

# Unit 2

## Technological Change, Population and Growth

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September 2, 2025

# Introduction

# Economics Reasoning

How could we understand the “Hockey-stick” growth?

- Recall the Interactive figure: <https://tinyco.re/3290463>
- Two facts we want to explain:
  - ① rapid growth starting from 1800s, and
  - ② stagnation in the centuries before 1800s
- In econ, we usually use **model** to understand Economics phenomenon.
- We will build two models to explain both facts above.
- Further reading: <https://tinyurl.com/4upjz46u>

# Economics Model

# Anecdotic Illustration of Economics Model

Build your own world (similar to real world) so that you know every detail!



# Formal Illustration of Economics Model

- Model is an alternative economy which only the *essential feature* of the economy that are **relevant to the question** are maintained
- To see deeper mechanism in real world, we need **simplification**
- Necessary evil to omit many real world details  $\Rightarrow$  endless debate!

assumptions  
that (we think)  
matters      How agent act  
with each other  
& assumptions       $\Rightarrow$  Outcome /  
Equilibrium       $\Rightarrow$  Assumptions  
Changes?

- **Equilibrium:** all forces within model are **balanced** unless *external force* is introduced

# What makes a good model?

Friedman's critique: model are judged by prediction power

- Clarity: is the logic and causality understandable?
- Prediction power: match data?
- Communication: what we (dis-)agree about?

ALL models are fake, only some are useful, i.e., elucidates the underlying mechanism that people implicitly follows

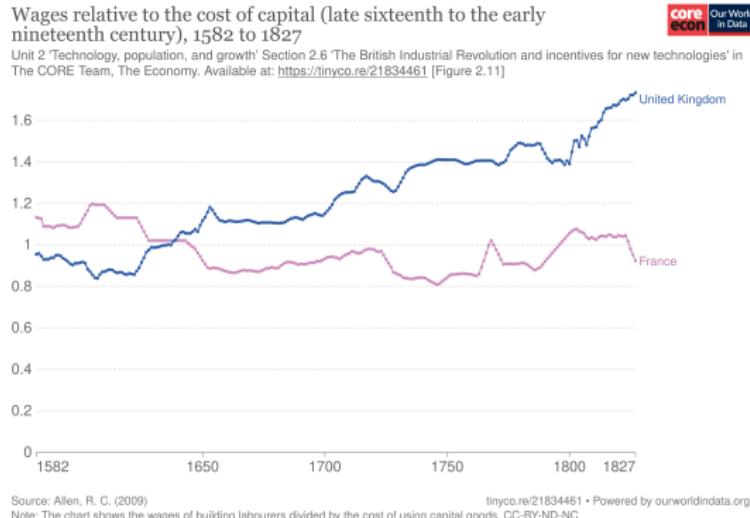
## Key concepts

- **Ceteris paribus** and other simplifications help us focus on the variables of interest. We see more by looking at less.
- **Incentives** matter, because they affect the benefits and costs of taking one action as opposed to another.
- **Relative prices** help us compare alternatives.
- **Economic rent** is the basis of how people make choices.

## Why “Hockey-stick” Growth?

# The need to develop technology

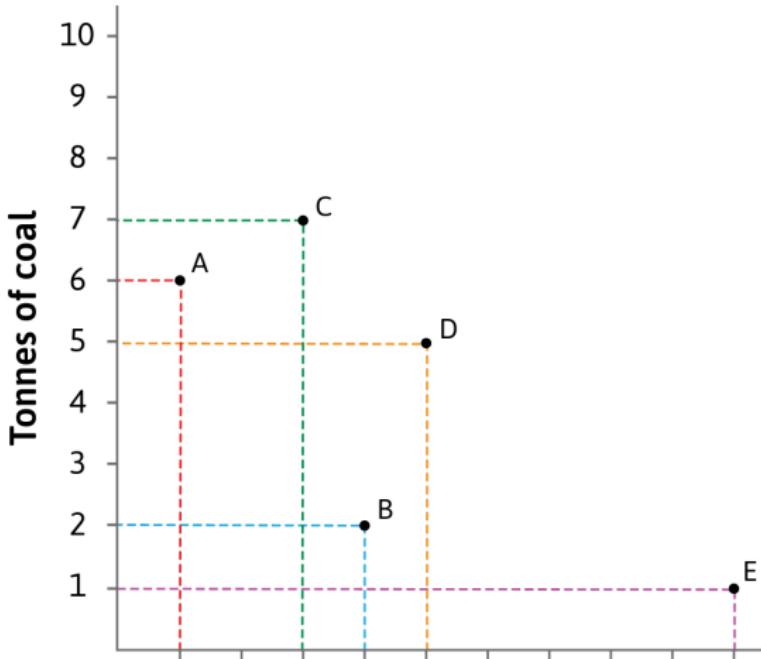
- There are two inputs for textiles: energy (coal) and labor
- Britain v.s. France: wage is higher yet coal is cheaper
- ⇒ incentive to invent steam machine, lower average cost



