies that higher incomes translate mainly into increased food purchases. But as Collier emphasizes, current prospects for sustained income growth are not encouraging.
- Bottom Line: Demographically-driven growth in food demand will be substantial well past 2050.



## Food Demand in 2100: Wealthy Nations

- With immigration compensating for negative natural increase in these countries, their combined population at the end of this century will be little changed from what it is today: 1.3 billion or so.
- Engel's Law will continue to hold, so increases in per-capita food consumption resulting from improved living standards will be modest.
- Food demand growth this century, such as it will be, will relate entirely to these modest increases in per-capita consumption.
- Between their own production and the imports made possible by non-agricultural exports, these countries will feed themselves with ease.



## Food Demand in 2100: Emerging Economies

- After peaking around the middle of this century, the combined population of China, India, etc. in 2100 will be 6.5 billion, about 30 percent greater than the current level though still more than half the 10.8 billion people expected to be alive at the end of this century.
- With increases in human numbers decelerating markedly, growth in food demand will be driven primarily by improvements in living standards. However, this growth-driver will weaken after 2050.
- Food insecurity could be severe in selected portions of some emerging economies – northern India, for example, which suffers from bottom billion realities (including elevated TFRs) and where water resources are severely depleted already. But otherwise, the emerging economies will feed themselves out of domestic production and imports paid for with non-agricultural exports.



## Food Demand in 2100: Least Developed Countries

- Bottom billion LDCs will not experience any demographic contraction this century. To the contrary, their combined population will more than triple, from 0.9 billion at present to 2.9 billion (27 percent of the global total) in 2100.
- If economic growth in these countries does not accelerate, improved living standards will not contribute as much as demographic expansion to food demand growth.
- Food insecurity is widespread already in LDCs. A minority of these countries rely heavily on non-agricultural exports: crude oil, copper, and other commodities rather than manufactured goods. Barring a quantum leap in food aid, food supplies will have to be produced domestically.



## Conclusions

- A magnificent achievement: Growth in human numbers and food demand has been unprecedented since the middle 1900s. Yet food supplies have increased faster than food demand, not because of an unmeasured expansion in agricultural land use but rather because crop yields have more than doubled.
- Population growth and increases in food demand this century are unlikely to match trends during the second half of the 20<sup>th</sup> century, certainly not in relative terms and probably even in absolute terms.
- In wealthy nations, where food supplies are already ample, future growth in human numbers and food demand will be negligible. Also, this growth will decelerate noticeably in emerging economies, where a shrinking portion of the population is food-insecure.
- In contrast, human numbers are expected to triple in LDCs, thereby adding to the challenge of achieving food security.



# THE WORLD FOOD ECONOMY

Second Edition

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