LECTURE SEVEN - PART FOUR

The Neoclassical Growth Model

- Explains how capital accumulation and technological change affect the economy.
- Pioneered by Nobel Laureate Robert Solow of MIT.

Neoclassical Growth Model Approach

- **Major Model Components:** Capital and technological change.
- **Primary Tool:** Aggregate Production Function.

Key Point

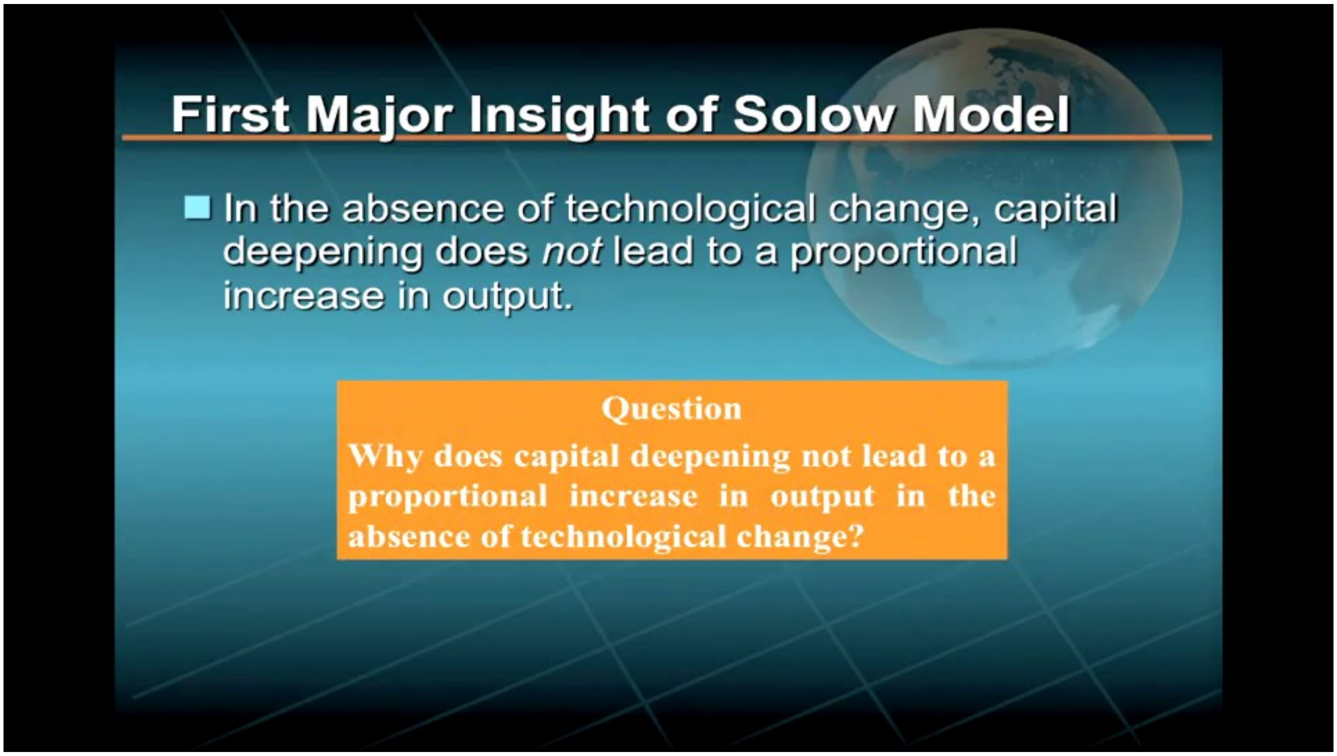
The Aggregate Production Function Model relates technology and factor inputs to total potential GDP.

Key Concept!!!!

- **Capital Deepening:** The process of increasing the amount of capital per worker.

Examples

- More farm machinery and irrigation systems in farming.
- More railroads and highways in transportation.
- More computers and communication systems in banking.


First Major Insight of Solow Model
In the absence of technological change, capital deepening does *not* lead to a proportional increase in output.
Question
Why does capital deepening not lead to a proportional increase in output in the absence of technological change?


The Law of Diminishing Returns
Answer: Capital deepening does not lead to a proportional increase in output because of the law of diminishing returns.
The Law of Diminishing Returns Applied: As you add more capital to a fixed supply of labor, the marginal product of capital must fall.

