Agriculture & development

Academic year 2024 – 2025

Introducing me

Caroline Miehe

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Caroline Miehe

Caroline Miehe is a researcher at NOVAFRICA, Nova University Lisbon and holds a Doctor of Economics from KU Leuven. She specializes in **Development Economics** and is involved in the design and evaluation of several field experiments and randomized control trials in sub-Saharan Africa. Caroline has recently worked for LICOS (KU Leuven) and the Development Economics Group (Wageningen University) and has taught courses at the University of Potsdam and KU Leuven. She has published articles in academic journals such as *World Development*, *Economic Development and Cultural Change*, and *Agricultural Systems*, and authored reports, a book chapter, and various blogs.

Academic mission statement: I conduct randomized experiments in sub-Saharan Africa to explore how economic principles—such as decision-making under risk and asymmetric information—can inform strategies that enhance agricultural technology adoption and climate disaster management, to strengthen the resilience of farmers and communities facing poverty and climate change.

Interest & expertise: information (asymmetries), learning (failures) • risk, uncertainty • agricultural technology (adoption), seed systems, smallholder farmers, agro-input dealers • gender bias/ dynamics • community-based monitoring, public service delivery • (climate-related) disasters, resilience • urbanization, urban development • community meetings/ involvement/ mobilization • field experiments, randomized controlled trials, intervention design • sub-Saharan Africa, Uganda, Mozambique

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Introducing you

- Did you study economics in your undergraduate degree?
- Have you ever been to a developing country?
- Are you considering a career in development?
- Do you enjoy lectures with interactive elements?

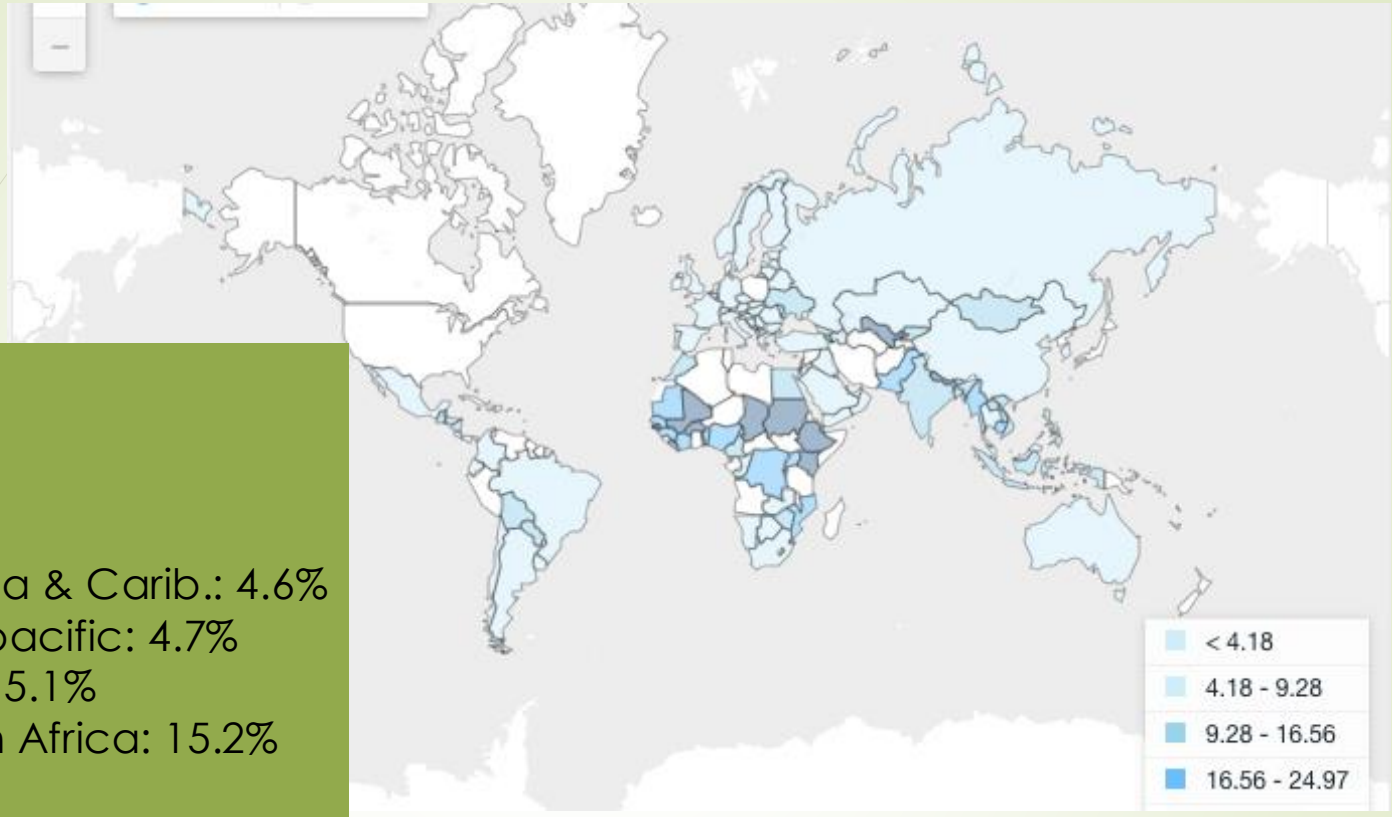
Why study agriculture?

Agriculture was the basis for historical development

- Jared Diamond: agriculture generated surpluses

Does it still matter today?

