

Growth and Ideas

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- 1 How does TFP growth come about?
- 2 What types of policies could manipulate long-run growth?

The dominant view today: **Innovation** (the production of new "ideas") is what drives TFP growth.

- We take the view that productivity growth is due to new "**ideas**".
- Ideas are broadly defined to include:
 - Designs for **new products**: the Pentium chip, the steam engine,...
 - New ways of **organizing** production: Walmart, the assembly line.
- Key assumption: **Ideas are produced** like other goods.
 - By profit maximizing firms.
 - The profit of innovation is the rent of owning a patent.

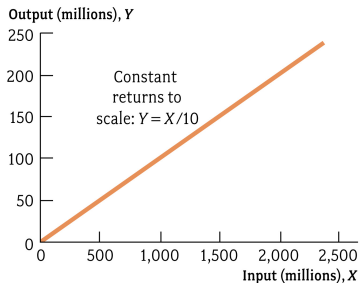
- Ideas differ from other goods in being **non-rivalrous**.
 - An idea can be used by many at the same time.
- Examples:
 - Software.
 - Calculus.
 - Production methods (just-in-time production, assembly line).

- In practice, it may be possible to exclude others from using an idea.
 - Patents
 - Secrecy
- Non-rivalry is a technological concept.
- Excludability is a legal arrangement.

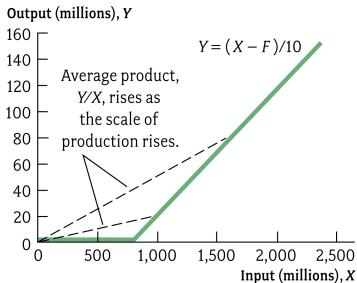
Nonrivalry \Rightarrow Increasing returns to scale.

- Production uses rival inputs (capital and labor) and non-rival inputs (ideas).
- It seems safe to assume (at least) constant returns to rival inputs
 - Doubling K and L should (at least) double Y . - Why?
- That means: Doubling all inputs (including ideas) \rightarrow more than doubling of output.

Example: Increasing returns to scale



(a) Constant returns to scale:
 $Y = X/10$.



(b) Increasing returns from fixed cost:
 $\bar{F} = 800$.

FIGURE 6.1 How a Fixed Cost Leads to Increasing Returns:
The Antibiotic Example

Macroeconomics, Charles I. Jones
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Problems with Perfect Competition

When do market economies tend towards "efficient" outcomes?

- Only when markets are **perfectly competitive**.

Perfect competition means:

- 1 Firms take all prices as given.
- 2 They sell their products at marginal cost.
- 3 Under perfect competition prices reflect the marginal "values" of goods.

Refresh your intermediate micro knowledge on this.

If perfect competition goes, so does the presumption that market outcomes are "**optimal**."

Problems with Perfect Competition

- Perfect competition requires that goods are **priced at marginal cost**.
- What happens if a firm tries that when production has increasing returns to scale?
- With increasing returns: Marginal cost $>$ average cost.
- The firm sustains a loss, if price = marginal cost.
- Example: Many drugs should cost virtually nothing, but their prices must amortize hundreds of millions of dollars in drug development costs.

How to provide incentives for innovation?

- The innovator must be able to charge more than marginal cost for some time.
- This is what the **patent system** achieves.
- The trade-off:
 - 1 The patent allows the seller to raise the price and recover the costs of innovation.
 - 2 It prices consumers out of the market who would be willing to pay marginal cost.
- Example: A drug costs \$800m to invent. Each dose costs \$1 to produce. The market size is 1m doses.
 - Breaking even requires a price of (more than) \$800 per dose.
 - A patient may be willing to pay \$400, far above marginal cost, but is priced out of the market.

Increasing returns → **Scale effects.**

- Scale effects mean: larger economies produce more innovations
- Larger means: Endowments of rival factors are larger.

- **Mechanical:**

If economies devote the same fraction of resources to innovation, the economy with more total resources produces more ideas.

- **Economic:**

- ① Innovation requires a fixed cost.
- ② The larger the market (size of the economy), the more profitable innovation becomes.
- ③ This argument is not tight: a larger economy could be divided into many small markets.

Scale Effects

Empirically plausible?

- Large countries are not richer / do not grow faster.
- Why not?

Scale Effects: Evidence

- 1 Isolated countries before shipping became feasible:
 - Europe / America / Australia / Tasmania / Flinders Island.
 - Per capita incomes in 1,000 AD line up nicely with population sizes.
- 2 Sustained growth is a modern phenomenon.

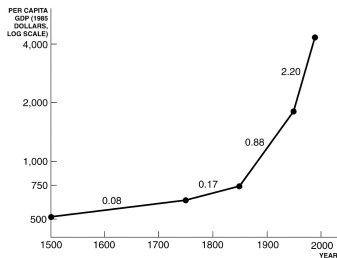


FIGURE 1.3 WORLD PER CAPITA GDP AND GROWTH RATES, 1500–1990

Economic Growth,
Copyright © 2004 W. W. Norton

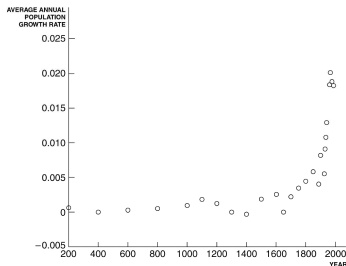


FIGURE 4.4 WORLD POPULATION GROWTH, 1 A.D. TO 1990

Economic Growth, 2nd
Copyright © 2004 W. W. Norton

- The main hypothesis is: Productivity growth is due to innovation / ideas.
- Ideas are nonrival.
- Nonrival inputs + constant returns to rival inputs \rightarrow increasing returns to scale.
- The key insight is therefore:

Nonrivalry \Rightarrow Increasing Returns \Rightarrow Scale effects

Why Do Scale Effects Matter?

Can you think of policy questions where scale effects matter?

- Jones, *Macroeconomics*, ch. 6
- Jones, *Introduction to Economic Growth*, ch. 4.
- Romer, *Advanced Macroeconomics*, ch. 3.1-3.4.

Advanced reading:

- Jones, Charles (2004). "Growth and Ideas." (Download from author's web site.).