Second Major Insight of Solow Model

- Capital deepening leads to economic stagnation in the absence of technological change!

Question
What happens to worker wages and the return on capital as a result of capital deepening?

Who Wins, Who Loses

- Workers Win: They have more capital so their marginal product rises along with wages.
- Capital Owners Lose: They see lower rates of return and falling real interest rates because of diminishing returns to capital!!!

Remember: This is in the ABSENCE of technological change!

The Long Run Without Tech Change

- Economy enters a *steady state* in which capital deepening ceases as the capital-labor ratio stops rising.
- As real wages rise and returns to capital fall, further investments become unprofitable.
- Without technological change, both capital incomes and wages stagnate!!!!

Replication Without Innovation Leads to Stagnation

Key Point

If economic growth consists *only* of accumulating capital through replicating factories with existing methods of production, then peoples' standard of living will eventually stop rising.

Third Major Insight of the Neoclassical Growth Model

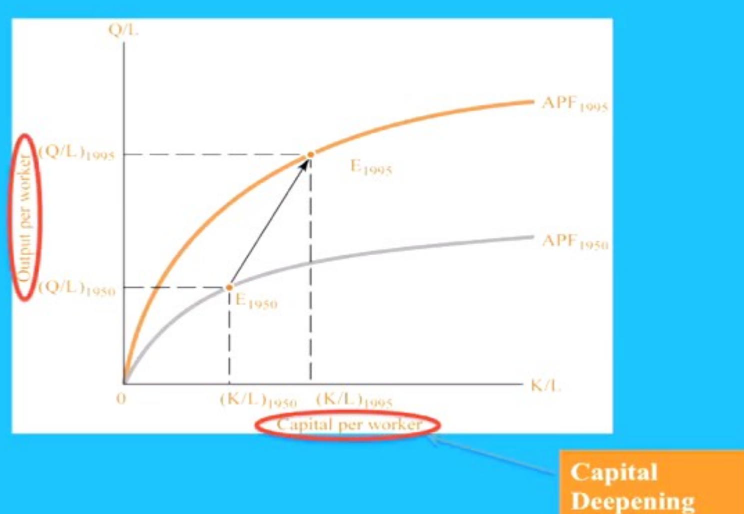
- It is only through **technological change** that modern economies can avoid the trap of economic stagnation.

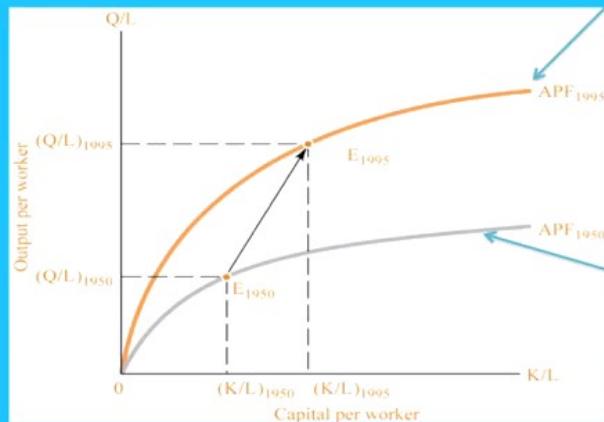
What isTechnological Change?

- Advances in production processes.
- The introduction of new and improved goods and services.
- New managerial techniques.
- New forms of business organization.

Examples Old and New

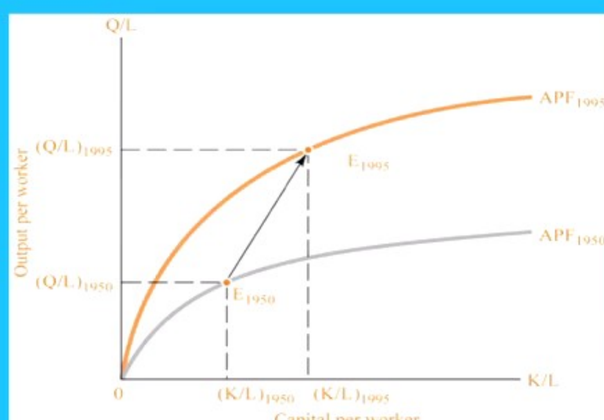
- Gas and diesel engines.
- Conveyor belts, assembly lines.
- Fuel-efficient aircraft, drones.
- Integrated microcircuits, computers.
- Xerography, MRIs.
- Containerized shipping.
- The Internet, 3D printing.
- Biotechnology, lasers, superconductivity.