- Everyone needs, and will continue to need food
- Remains an important economic activity and source of employment, especially so in developing countries



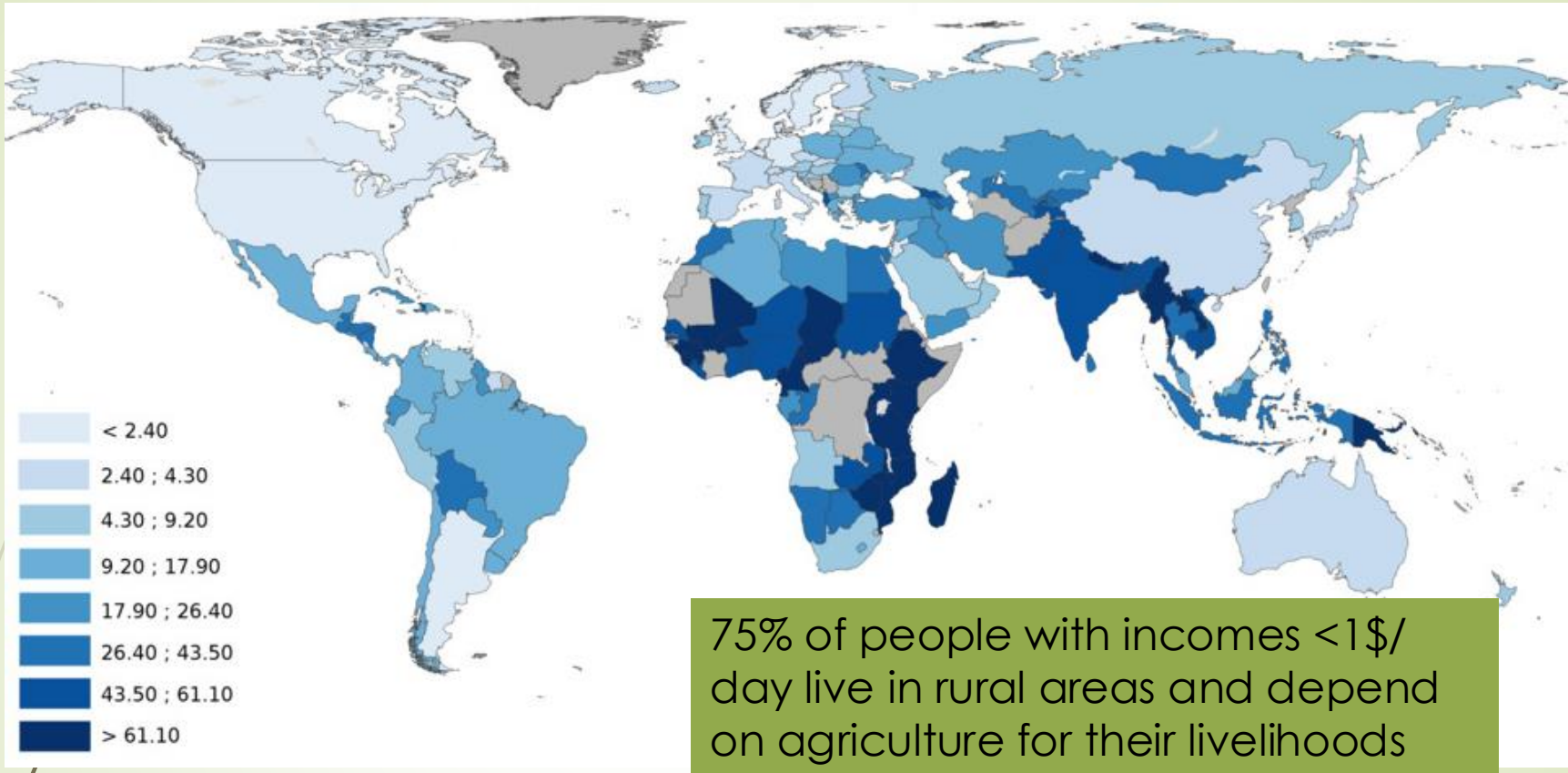
- World: 3.4%

- US: 0.9%
- EU: 1.4%
- Latin America & Carib.: 4.6%
- East Asia & pacific: 4.7%
- South Asia: 15.1%
- Sub Saharan Africa: 15.2%

- > 60%: Somalia, Sierra Leone

Agriculture, forestry & fishing (% of GDP)

