ECON1071 GLOBAL ECONOMIC HISTORY

Topic 2.
World Before the Industrial Revolution - I:
the Neolithic Revolution

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'The agricultural revolution is one of the most controversial events in history. Some partisans proclaim that it set humankind on the road to prosperity and progress. Others insist that it led to perdition'.

(Yuval Noah Harari)

Required readings for Topic 2

- **Bowles, S. (2011)**, *Cultivation of Cereals by the First Farmers Was Not More Productive Than Foraging*, Proceedings of the National Academy of Sciences of the United States of America, 108(12): 4760-4765
- **Diamond, J. (1987)**, *The Worst Mistake in the History of the Human Race*, Discover Magazine, May: 64-66

Economic prehistory

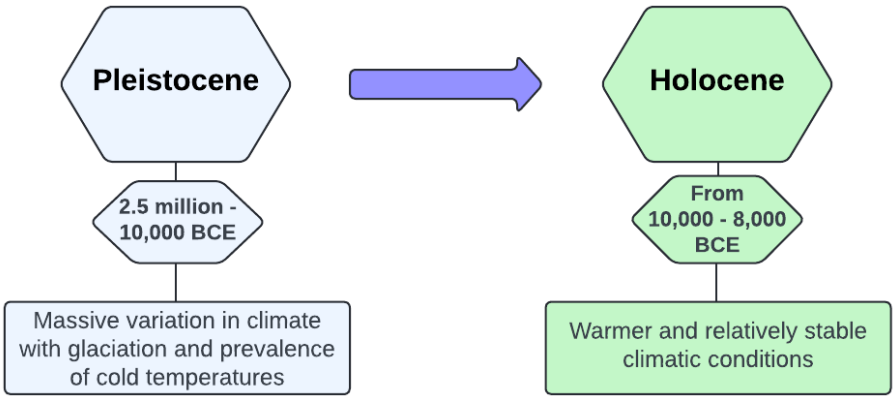


Source: Dow and Reed 2022, fig. 1.1

Note about time units:
KYA = thousand years ago *from the present*; *BCE* = before the Common Era

Changing climatic conditions

Two geological epochs:



Key timeline

300,000 - 250,000 BCE: appearance of anatomically modern human

60,000 BCE: *Homo sapiens* disperse from Africa

12,000 BCE: Scattered evidence of sedentism

10,800 - 9,600 BCE: Cold snap (**Younger Dryas** period in geologic history)

10,000 - 8,000 BCE: Scattered evidence of domesticated plants and livestock

5,000 BCE: Strong evidence of agrarian villages relying primarily on planted crops and livestock

Economic activities in the Pre-Neolithic era

People lived in groups of nomadic hunter-gatherers, finding food provided *spontaneously* by nature.

Key activity – **foraging**:

- Hunting
- Gathering of wild plants
- Fishing

Foraging was a highly successful method of adaptation for many thousands of years, allowing humans to spread and survive over most land areas on the planet.

The Neolithic (Agricultural) Revolution

Shift from foraging to **farming**:

- Cultivation (planting, weeding, and otherwise tending plants prior to harvest)
- Domestication (*genetic changes* in plants caused by the practice of cultivation)
- Domestication of animals

The term '*revolution*' can be misleading ⇔ it was an evolutionary process of interaction between people and nature

- Agriculture was preceded by several millennia of cultivation, herd management, and predomestication of wild species

Fertile Crescent:
'*the craddle of civilisation*'



Domestication of plants

- Persistent change to the shape, size, and/or structure of plants $\Longrightarrow$ species which are *morphologically distinct* from wild progenitors
- Key genetic traits evolved slowly $\Leftrightarrow$ a long preceding *predomestication* phase
- $\sim$ 11.5 KYA $\Leftrightarrow$ 9,500 BCE: first evidence of a dependence on domesticated plants
    - Wheat $\rightarrow$ barley $\rightarrow$ pulses (lentils, peas, chickpeas)
- Direct evidence of an emerging cereal-dependent economy: *first granary* at Dhra, Jordan ($\sim$ 9,300 BCE)



Domestication of animals

- Very long history: it all started with the human-wolf relationship
  - Hungry wolves approached human compounds for food leftovers in Ice Age Siberia ($\sim$ 23 KYA)
- Predomestication stage: selective culling, herd control
- The first mammal specie domesticated in the Fertile Crescent: *a goat*
- Consequences beyond meat:
  - Reorientation of human subsistence strategies $\Rightarrow$ sedentism
  - Secondary products: milk, wool, traction



Accepted dates for domestication of plants and animals

Region	Plants	Animals	Date of initial domestication
Southwest Asia	Wheat, barley, lentils	Goat, sheep, pig, cattle (taurine)	11 kya (12 kya)
East Asia	Millets, rice (japonica)	Pig, yak, horse, Bactrian camel	8.5 kya (12 kya)
South Asia	Rice (indica), millets	Cattle (zebu), water buffalo	8 kya (9 kya)
New Guinea	Banana, taro, yam		4 kya (10 kya)
East Africa & Southern Arabia	Date palm, sorghum, pearl millet	Cattle (taurine), donkey, dromedary camel	8 kya (9 kya)
North America	Sunflower, sumpweed		5 kya (6.5 kya)
Meso-America	Squash, maize, avocado	Turkey	10 kya (10 kya)
South America	Manioc, potato, quinoa	Llama, alpaca, guinea pig, duck	(10 kya)

