

# Adam Smith's invisible hand

---

Searching for the code of nature

# An inquiry to the nature

---

- Greedy versus moral
- Centralization versus distributed and asynchronous processes
- Microscopic view versus Macroscopic view
- Global information versus local information
- Competition and cooperation
- Economics, physics, neuroscience and biology

# Biography

---

- biography of Adam Smith

# 國富論

---

- 國富論

# Greedy

---

- Individual greedy
- Some kind of rule that guides individual behaviors to persuade individual benefits
- Such rule may fit global benefits or result in obstacles against global benefits or damage to individual benefits

# Centralization

---

- Powerful Central government
- A top-down plan or program that guides all individuals synchronously and sequentially toward some global goal
- A top-down program focuses more on social control and management less on individual benefits
- Inhibition to individual development

# Invisible hand

---

- Asynchronous and distributed approach
- Bottom-up approach
- Collective decisions
- Equilibrium
  - Fluctuation & interaction
  - Randomness & Entropy & Evolution to seeking ground states
  - Efficiency & greedy & Reduction of social costs

# Quantitative and qualitative measures

---

- Quantitative measures
  - Physics : Energy and entropy
  - Social science : GDP, CPI, Job, Housing, income...
- Qualitative measures
  - Happiness
  - Honor
  - Security
  - Medicine care
- Local minimum & Global minimum



# Interactive Dynamics

---

- Asynchronous and distributed processes
  - Differential equations
- Competition and cooperation, collective decisions
- Fault tolerance
- No central control
- No synchronous instructions
- Free run system
  - Maximal possibility and minimal social cost
  - Self-correction
  - Evolution to improve performance

# Interactive dynamics

---

- Phase transition
- Evolution
- Global optimization

# Function exploration

---

Linear function and quadratic  
function

# Function exploration

---

- Mapping from  $\mathbb{R}$  to  $\mathbb{R}$
- Domain and Range
- Linear function
- High-order polynomials
- Triangular function
- Logistic function
- Exponential grow & exponential decay

# Linear function

---

- $y=f(x)=ax+b$
- Zero
- Slope
- Intersection to x axis and y axis
- Plot a linear function

# Quadratic function

---

- $y = f(x) = ax^2 + bx + c$
- Zeros
- Intersection to x axis and y axis
- Slope
- Minimum & maximum
- Concave up & concave down
- Plot quadratic function