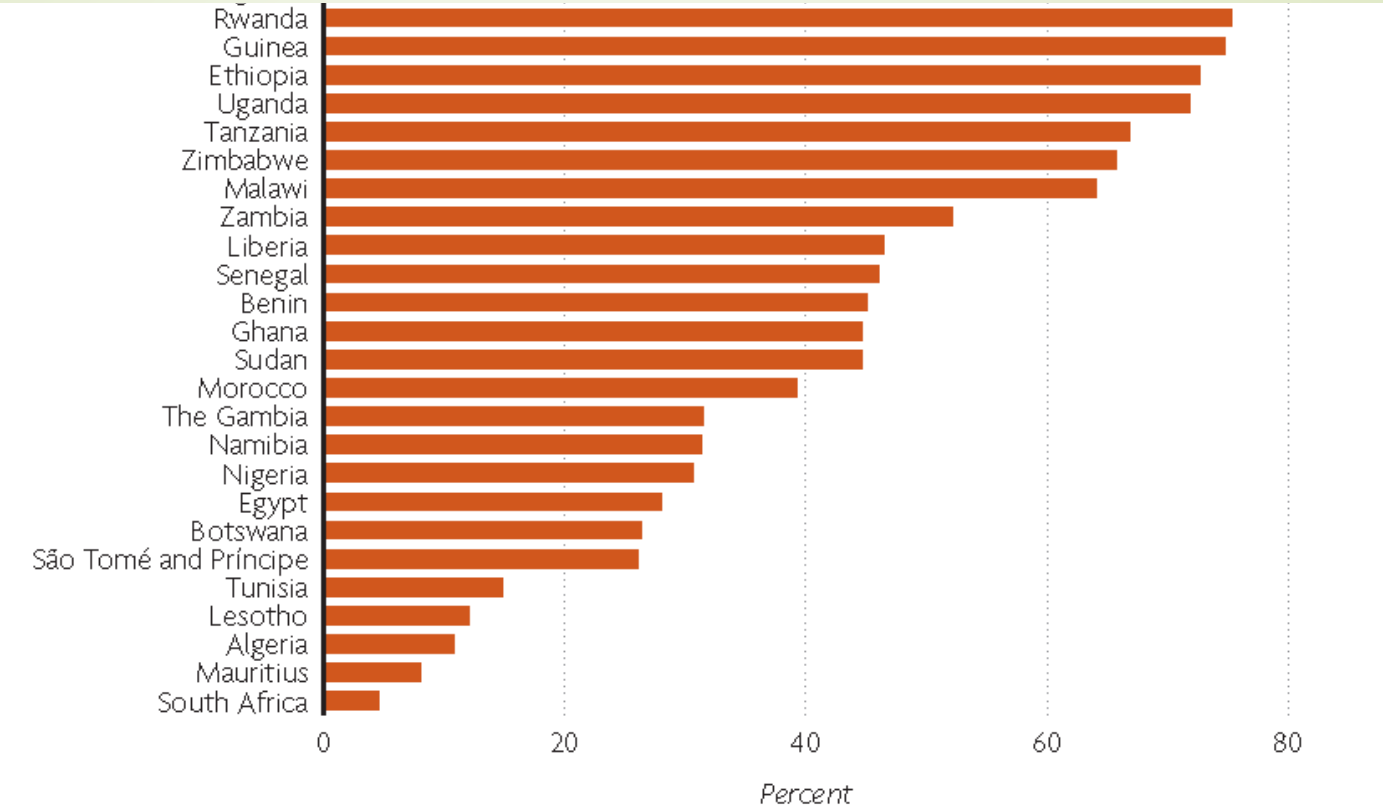
Source: World Bank



75% of people with incomes <1$/ day live in rural areas and depend on agriculture for their livelihoods (de Janvry & Sadoulet, 2016)

Employment in agriculture (% of total labor force)

Source: World Bank



Large share of Africans are employed in agriculture

Source: ACET, 2016

Quiz

Overview

1. Agriculture for development
   - Agriculture as a source of GDP growth
   - Agriculture for poverty reduction
   - Agriculture for resource saving against climate change
2. Relationship between food production and population growth

1. Agriculture for development

A) GDP growth

Source: Chapter 18 in De Janvry & Sadoulet, Development Economics: Theory & Practice

Agriculture as a source of GDP growth

- In developing countries, agriculture contributes strongly to
  - GDP
  - Employment
- Why?
  - Rich in natural resources
  - Potential to improve (in agri sector)
  - Too weak business climate (for manufacturing & service sector)
  - Too large economies of scale (in manufacturing sector)

Agriculture as a source of GDP growth

- Agriculture contributes to growth through:
  - Product markets
  - Capital contributions
  - Foreign exchange contributions
  - Labor and welfare contributions
  - Market contributions

→ Of course, many of these channels interact, but we will discuss each of these in turn

Product markets

Higher productivity in agriculture

- More surplus available for urban markets
- Possible to sustain larger urban population, engaged in other activities

Higher productivity in agriculture

- Lower price of food
- Lower nominal wages for industry (for given real wage)
- Larger return on investment in industry
- Economic growth

Capital contributions

Higher productivity in agriculture

- More revenues
- Financial surplus: money not needed in the agricultural sector can be invested somewhere else

How?

- Taxes, for instance on land (cfr. Japan, mid 1800s)
- Forced deliveries (cfr. Soviet Union, 1930s)
- 'Invisible' indirect transfers, through export taxes, price controls, …

Foreign exchange contributions

Agricultural exports are main source of foreign currency for several countries (cfr. coffee)

- Foreign currency can then be used to pay for other (industrial) imports
- Also, export taxes easier source of taxation than income taxes or VAT

Labor and welfare contributions

- Higher productivity in agriculture → release labor from agriculture → rural-urban migration
- Migrants' education paid by rural agriculture, benefits for urban industry
- 'Farm financed social welfare' (Owen, 1966): in cases of economic downturn, workers return to the safety net of agriculture
  - China: 20 million unemployed urban workers returned to their villages during financial crisis of 2008
  - COVID

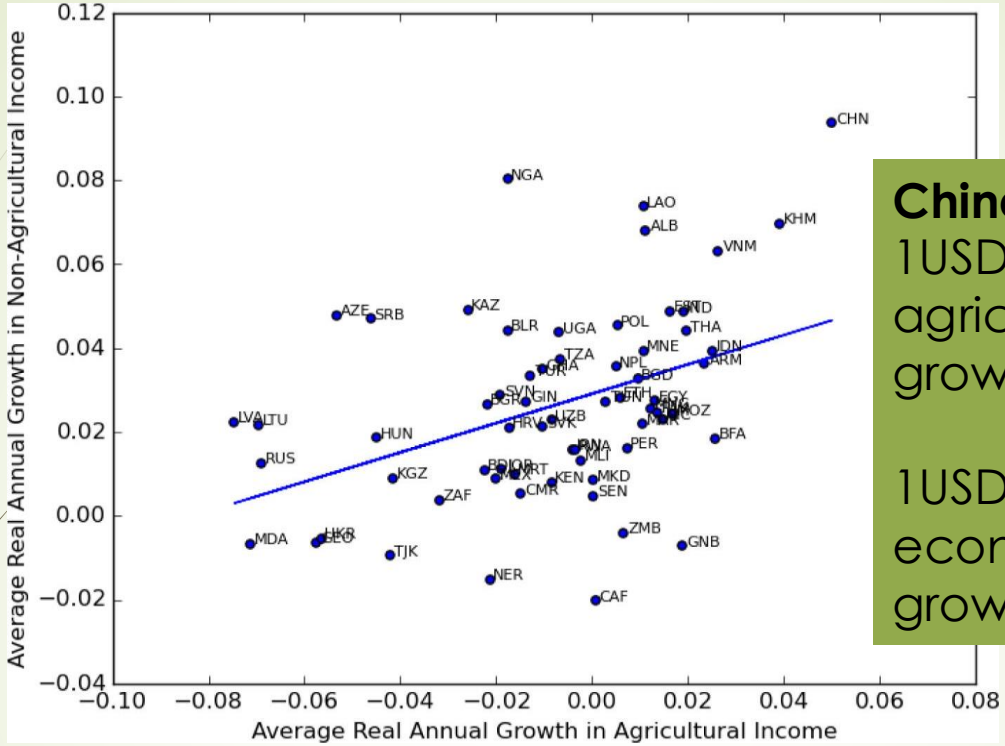
Market contributions

Higher productivity in agriculture

- Higher demand for industrial machinery
- Higher industrial growth
- Virtuous cycle (higher productivity → higher industrial growth → higher productivity → …)

Higher productivity in agriculture

- Higher agricultural incomes
- Higher demand for other products



China 1980-2001
1USD investment in agriculture → 1USD growth in rest of economy

1USD invested in rest of economy → 0.18USD growth in agriculture

Conclusion: investing in agriculture has growth spillover effects in the rest of the economy, especially at low levels of growth.

