



# Session 5:

## The Economics of Ideas

Chad Jones  
Stanford GSB

## Outline: The Economics of Ideas

- Objects and Ideas
- The Idea Diagram
  - Ideas
  - Nonrivalry
  - Increasing Returns
  - Problems with Pure Competition
- How does the nonrivalry of ideas change how we think about economics?

## Solow and Romer

- Robert Solow (1950s)
  - Capital versus Labor
  - Cannot sustain long-run growth
  - Nobel prize, 1987
- Paul Romer (1990s)
  - Objects versus Ideas
  - Sustains long-run growth
  - Wide-ranging implications for intellectual property, antitrust policy, international trade, the limits to growth, sources of “catch-up” growth
  - Nobel prize, 2018

## Objects versus Ideas

## Objects versus Ideas

- Objects
  - Most goods: iPads, houses, oil, computers, capital, labor
  - The economics of objects underlies Adam Smith's invisible hand theorem
- Ideas
  - Instructions or recipes — designs for making/using objects
  - Sand: from beaches/glass to computer chips
  - Other examples: design of iPad, architectural plan for a house, method for turning oil into plastic, management techniques of Walmart, oral rehydration therapy

## Ideas

Reading: Paul Romer, “Economic Growth”

- Objects = raw materials (atoms), Ideas = instructions
- How many potential ideas are there?
  - Chemical exploratory synthesis
  - Romer’s “ideal chemical refinery”

## Ideas (continued)

- The amount of raw material available — oil, sand, atoms of carbon, oxygen, and so on — is finite
- But the number of ways of arranging these raw materials is virtually infinite

**Romer's insight:** Economic growth is sustained by discovering better and better ways to use the finite resources available to us

## The Idea Diagram



## Nonrivalry

## Nonrivalry

- Objects (most goods) are rival
  - Your use of a container ship to deliver Lenovo laptops means I cannot use that same container ship to deliver microwave ovens
  - Gives rise to scarcity, a central focus of economics
- Ideas are nonrival = infinitely usable
  - One architect's use of the Pythagorean Theorem in designing a building does not reduce the "amount" of the theorem available to anyone else
  - The PCR (polymerase chain reaction) technique for replicating strands of DNA can be used by 1 lab, 10 labs, or 1000 labs simultaneously

## Example: Cross-docking

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- By studying logistics carefully and experimenting with different alternatives, Walmart concludes that cross-docking will cut costs by 2% (for example)
  - This idea can then be applied to one distribution center, or two distribution centers, or 100 distribution centers
  - It does not get “depleted” by using it multiple times
  - Only needs to be “invented” once
  - In fact, Walmart’s use of the cross-docking technique doesn’t reduce the “amount” of cross-docking that Target can do

## Excludability

## Excludability

- The extent to which someone has property rights over a good and can legally restrict its use
- Nonrivalry says ideas **can** be used by many people simultaneously. But society may provide property rights that lead to legal restrictions on this
- Nonrivalry vs. Excludability
  - Nonrivalry is an **intrinsic** characteristic — from nature
  - Excludability (the extent of property rights) is a feature of the institutions chosen by society

Are ideas scarce in the same way that objects are?

## Increasing Returns

## Increasing Returns

- Suppose Asthma Inc. is developing a new drug for treating asthma (affects about 10% of the population)
  - Coming up with the successful, new chemical formula is the hard part — rough estimates suggest an average cost of \$2 billion to develop a new drug
  - Once developed, just an object, subject to standard CRS production
  - Example: \$2 billion R&D cost, then \$1 per dose in manufacturing costs
- Constant returns **after** invention implies increasing returns **including** invention
  - \$2 billion dollars → 1 dose
  - \$4 billion dollars → about 2 billion doses!
  - Doubling inputs far more than doubles output!

## Revisit our standard Production Function

- Familiar notation, but now let  $A_t$  denote the “stock of knowledge” (i.e. the cookbook of recipes)

$$Y_t = F(K_t, L_t, A_t) = A_t K_t^{1/3} L_t^{2/3}$$

- Constant returns to scale in  $K$  and  $L$  holding knowledge fixed. Why?

$$F(2K, 2L, A) = 2 \times F(K, L, A)$$

- But therefore increasing returns in  $K$ ,  $L$ , and  $A$  together!

$$F(2K, 2L, 2A) > F(2K, 2L, A)$$

- Economics is quite straightforward:
  - Replication argument + Nonrivalry  $\rightarrow$  CRS to objects
  - Therefore there must be IRS to objects and ideas

## Problems with Perfect Competition

- Adam Smith's fundamental **Invisible Hand** result
- Why do increasing returns pose a problem?
  - What if Asthma Inc. charges marginal cost?
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Many people who would purchase the drug at marginal cost (\$1) will not purchase at the higher price → inefficiency (deadweight loss)

## Problems with Perfect Competition (continued)

There must be a wedge between price and marginal cost so firms can recover the fixed cost of inventing new ideas

A single price cannot simultaneously provide the appropriate incentives for research **and** allocate scarce resources efficiently

We no longer live in the Best of All Possible Worlds —  
there is an important role for institutions beyond free markets

## How to Address Problems with Perfect Competition?

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  - Trade secrets to keep monopoly and sell at markup
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    - How long to grant monopoly? Innovation vs. restricted supply
  - R&D subsidies and public-private joint ventures
    - How to know which ideas to subsidize?

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- How do these issues differ for poor vs. rich countries



## Questions for Discussion

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- What are “meta-ideas” and why are they important?
- Natural resources, climate change, and ideas — how do they interact?
- Data is also nonrival — what are the implications?