Source: Olsson 2024, Table 8.1

Initial location and diffusion of the Neolithic Revolution

Jared Diamond (1997), Guns, Germs, and Steel

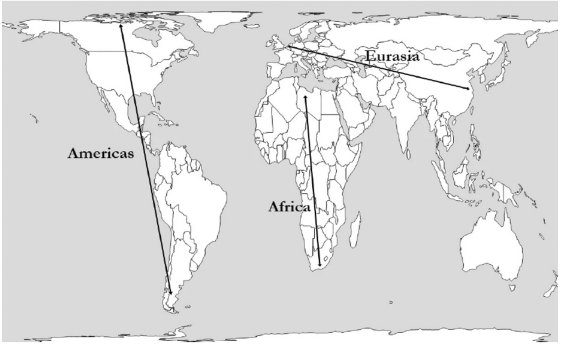
Why did certain societies transition from hunter-gatherer tribes to farming earlier than others?

- Agriculture began in regions having wildplant and animal species that were *easy to domesticate*
  - The Fertile Crescent was a place with the most favorable endowments
- Why did agriculture diffuse outward to other locations?
  - Probably, agriculturalists were militarily more powerful than foragers $\Longleftrightarrow$ they forced sedentary farming on many of the territories previously occupied by hunter-gatherers

Initial location and diffusion of the Neolithic Revolution

Jared Diamond (1997), Guns, Germs, and Steel

- Changing microclimates $\Longleftrightarrow$ spread of crops, animals and people
- The *shape of the continents* determined the speed of technological diffusion: **vertically aligned continents** (Americas, Africa) vs. **horizontally aligned continents** (Eurasia)
- Agriculture was independently invented in both the Eastern and Western hemispheres. But it *spread more quickly across Eurasia compared to the Americas*



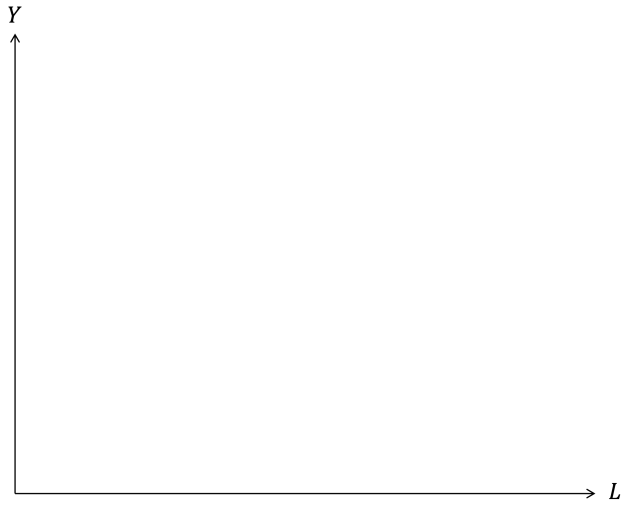
Economics of the Neolithic Revolution

Assume a simple production function for a primitive economy:

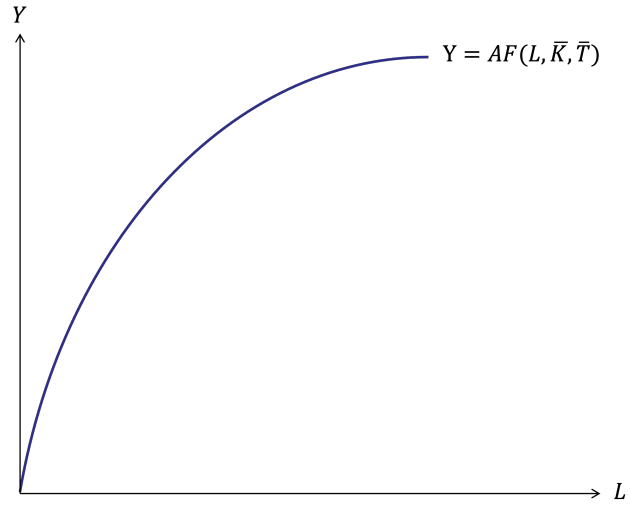
$$Y = AF(L, \overline{K}, \overline{T})$$

- L is **human labour effort** $\Leftrightarrow$ hours of work
- $\overline{K}$ is **physical capital** $\Leftrightarrow$ reproducible assets
  - Physical infrastructure (granaries, storage pits, fencing, dwellings)
  - Tools (grinding stones, sickles, digging sticks, hoes)
  - Living stock (herds of domesticated animals, seed stock)
- $\overline{T}$ is **land** $\Leftrightarrow$ natural endowment
  - Arable surface, soil fertility etc.
- A is an index of **technology** (shifter of the function)

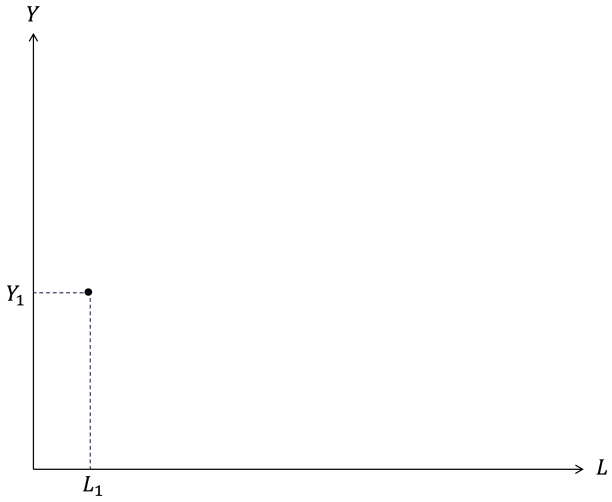
Production function in a primitive economy