Source: Ligon, Sadoulet (2018)

Quiz

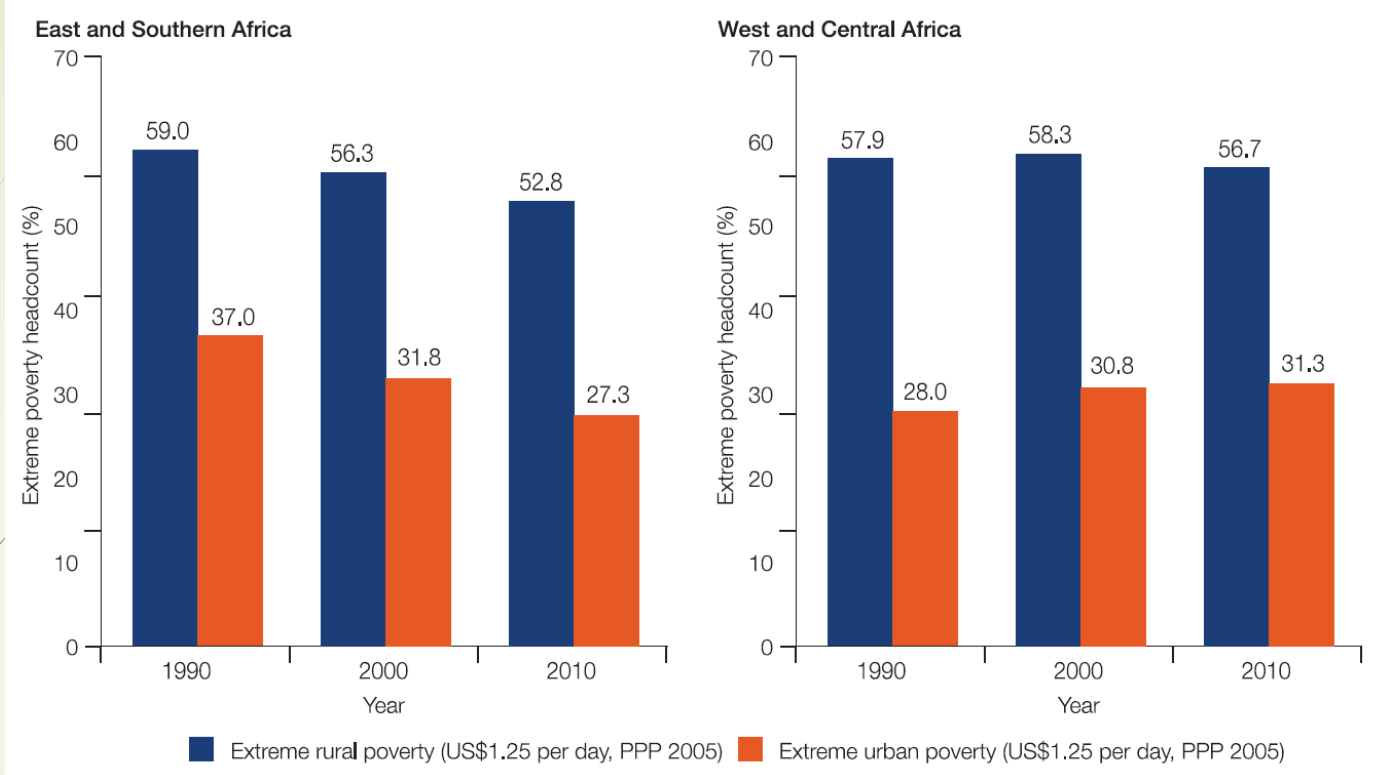
1. Agriculture for development

B) Poverty reduction

Source: Chapter 18 in De Janvry & Sadoulet, Development Economics: Theory & Practice

Agriculture for poverty reduction

- Higher productivity in agriculture reduces poverty
  - Most of the world's poor live in rural areas
  - Most of the world's poor depend on agriculture
- Especially in developing counties
  - In more developed countries, industry and services are more effective in reducing poverty (because less people work in agriculture)



Rural vs. urban poverty

Source: IFAD, based on World Bank (2015)

Agriculture for poverty reduction

The effect of agriculture on poverty is determined by

- Who participates/ works in and benefits from growth in sector
  - Few large companies vs. many smallholder farmers
  - Staple crops (consumers benefit from lower prices) vs. export crops (producers benefit from higher incomes)
- Size of agricultural sector (even small improvements have large effects in a large sector)
- Strength of economy wide linkages to other economic activities (spillover effects)
- Socio economic setting and stage of development (developing vs. developed countries)
- Topographical conditions (e.g., matters for agri-technologies like irrigation systems; ruggedness hinders transportation)
- Resource endowments (e.g., nutrient rich soil)
- Agro-ecological potential (climate, rainfall, temperature)

Video for visual learners: https://www.youtube.com/watch?v=XtFU2_RydcQ&ab_channel=Grist

Source: Grist (2015)

Quiz

1. Agriculture for development

C) Agriculture for resource saving against climate change

Agriculture for resource saving against climate change

Agriculture = major (mis)user of natural resources

- Agriculture uses 80% of freshwater
- Agricultural chemicals pollute drinking water
- Agriculture + deforestation in developing countries = 25% of global greenhouse gas emissions
- Agricultures leads to loss of biodiversity, soil erosion, …

- Agriculture = big source of climate change
- Agriculture = potential engine to tackle climate change (e.g., resource-saving technologies; making farm systems resilient to climate change)

2. Food production and population growth

Will we be able to feed the world?