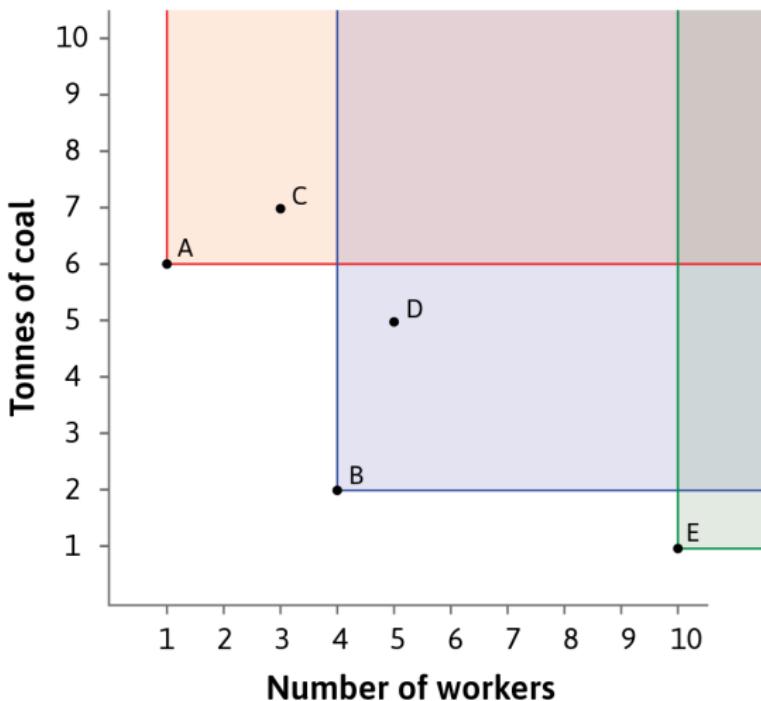
# Modelling Technology



- All A-E produce 100 cloth
- A: relatively energy-intensive
- E: relatively labor-intensive



## Some Technology are Inferior



- Tech C is dominated by A, and Tech D is dominated by B
- C produce the same output as A, but use more input

## Firm's Behavior

- Firm's Objective: maximizing profit ( $\neq$  minimizing cost)
- Profit = revenue – costs
- If revenue is fixed (?!), then maximizing profit = minimizing cost
- cost = wage  $\times$  workers + price of coal per ton  $\times$  numbers of ton
  - $c = w \times L + p \times R$
- **Isocost line:** the combination of  $(L, R)$  that yields same cost  $c$ , given market prices  $w$  and  $p$
- To draw the line, we rearrange the cost function into

$$R = \frac{c}{p} - \frac{w}{p} L$$

# Change in relative price

- Interactive figure:

