### Labor supply factors and impact on economic growth

**Labor force** = number of working age people available to work (both employed and unemployed)

**Labor Supplies Factors**

1. **Demographics**:
   - Younger population → higher potential growth
   - Low / Declining fertility rates → Decline labor force → reduce growth

2. **Labor force participation** = Increase as more women enter workforce

\[
\text{Labor force participation} = \frac{\text{Labor force}}{\text{Working age population}}
\]

3. **Immigration** = potential sources of continued economic growth for developed countries as a solution for declining labor force

4. **Average working hours**
   - General downward trend, due to legislation
   - Wealth effect = induce individuals to take more leaves
   - High tax rates on labor income
   - Increase part-time and temporary work

### Impact of investment on physical capital, human capital and technological development on economic growth

1. **Human capital** = knowledge and skills of individuals
   - Investment via education / work experience → increase productivity and economic growth
   - External spillover effect = Worker innovate → used by society to create greater efficiencies for the economy

2. **Physical capital** includes ICT capital (Infrastructure, Computers and Telecommunication) and non-ICT (machinery, transportation and non-residential construction)
   - Includes investment in both physical and human capital
   - Development countries rely on technological progress for growth → spend more on R&D
   - Less developed countries often copy from developed countries → spend less on R&D

3. **Technological development**:
   - Includes investment in both physical and human capital
   - Capital investment may influence technology progress → economic growth

4. **Public infrastructure**:
   - Includes investment in both physical and human capital
   - Includes ICT capital (Infrastructure, Computers and Telecommunication) and non-ICT (machinery, transportation and non-residential construction)

### Classical growth theory

- **↑ in capital / technology progress** = income per capital increases above a subsistence level
- **↑ in population growth** = diminishing marginal return to labor = ↓ productivity
- GDP per capita back to subsistence level
- Subsistence level: minimum income needed to maintain life
- Conclusion: growth in real GDP is not permanent

### Neoclassical growth theory

**Focus on estimating economy’s LT sustainable growth rate**

**At equilibrium**:
- Output-to-capital is constant
- Labor-to-capital and output per capita grow at equilibrium growth \( \theta \)

**Sustainable growth rate of output** = \( \Delta Y = \frac{\theta}{\alpha} \)

- \( \Delta Y = \) growth rate in technology
- \( \alpha = \) growth of labor

**Under neoclassical growth theory**:
- Capital deepening affects level of output, but not growth rate in the long run (Capital deepening temporary increase growth rate, but growth rate will revert back to sustainable level if not technological progress)
- Economy growth rate move toward equilibrium, regardless of initial capital to labor ratio / level of technology
- In equilibrium, only growth rate of technology and labor’s share of total output affect productivity
- In equilibrium, marginal product of capital (MPK = \( \alpha \times Y/K \)) is constant, but marginal productivity is diminishing
- Increase savings only temporary raise economic growth
- Increase savings rate → higher capital to labor ratio → higher productivity
- Developing countries (lower level of capital per worker) are impacted less by diminishing marginal productivity of capital → higher growth rate compared to developed countries

### Endogenous growth theory

**Investment in physical and human capital → technological progress → enhance productivity of both labor and capital**

- No equilibrium growth rate = increase investment → increase growth rate

- Increase R&D investment = benefit to entire economy
- Constant returns to capital → increase savings lead to increase in growth rate

### Convergence hypothesis

**Absolute convergence** = Less developed countries will achieve equal living standards over time

**Conditional convergence** = convergence in living standards for countries with same savings rates, population growth rates and production functions only

- Less developed countries’ growth rate is higher until they catch up to stabilise to same steady growth rate as developed countries

**Club convergence** = separate countries into clubs (with similar saving rates, financial markets, property rights, health and educational services, etc.). Countries can join the club by making appropriate institutional changes. Countries that are not part of the club cannot achieve that club’s standard of living

### Rationale for incentives to private investment in technology and knowledge

- ↑ expenditure that provide both benefits to the company and society (R&D) → permanently increase economies growth

- Many R&D projects have low expected returns → not enough to compensate firms for the riskiness of the investment → Sub-optimal (too low) R&D investment

- Government incentives that subsidise R&D investment → increase investment on R&D to optimal level