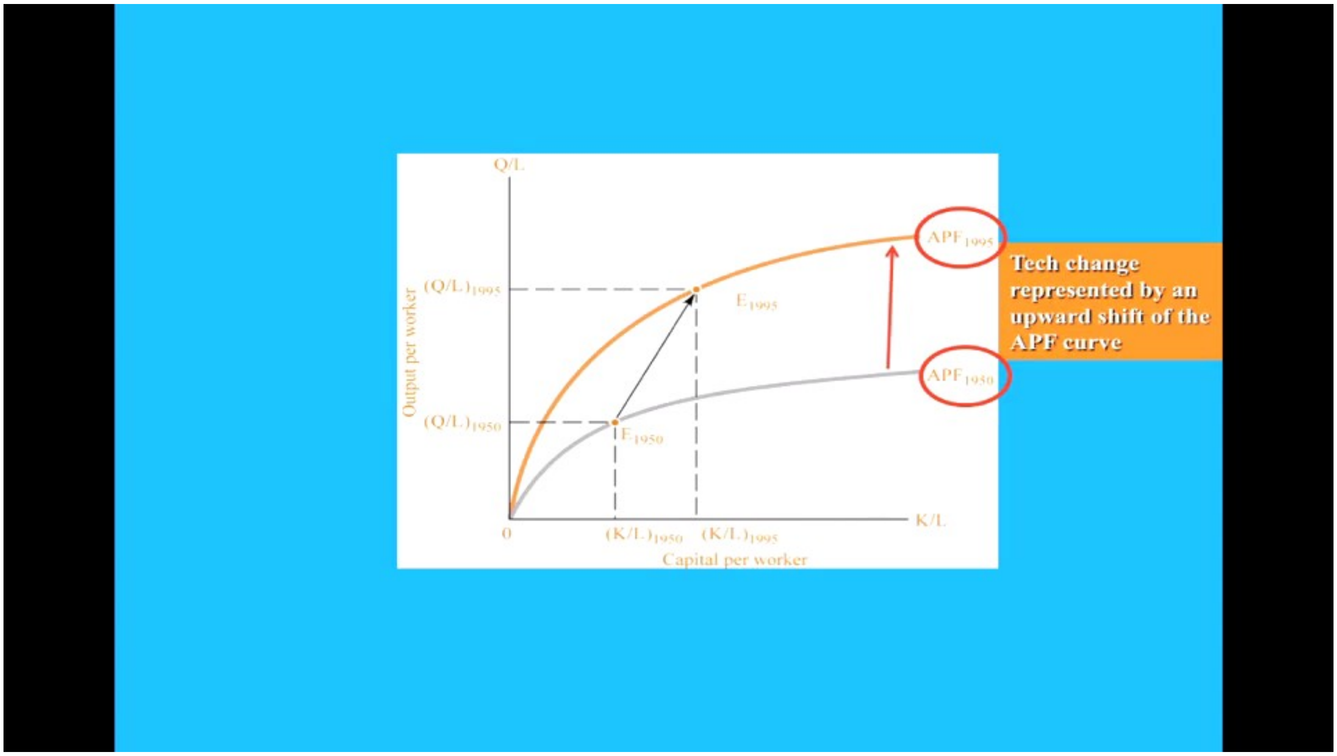


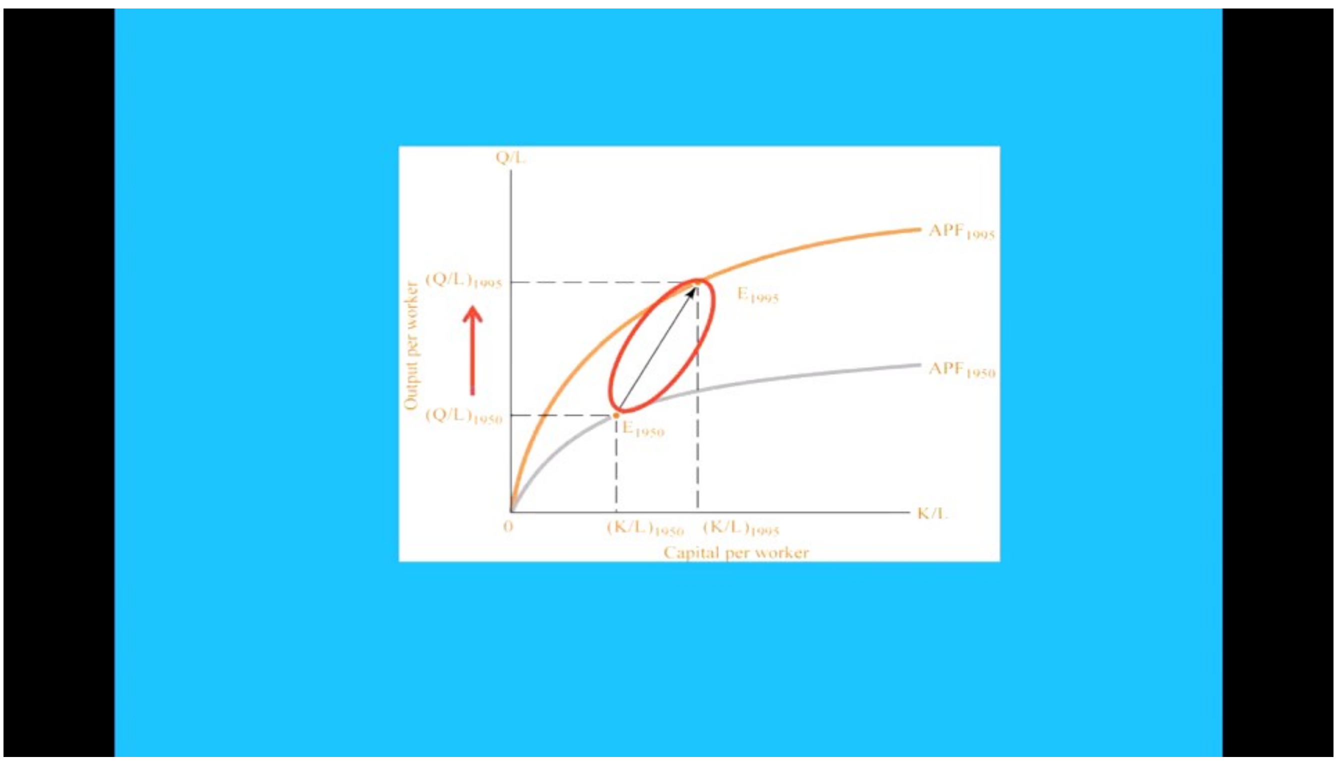
Aggregate production function given 1995 technology.

Aggregate production function given 1950 technology.



1. **How is technological change represented?**
2. **How is the effect of capital deepening & technological change on growth measured?**


Q/L
Output per worker
$(Q/L)_{1995}$
$(Q/L)_{1950}$
E_{1995}
E_{1950}
APF_{1995}
APF_{1950}
Tech change represented by an upward shift of the APF curve
0
$(K/L)_{1950}$
$(K/L)_{1995}$
K/L
Capital per worker


Q/L
Output per worker
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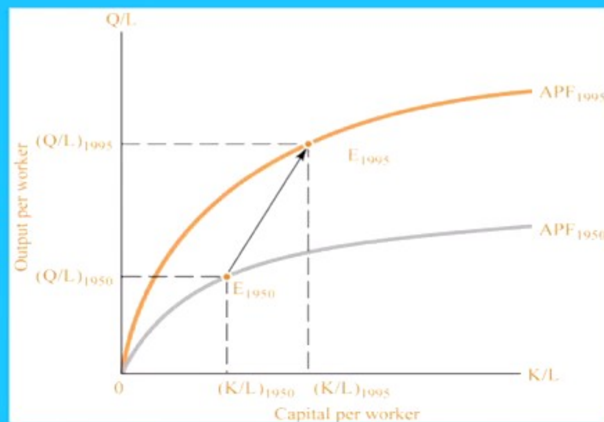
K/L
Capital per worker



Key Point

With technological change, both wages and returns to capital rise along with the standard of living!!!!