<https://tinyurl.com/2fsfzcm3>

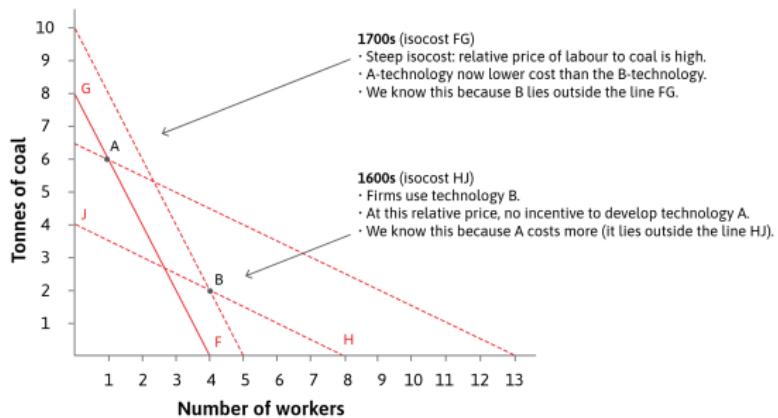
- Original at pt B, with

isocost line  $\overline{JH}$ ,  
 $\frac{w}{p} = \frac{10}{20} = \frac{1}{2}$

- Relative price increases

such that  $\frac{w}{p} = \frac{10}{5} = 2$ ,  
isocost line steeper

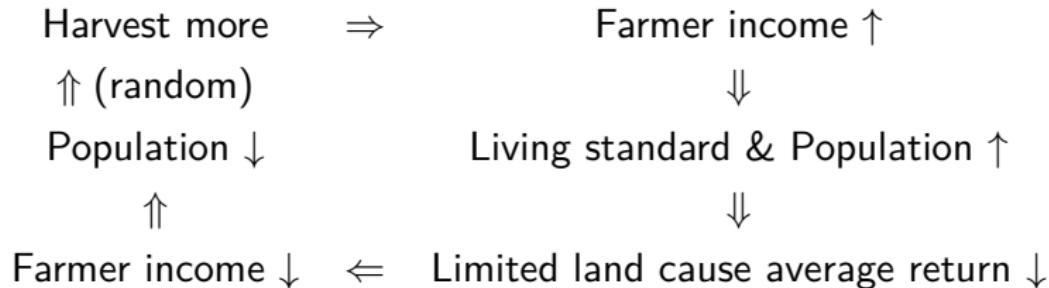
- Cost increase if still stay at labor-intensive tech B  $\Rightarrow$  move to energy-intensive



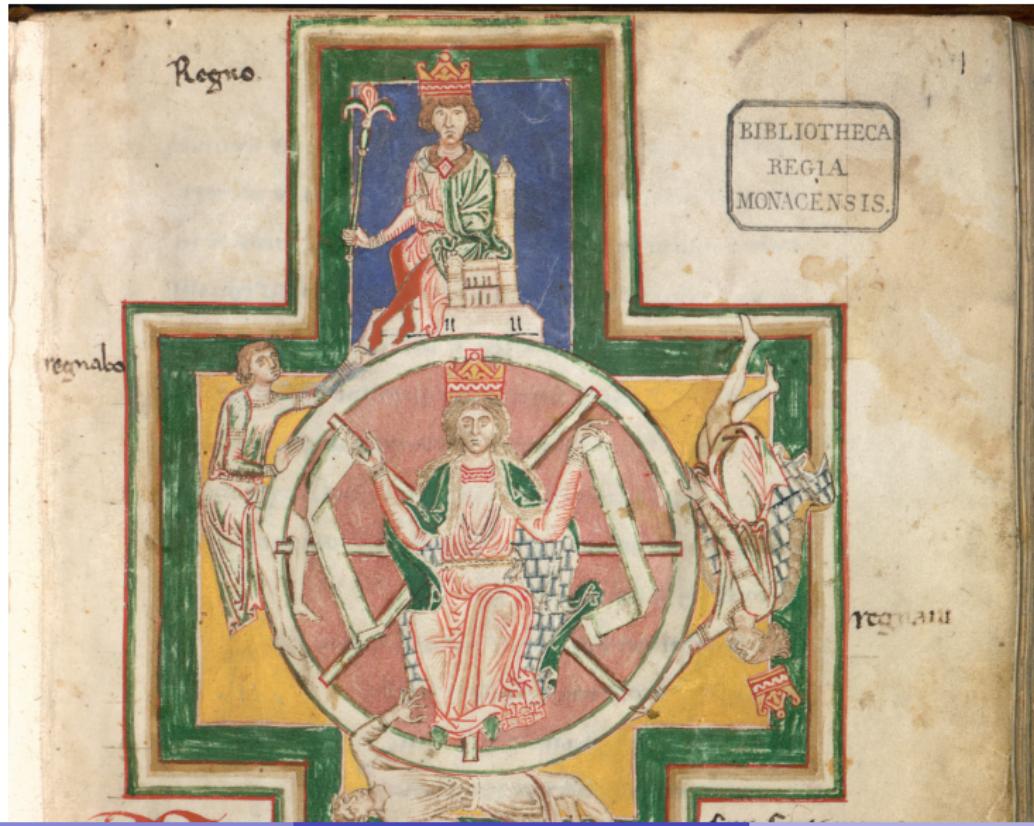
# Why Stagnation?