Food production and population growth

Relationship between food production (supply) and population growth (food demand) - **2 theoretical views**

- Positive relationship: population growth enhances food production (optimists)
  - Demand-driven theory
  - Supply-driven theory
- Negative relationship: population growth > food production (pessimists) → disaster

Positive relationship: Demand-driven theory

Boserup, 1981

- Population growth → more mouths to feed → innovation ("Necessity is the mother of invention")
- Population growth induces the improvement of agricultural technologies and hence enhances food production **through increased demand**
- Technology and food supply are *endogenously* determined by population growth, while the growth in population itself is explained by *exogenous* factors (e.g., cultural norms)

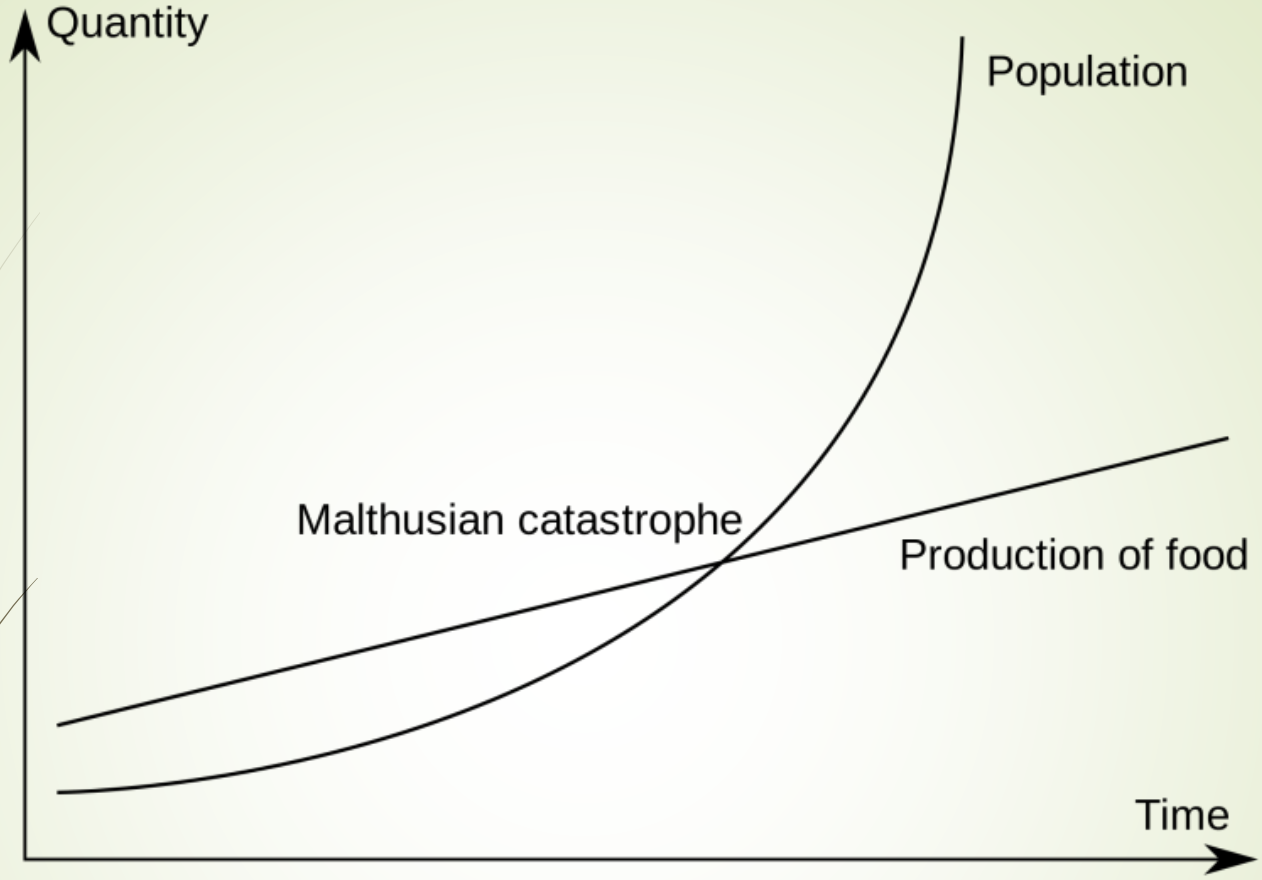
Evidence?

Positive relationship: Supply-driven theory

Kremer, 1993

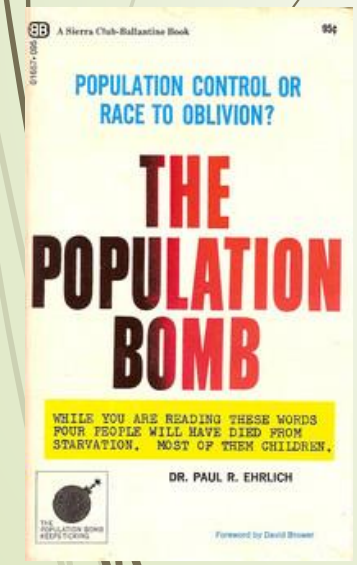
- Population growth → more potential inventors → innovation
- Population growth induces the improvement of agricultural technologies and hence enhances food production **through increased supply**

- Evidence?



Negative relationship: Malthus (1798)

