Technology

Diminishing returns imply that growth fueled by more capital & labor has limits. ⇒ Due to diminishing increases in output as inputs are added.

So, over the long-run we need to be able to get more out of the existing available inputs.

This is the role played by Technology.

Technology - anything that raises the amount of output that can be produced using a given amount of capital & labor

$$Y = F(K, L, \text{Technology})$$

Invention - discovery of new knowledge

Innovation - application of an invention in a way that creates new products or significantly changes old ones.

Diffusion - The spread of innovation throughout the economy.

TECHNOLOGY ALSO INCLUDES the way firms are organized.

Better organizations produce more with same tools and similar people.

Technology can affect how Labor & Capital are used.

* LABOR-SAVING - Fewer workers needed to produce some amount

* Capital-SAVING - Fewer Machines/tools etc. needed to produce some amount

Human Capital

Workers get Better Through education, & experience & training.

Special Features of Technology.

Non rivalry – use of Tech By one Person does not reduce the amount available to any one else.

Non excludability – owner or inventor cannot exclude others from using the invention or Tech.

Legal system governs this.

Trademarks
Patents
Copyrights.

} Provide some ability to exclude use, But incomplete.

A lot of University research is given away.

Profit provides substantial incentives to develop labor & Capital saving innovations.

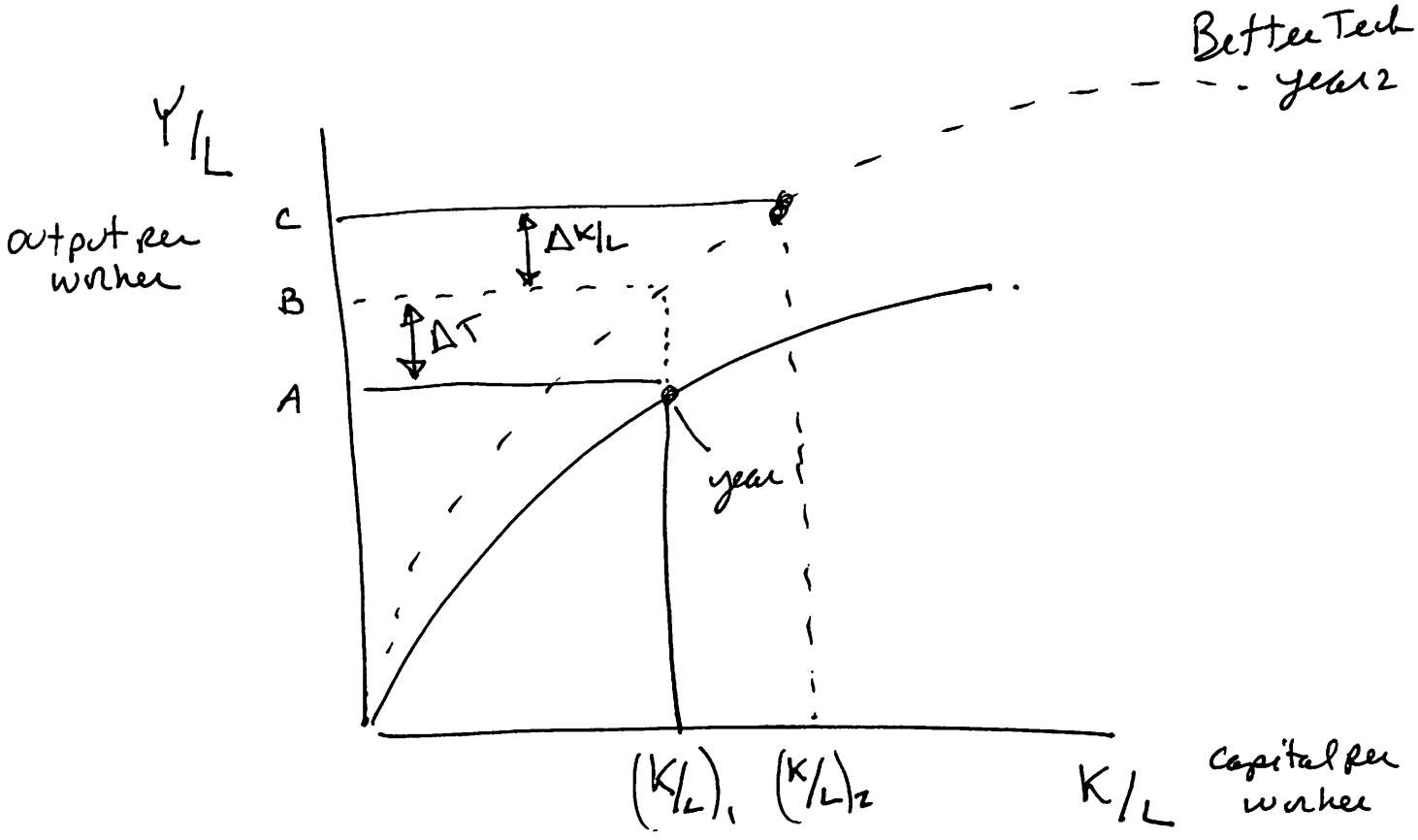
The Institutions play a substantial Role as well.

- Legal system
- Political system
- Regulatory environment.

Strong Private property rights encourage people to invest in Better Technology, get educated, and use Resources wisely.

Geography - Natural resources, climate, transportation

Openness - free trade



In year 2 we are more capital and have an improvement in Technology

Output per worker rises

Part is due to increase in K/L and part is due to Better Tech.

$\Delta Y/L$	(new curve).	C − A
Δ	Tech	B − A
Δ	Higher K/L	C − B

Growth Accounting

$$\text{Rate of Productivity Growth} = \alpha \cdot \%\frac{\Delta K}{L} + \%\Delta T$$

$$\%\Delta \text{ output per worker} = \alpha \cdot \%\Delta(K/L) + \%\Delta T$$

$$\alpha < 1$$

α is ~~Proportion of~~. The fraction of increased output due to the use of More Capital.

$\frac{\Delta K}{L}$ growth in capital per hour of work.

ΔT growth in Technology.

Research shows that $\alpha \approx \frac{1}{3}$