## Malthusian Trap

- Law of diminishing return: increment of output ↓ as input ↑
  - e.g. Study effort is lower from 50 → 60 compared with 90 → 100
- Production function also exhibit **diminishing average product of labor**:



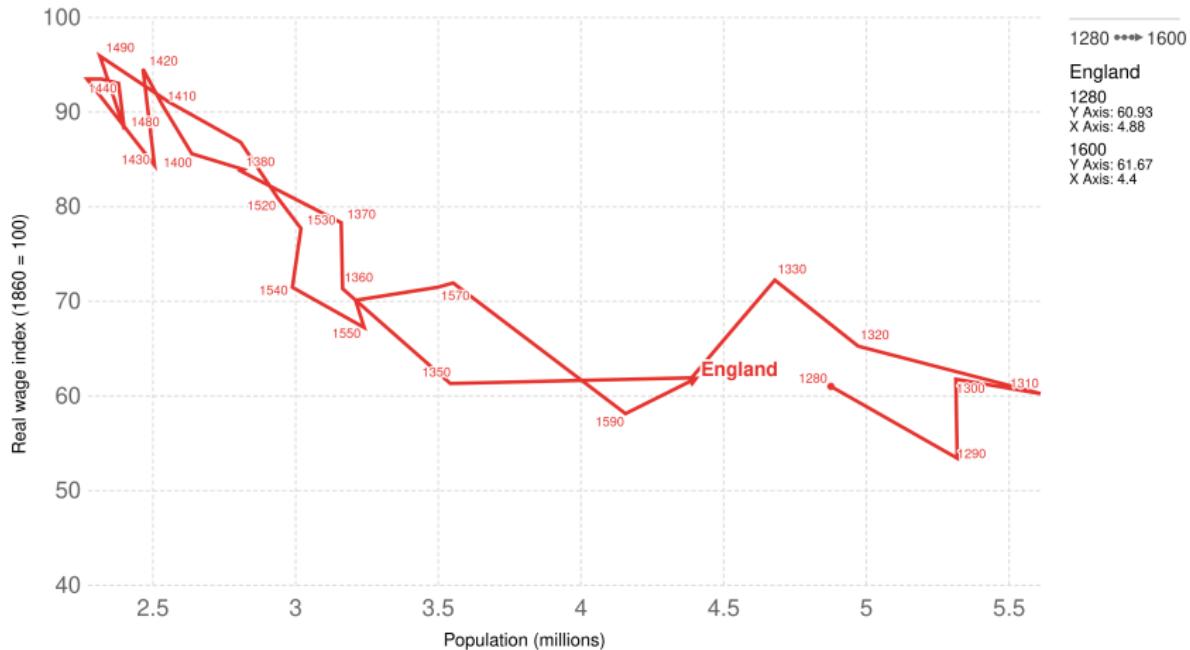
# O Fortuna! (Carmina Burana)



# Was Malthus Correct?

The Malthusian trap: Population and real wages, England, 1280 to 1600

Unit 2 'Technology, population, and growth' Section 2.9 'The Malthusian trap and long-term economic stagnation' in The CORE Team, The Economy. Available at: <https://tinyco.re/20918330> [Figure 2.18]



Source: Clark (2005)

Note: The data points at each year are calculated averages over the succeeding decade. CC-BY-NC-ND

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# How could we escape from Malthusian trap?

By improvement in technology to offset diminishing return!

Escaping the Malthusian trap: Population and real wages in England, 1280 to 1860



Unit 2 'Technology, population, and growth' Section 2.10 'Escaping from Malthusian stagnation' in The CORE Team, The Economy. Available at: <https://tinyco.re/21020330> [Figure 2.20]