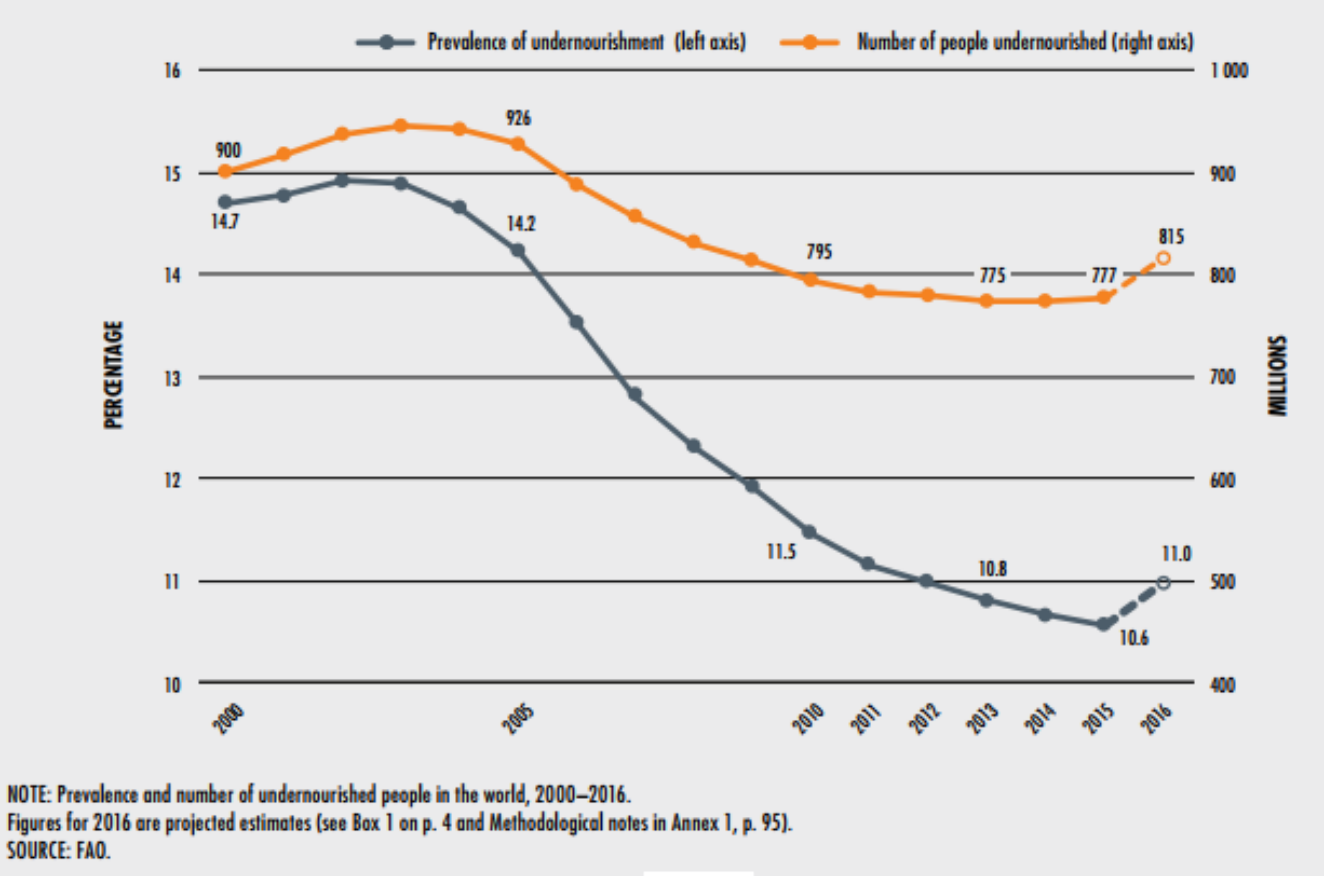
Negative relationship



- Neo-Malthusians (e.g., Paul Ehrlich: The Population Bomb, best-seller in 1968)
- Evidence?
  - For most of human history: living at subsistence level; change in food supply (drought, fire, …) → population reduction
  - Many deaths from famines (at Malthus' time and afterwards)
  - However, we have avoided a Malthusian catastrophe on a global scale so far
  - Famines and hunger are declining over time
  - While population has increased drastically, we have also managed to increase food production drastically: (Neo-) Malthusians underestimate technological progress and increases in agricultural productivity (not linear)

Deaths from famines

Source: The Lancet 2015



NOTE: Prevalence and number of undernourished people in the world, 2000–2016.
Figures for 2016 are projected estimates (see Box 1 on p. 4 and Methodological notes in Annex 1, p. 95).
SOURCE: FAO.

Undernourishment

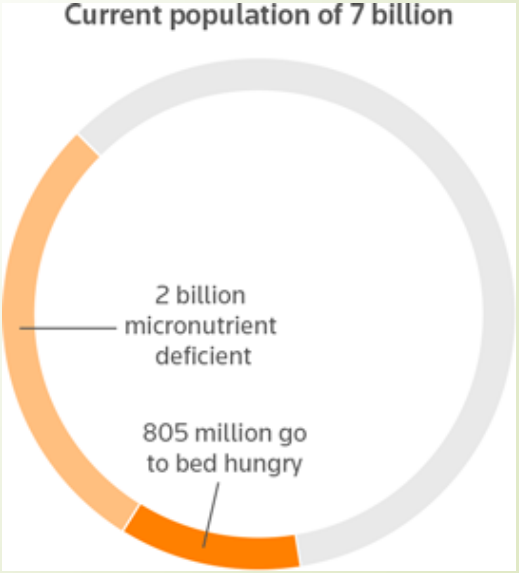
Source: FAO

Global scale ≠ local scale

- We produce enough food to feed the world
- But hunger and malnutrition in many locations

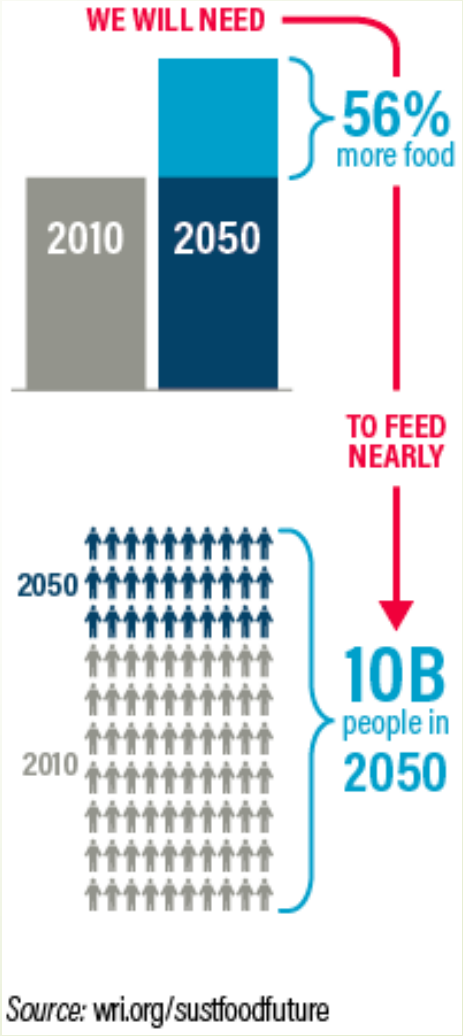
Why?