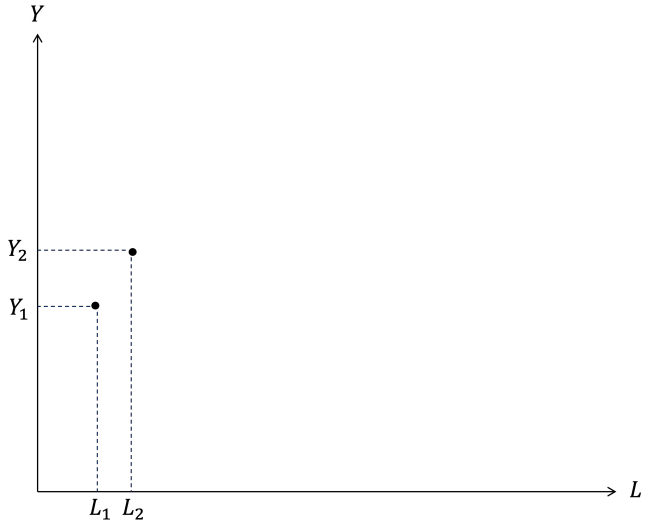
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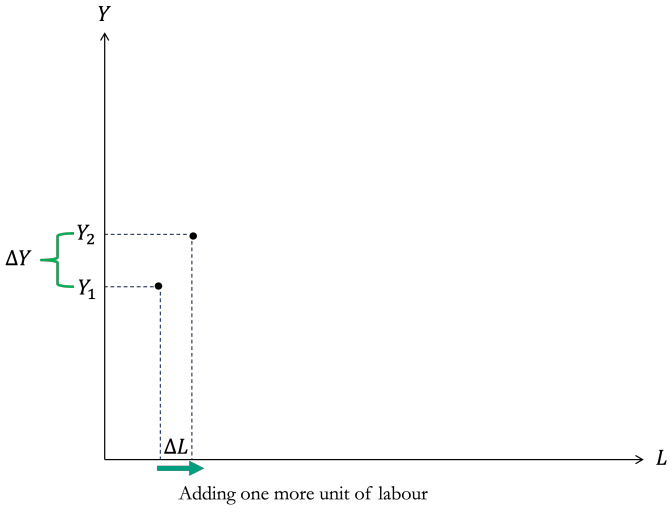
How to explain the shape of the production function?



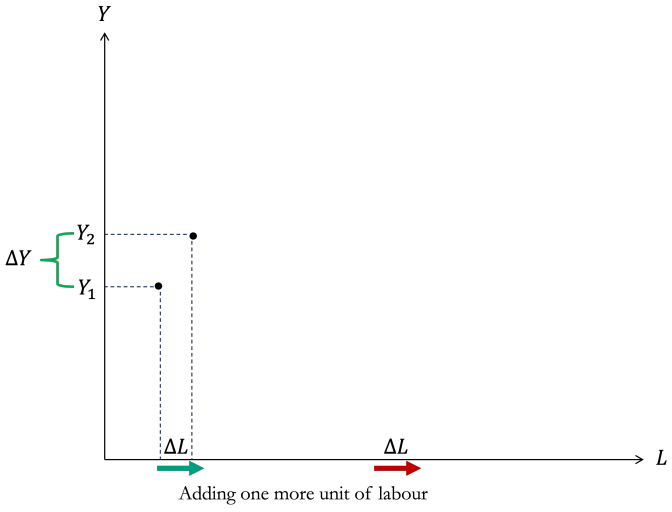
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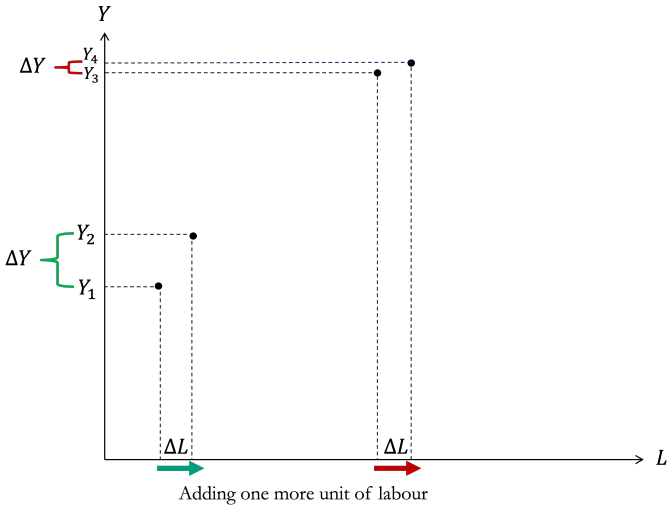
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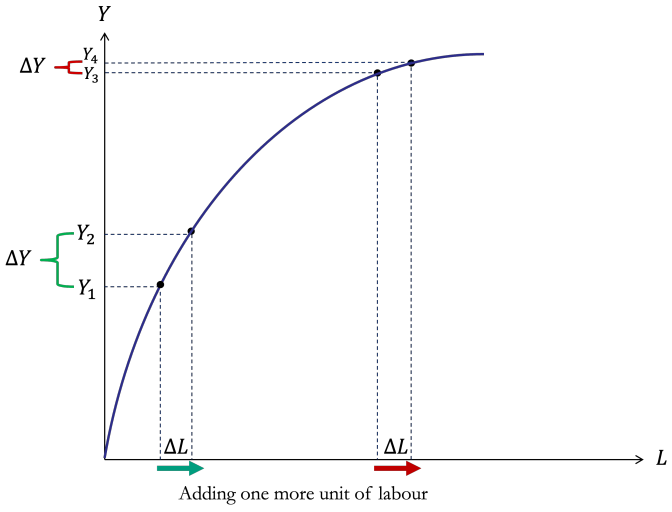
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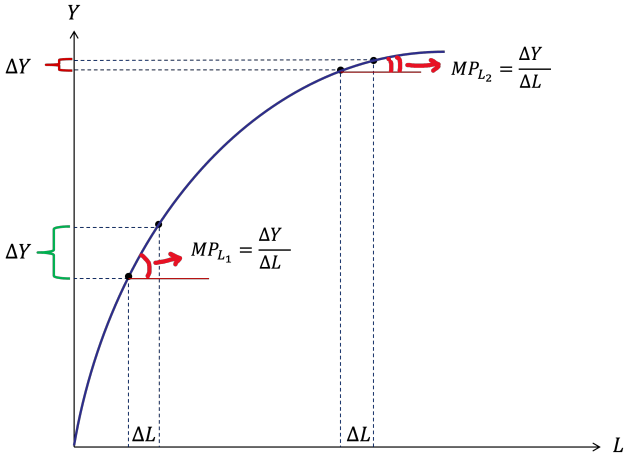
How to explain the shape of the production function?