## Meta-Ideas

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- Meta-Ideas: Ideas for shaping the creation of new ideas
- Institutions are themselves **ideas** — invented and evolving
  - The free market
  - The patent system
  - The National Science Foundation and National Institutes of Health
  - Research prizes — Longitude, Lindbergh, X Prize, Kremer
- What other meta-idea does Paul Romer suggest? Why does he think this might be useful?
- Better institutions lead to
  - $\downarrow$  misallocation  $\Rightarrow \uparrow$  TFP (last class)
  - $\uparrow$  Innovation  $\Rightarrow \uparrow$  TFP (next class)

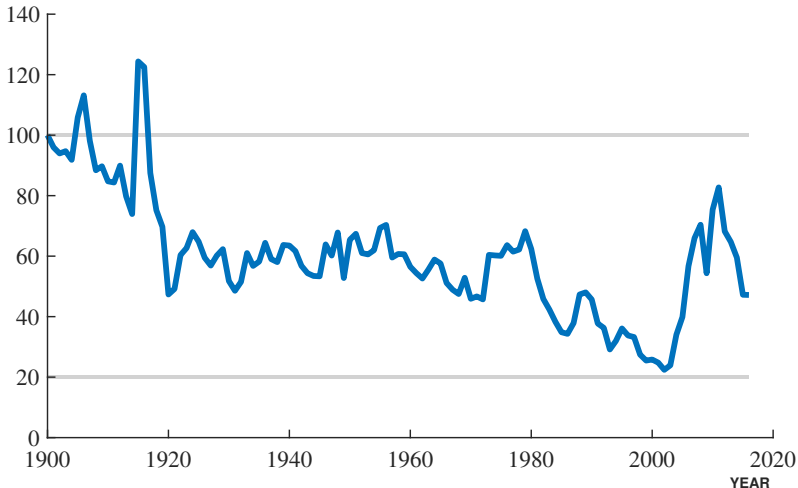
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EQUALLY-WEIGHTED PRICE INDEX (INITIAL VALUE IS 100)



## Climate Change and Ideas

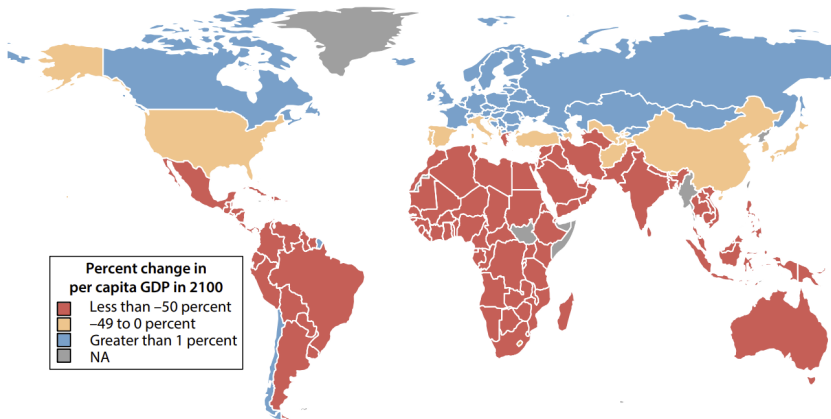
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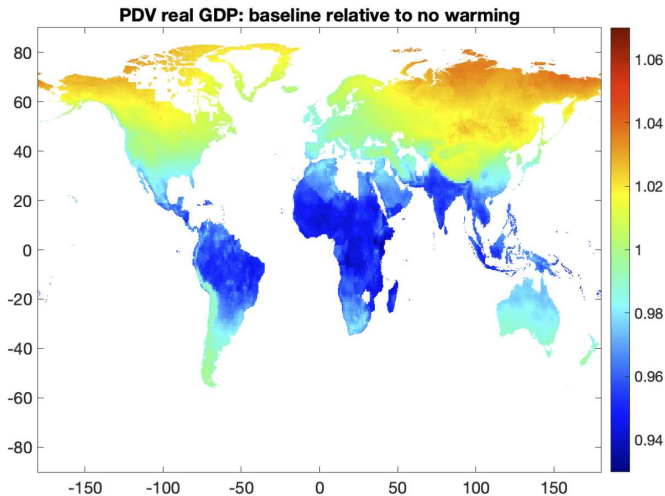
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- Takeaways?
  - A global problem: all regions contributing now: U.S./Europe more historically, China more today
  - Economic damages could be very large, highly uncertain
  - Poor countries are likely to be hardest hit
  - Carbon tax!

## Potentially Huge Effects on Levels of GDP by 2100



## Alternative Estimate — very different!



Cruz and Rossi-Hansberg, 2021

## The Nonrivalry of Data (WSJ)

Reading: “Should Consumers Be Able to Sell Their Own Personal Data?”

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Reading: “Should Consumers Be Able to Sell Their Own Personal Data?”

- Just like ideas, data is nonrival
- Data is used in the production of ideas (ML algorithm for detecting cancer)
  - We cannot all use the best surgeon, but we can all benefit from all the data
- Firms may have incentives to hoard data to protect market share
- Consumers can balance privacy concerns with social gains from broad use

## Questions for Review

- What is the key distinction between objects and ideas, and why is this distinction important?
- What is nonrivalry, and how does it lead to increasing returns?
- Why is there a tension between increasing returns and perfect competition?
- How does a careful consideration of the economics of ideas lead to a failure of Adam Smith's invisible hand result?
- What are meta-ideas and why are they important?
- How do ideas interact with natural resource constraints and climate change?