- Global food supply is not evenly distributed
- Local Malthusian crises (natural disasters, droughts, conflicts, …)



What about the future?
Will we be able to feed the world?
Why (not)?

Discussion



Determinants of food demand

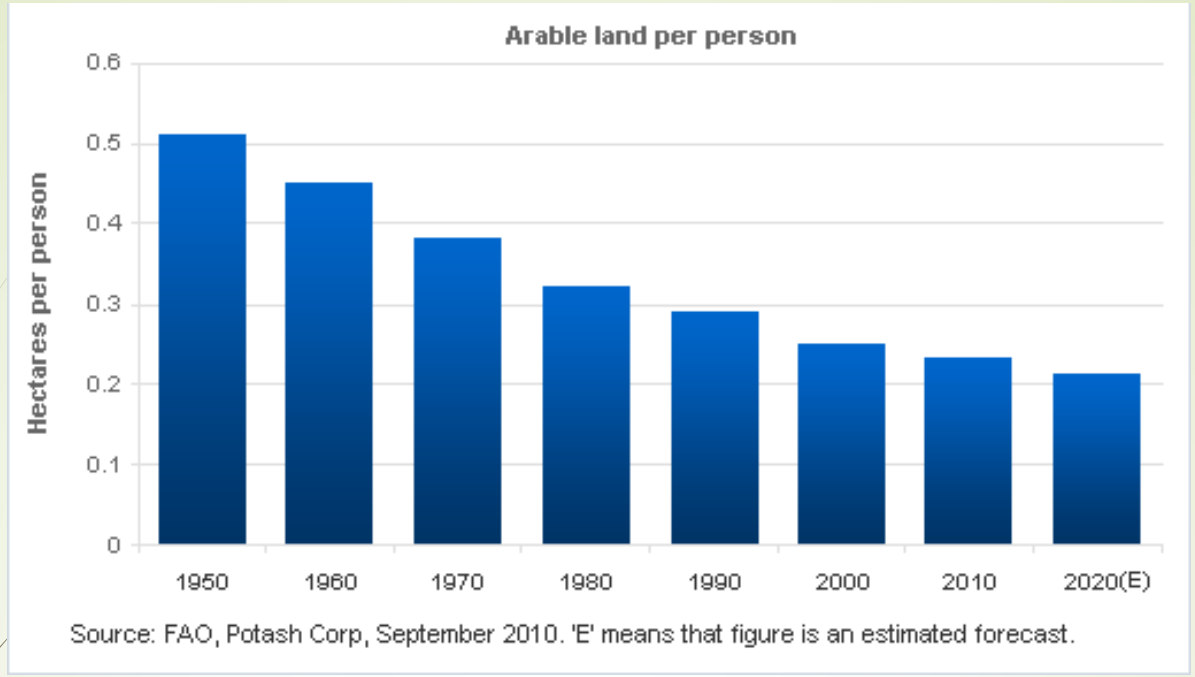
- Population size
- Urbanization
  - Increase in the share of net food buyers
  - Change in food habits (supermarkets, fast food, …)
- Income
  - As income rises, the demand for food rises (although the share of income spent on food decreases - Engel's law)
  - Meat, diet diversification, quality, convenience, bio
- Non-food uses
  - Energy (biofuels)
  - Animal feed

Determinants of food supply

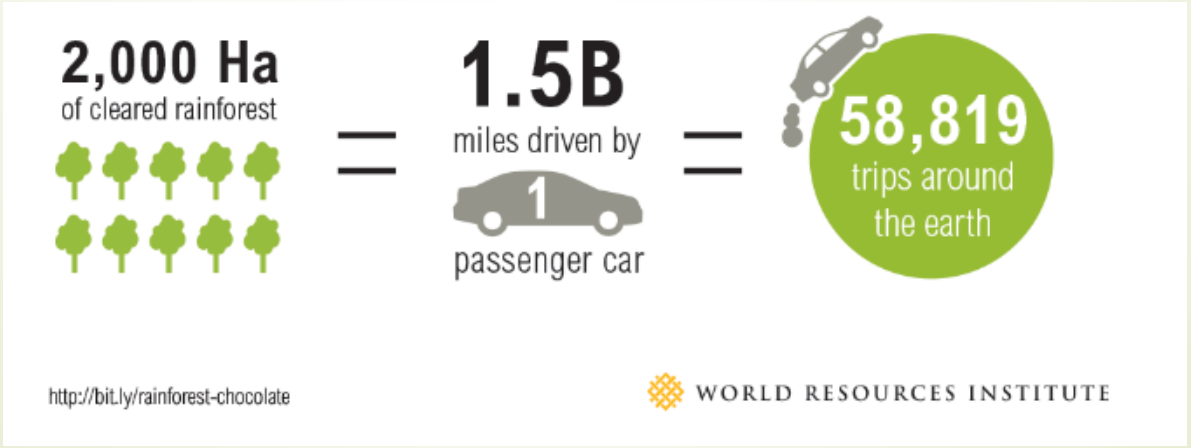
How to increase agricultural output?

a) Increase inputs (land, water, …): "produce more food on more land"
b) Increase agricultural productivity "produce more food on the same/ even less land"