How to explain the shape of the production function?



Diminishing **marginal product of labour**



Marginal product of labour in a foraging society

- After a certain labour input: each *extra* hour of labour *adds* less output
  - In this range, MP_L declines
  - Total output still increases, but *at a decreasing rate*

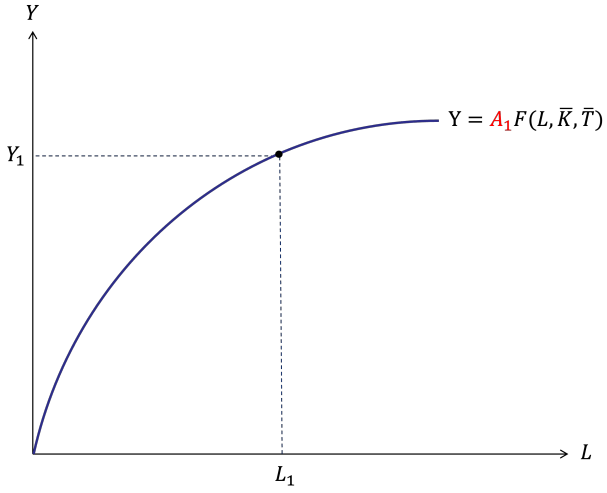
In hunter-gatherer society:

- Foragers exploit the most accessible and high-yielding resources first
- As labour input increases:
  - remaining resources are of lower quality or farther away
  - search and travel times increase
  - competition for the same resources intensifies
- Hence, MP_L line slopes downward

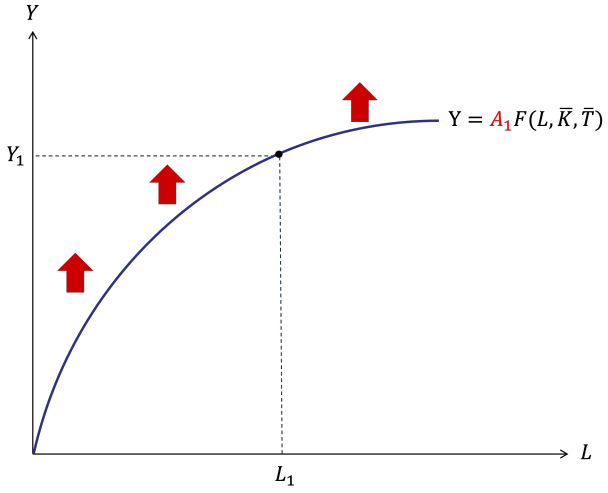
Marginal product of labour in a farming society

- We can assume that marginal product of labour is nearly constant at the *early phase of agriculture* $\Leftrightarrow$ MP_L line is *horizontal*
- Justification:
  - Early cultivators begin by using the most fertile and accessible land
  - At a small scale, labour does not yet compete for scarce land or inputs
  - Each additional hour of work (e.g., planting or weeding) contributes roughly the same output
- In the subsequent stages of farming, technological progress can maintain the MP_L unchanged (new cultivation methods etc.)

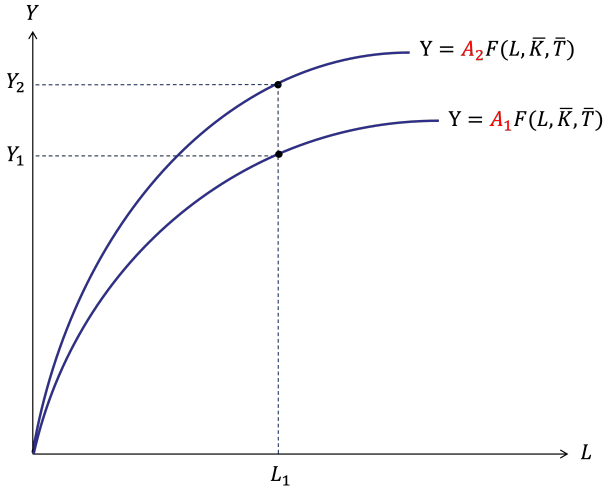
Effects of improvements in technology



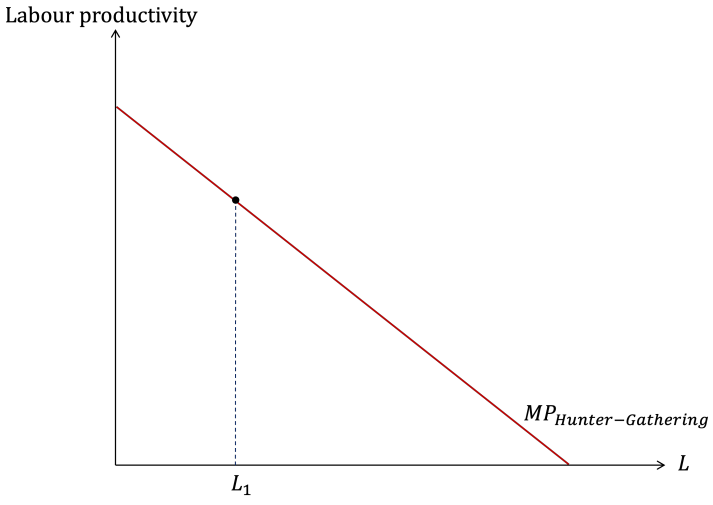
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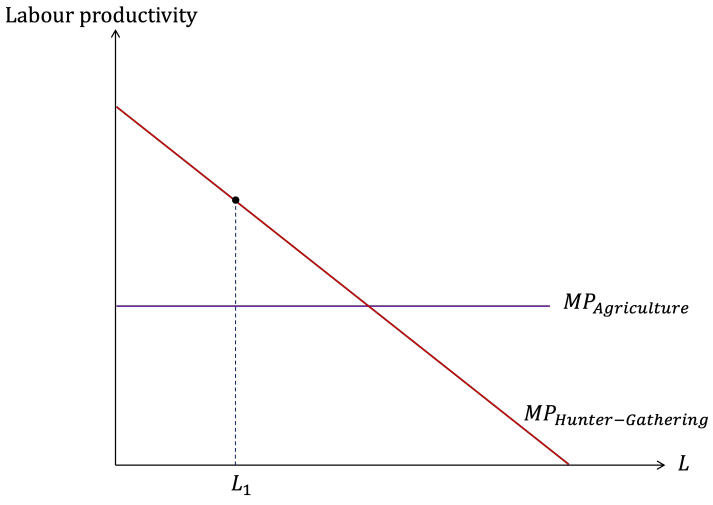
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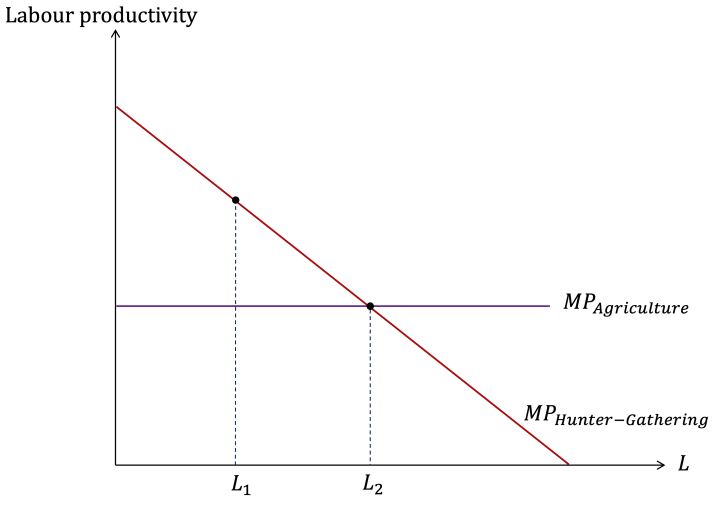
Transition from hunter-gathering to farming