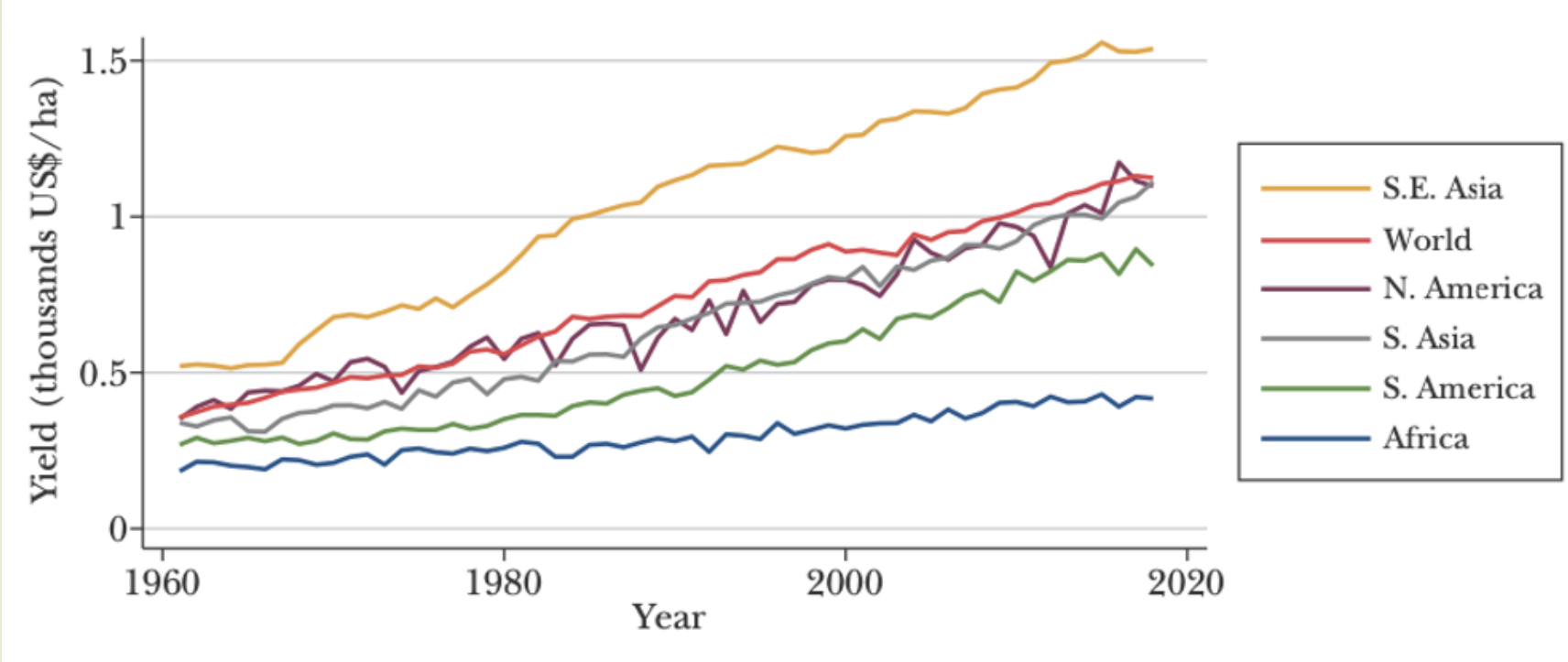
Productivity = yield = output per unit of land



Supply of arable land is limited …



… and land conversion to agriculture comes at a high cost.

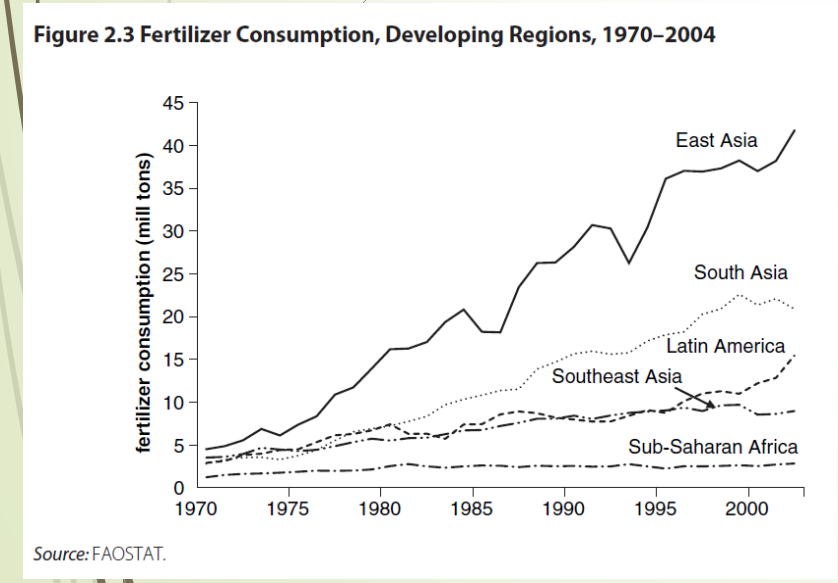


Cereal yields by region of the world

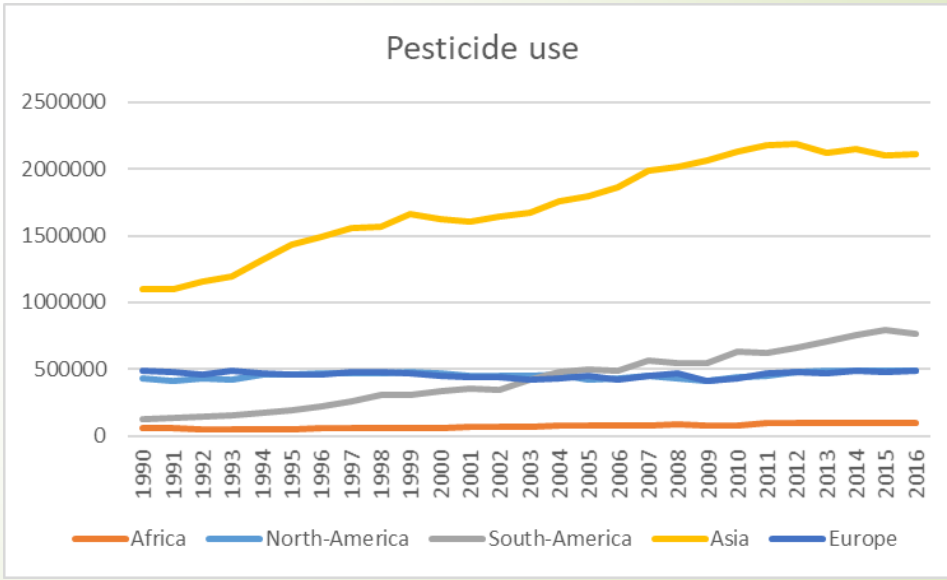
Source: FAOSTAT

How to increase agricultural productivity?

Fertilizer



Pesticide



Conclusion

- Need to increase agricultural productivity (e.g., by increasing agricultural technology adoption)…
- …within environmental constraints (sustainability condition)
- Technological and institutional innovations are crucial
- In addition
  - Changing diets
  - Reducing (accidental) food losses and (deliberate) wastage

Quiz

Reminder