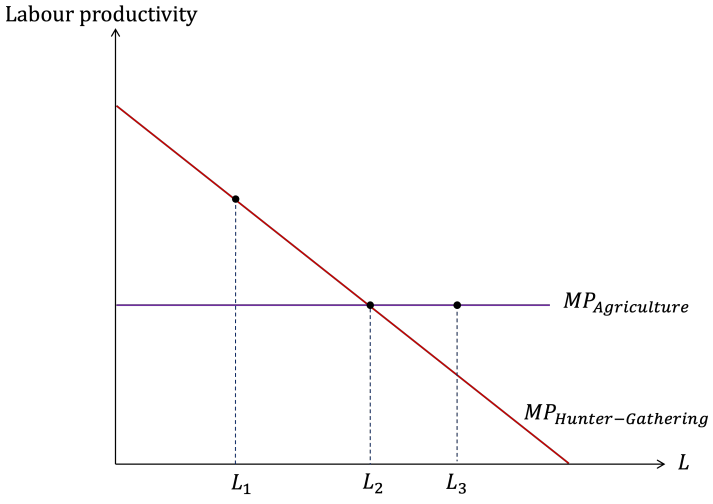
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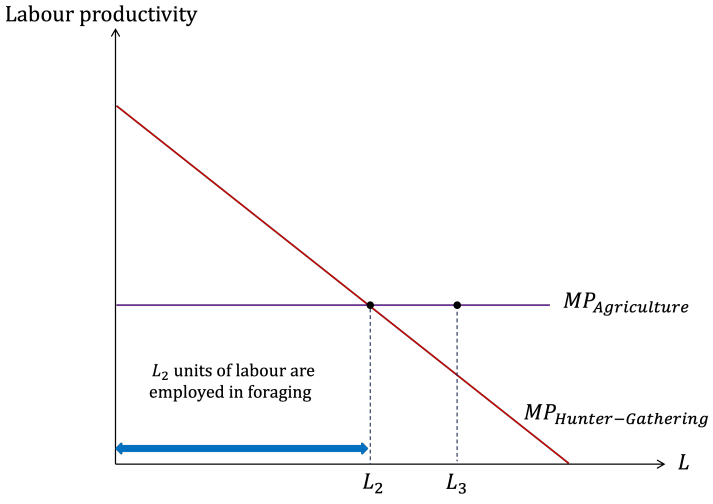
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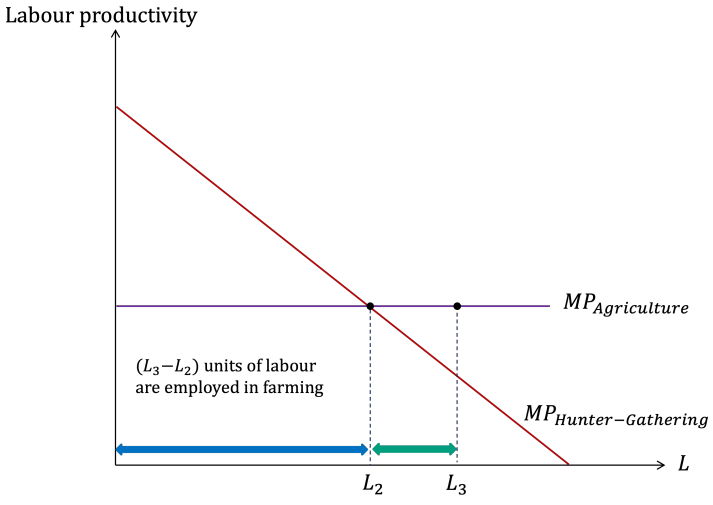
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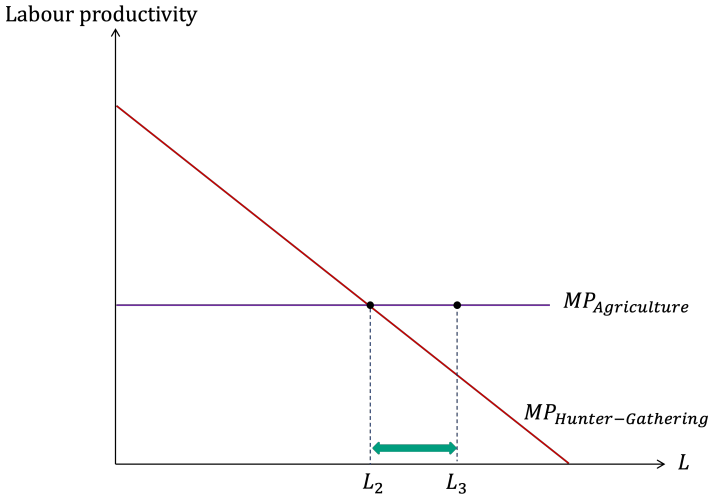
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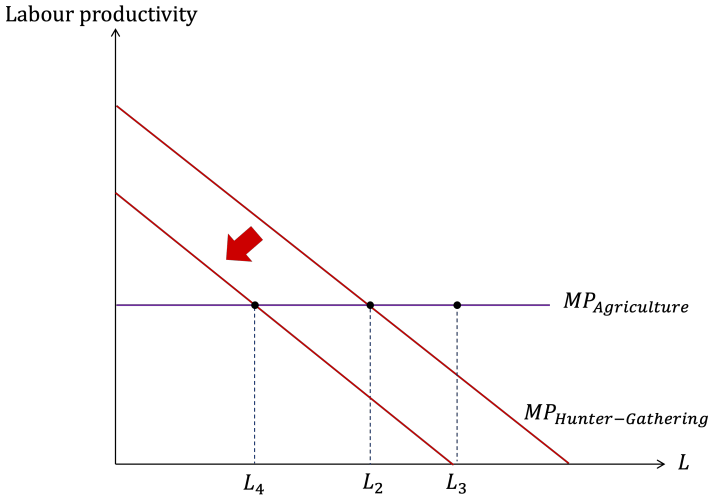
What could drive the transition to agriculture

1. Lower marginal productivity in hunter-gathering
   - '**Dessication**' hypothesis:
     - sudden drop in temperatures and precipitation around 13 KYA during the Younger Dryas $\Longrightarrow$ drier conditions $\Longrightarrow$ humans, plants, and animals crowded into oases and river valleys $\Longrightarrow$ intensified competition for decreased stock of wild food
     - Downward shift of the $MP_{\text{Hunter-Gathering}}$ curve
2. Higher marginal productivity in farming
   - '**Natural habitat**' hypothesis: agriculture began in regions where the wild ancestors of domestic plants and animals already lived abundantly
     - Humans experimented with selective gathering and herding $\Rightarrow$ domestication through more knowledge and innovation, not environmental pressure
   - Upward shift of the $MP_{\text{Agriculture}}$ curve
     - As people learned and innovated, *extra unit* of labour invested in agriculture produced more output than before
3. Growth in labour force
   - **'Population pressure'** hypothesis: movement along the L axis

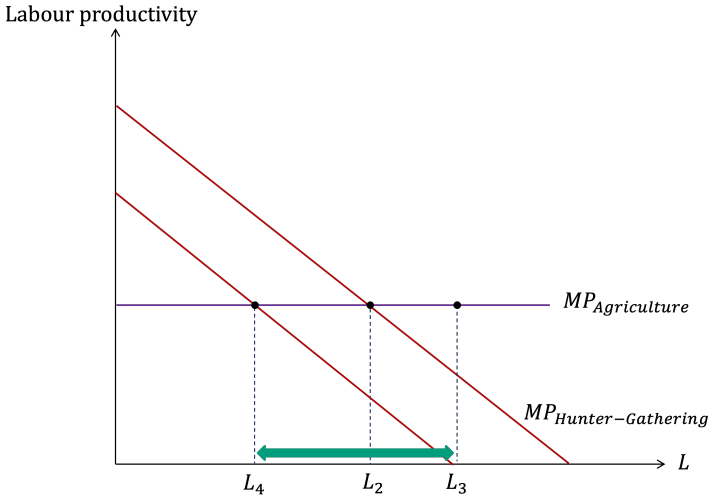
Effects of lower marginal productivity in hunter-gathering



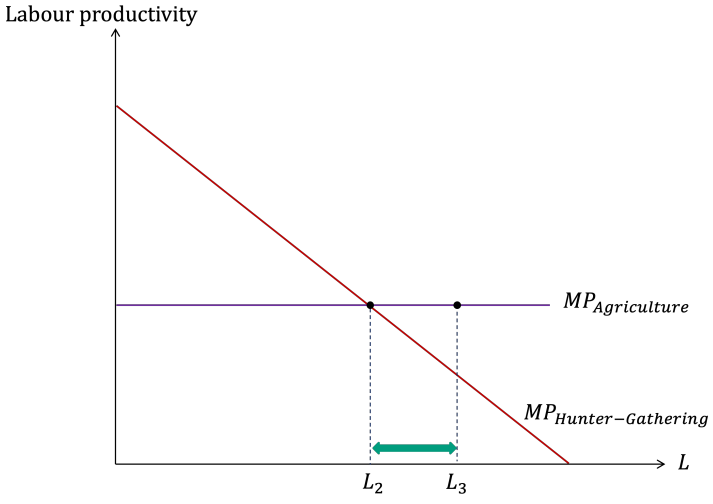
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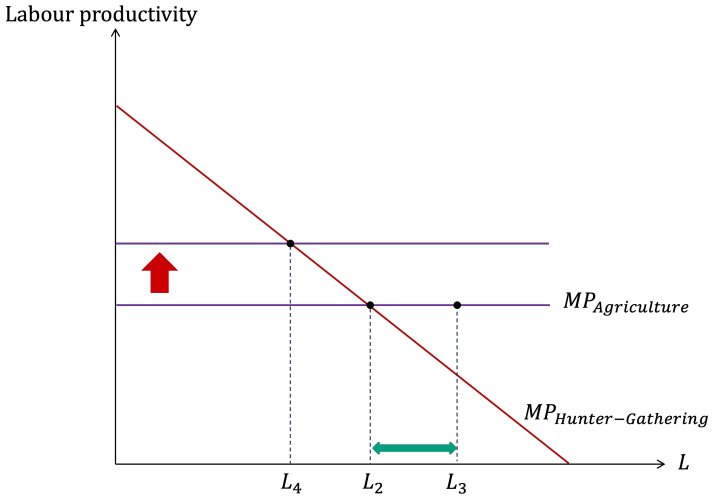
Effects of lower marginal productivity in hunter-gathering



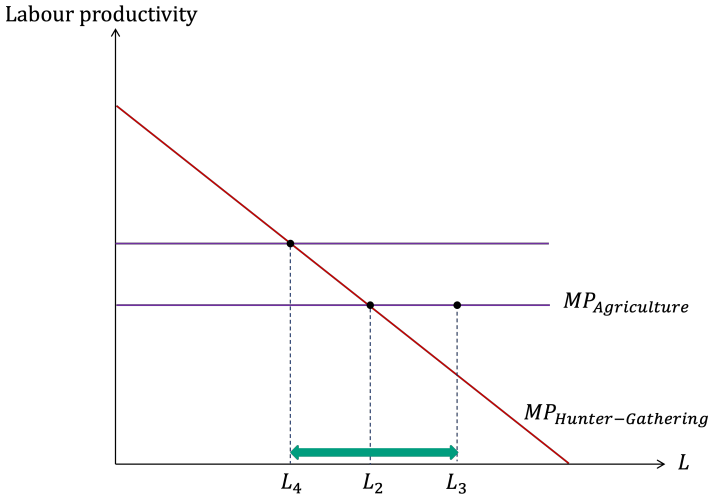
Effects of higher marginal productivity in farming



Effects of higher marginal productivity in farming



Effects of higher marginal productivity in farming



Role of institutional innovations (property rights)

North & Thomas 1977; Bowles & Choi 2019

- **Common** property rights in a foraging society ⇔ hunter-gatherers ignored true resource costs ⇒ overexploitation
- Sedentary lifestyle required a capacity to defend costly investments in fields, herds, and dwellings
- Early farmers adopted **exclusive communal rights** to land and output ⇒ increase in the expected returns of resource investments ⇔ boosting *MP* in agriculture
  - *Exclusion of outsiders* protected the investment ⇒ incentive to improve methods, tools, and yields
  - The greater the number of groups adopting such norms, the more easily they spread and gained legitimacy

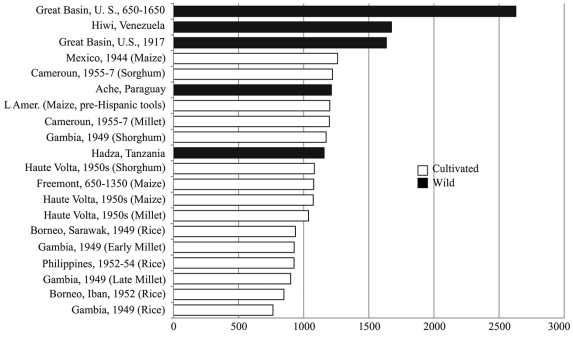
Was farming *absolutely* more productive than foraging?

Bowles 2011

We need to compare ***average products***: energetic output (calories) per hour of labour $= Y/L$

- Average caloric return per hour of labour for the cultivars is **63 percent** of the average for wild species
- But we also need to account for:
  - the extent of time delay between the effort and output in farming
  - greater risk (due to reduced geographical mobility and limited diversity of nutrition sources among farmers)

Net kilocalories per hour of labour for wild and cultivated specie:

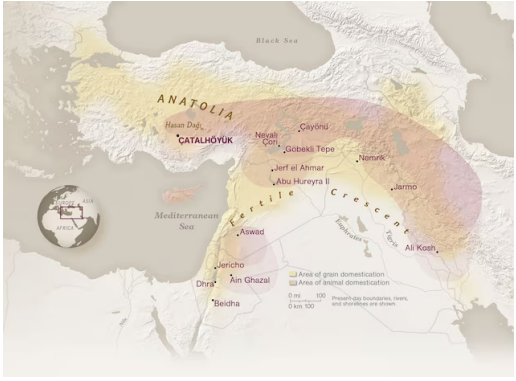


Consequences of the Neolithic Revolution – 1

- Population growth
  - The world's population expanded over 40 times compared to pre-agrarian societies: 200-300 million people by the start of the Common Era
- Technological progress and knowledge accumulation
  - Agrarian societies facilitated the development of skills, knowledge, and innovation
- Urban and state development
  - Emergence of early cities, states and first taxation systems

Çatalhöyük

- Cluster of modest-sized dwellings ⇔ probably, the first proto-city on the planet
  - Between ∼7,500 and 6,000 BCE
- Population around 8,000 people
- Diversified agriculture:
  - Wheat, barley, almonds, peas, pistachios
- Handicraft production of *pottery* for storage and cooking
- Early evidence of *trade* with surrounding regions: seashells, ochre, flint



Ancient cities in the Fertile Crescent



Uruk: the first city on the planet

- City-state in ancient Sumer
  - Founded $\sim$ 4,000 BCE
  - Population around 10,000
- List of professions and *formal hierarchy* of roles
- Birthplace of ***writing*** $\Rightarrow$ *cuneiform* (the scribes used clay tablets)
- Urban planning

First ancient civilisations

- **Mesopotamia**: Sumer, Akkad, Babylonia, Assyria
  - First empire in the history $\longleftrightarrow$ city-states united under Sargon of Akkad
  - Diversified agriculture and extensive trade relations
  - First written evidence of established institutions: the **Code of Hammurabi** in Babylon (XVIII century BCE)
    - 282 laws defining and enforcing property rights and contracts
- **Indus valley**: the Harappan civilisation ($\sim$2,600–1,700 BCE)
  - Advanced engineering and crafts
    - Systems of water supply / sewage disposal
  - Active internal and external trade
- **Egypt** ($\sim$3,100–30 BCE)
  - Politically unified state $\Rightarrow$ centralised control of resources
  - Large-scale public works (temples, pyramids, canals)

Consequences of the Neolithic Revolution – 2

- Rise of social and economic inequality
  - The formation of agrarian societies introduced greater social stratification
  - Development of complex social structures, where wealth and resources became more unequally distributed
- Temporary decline in living conditions
  - There was no immediate improvement in living standards
  - Human diet became increasingly dependent on cereals
  - Spread of diseases
  - Farmers had to work longer

Discuss the article by Jared Diamond at the seminar 2!