

# Digital Economics












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01

# Introduction



# Introduction

- ◆ What Is Digital Economics?
  - Digital technology is the representation of information in bits.
  - Digital economics explores how standard economic models change as certain costs fall substantially and perhaps approach zero.
  - The digital economics literature has grown to contribute to the economics of crime, public goods, organizational economics, finance, urban economics, labor economics, development economics, health economics, political economy media economics, public finance, and international economics.



# Introduction

## ◆ Digital Technology: A Brief History

- In 1945, the **commercialization of technologies** developed during World War II;
- By the early 1950s, magnetic core memories enabled efficient digital information storage, **storage technology**, software, and hardware improved rapidly;
- In the 1960s and 1970s, the rise of **the Internet** was built on key inventions developed through US military funding, with low-cost, commercial, computer-to-computer communication;
- Between 1990 and 1995, **privatization** occurred and led to the modern commercial Internet;
- Over time, **new technologies** have been layered on top of the basic TCP/IP-based Internet, including browsers, search engines, online shopping, social networks, mobile communications protocols, security standards, customer relationship management systems, and many others.



# Introduction

## ◆ Digital Technology: Control

- **Standards** have an influence on which technologies are widely adopted (Rysman and Simcoe, 2008), eg control of hardware and software standards.
- **Net neutrality** has become a central research and policy focus. Net neutrality means that an Internet service provider should treat all data in the same way; regardless of the content provider or content, companies cannot pay an Internet service provider to have faster speeds.



02

Reduction in  
Five Costs



# Reduction in Five Costs

- (i) **Lower search costs**
- (ii) Lower replication costs
- (iii) Lower transportation costs
- (iv) Lower tracking costs
- (v) Lower verification costs

Search costs are the costs of looking for information.

It is easier to find and compare information about potential economic transactions online than offline.





# Reduction in Search Costs

## ◆ 1、 Are Prices and Price Dispersion Lower Online ?

- Low search costs make it easier for consumers to compare prices, putting downward pressure on prices for similar products. This should **reduce both prices and price dispersion**.
- Why **price dispersion does not disappear**? Since different retailers offer different quality, shopping experiences, and shipping policies.
- **Search costs are endogenous**, and so firms can manipulate the search process in order to sustain higher margins and prices.



# Reduction in Search Costs

- ◆ 2、 How Do Low Search Costs Affect Variety ?
  - Low search costs lead to **increased variety**.
  - **Long-tail effects & superstar effects.**
  - More or less variety depends on the **search process endogenously** chosen by the firm.
  - The effect on **welfare** is not obvious.
  - Echo chamber & narrow viewpoint; Fake news & quality filter.



# Reduction in Search Costs

- ◆ 3、 How Do Low Search Costs Affect Matching ?
  - Reduced search costs facilitate exchange more generally, often enabled by **large digital platforms**.
  - It increases the **quality of matches** between buyers and sellers, firms and workers, etc.
  - It leads to the development of **online “peer-to-peer” platforms** dedicated to facilitating matching. They are dubbed the “sharing economy” where unused capacity could be filled more efficiently.
  - Low search costs provide **market demand information** that enables supply to enter the market when needed.



# Reduction in Search Costs

## ◆ 4、 Why Are Digital Platform-based Businesses So Prevalent ?

- Digitization has led to an **increase** in the prevalence of platform businesses, eg, Apple, Google.
- First, platforms facilitate **matching**.
- Second, platforms increase **the efficiency of trade**, through lower search costs, lower reproduction and verification costs. **Interoperability and standards** are the key aspect of platforms.



# Reduction in Search Costs

- ◆ 5、 How Do Low Search Costs Affect the Organization of the Firm ?
  - **Trade-offs:**
  - (1) Low-cost digital information flow could **increase centralization** by enabling headquarters, and organizational leaders, to understand better what is happening at a distance.
  - (2) Low-cost communication could **decrease centralization** by enabling front-line employees to access information previously only available to senior employees at headquarters.
  - The reduction in search costs (combined with the reduction in verification costs discussed below) has also led to an increase in **international hiring and outsourcing.**



# Reduction in Five Costs

- (i) Lower search costs
- (ii) **Lower replication costs**
- (iii) Lower transportation costs
- (iv) Lower tracking costs
- (v) Lower verification costs

## **Non-rival digital goods**

Bits are non-rival, meaning that they can be consumed by one person without reducing the amount or quality available to others.



# The Replication Cost of Digital Goods Is Zero

- ◆ 1、 How Can Non-Rival Digital Goods Be Priced Profitably ?
  - How to structure pricing of a large variety of non-rival zero-cost goods, should a producer choose to charge?
  - **Bundling** occurs when two or more products are sold together at a single price. And a sufficient condition for price discrimination benefit of bundling arises when consumers have negatively correlated preferences.
  - The non-rival nature of information goods means that large numbers of information goods can be bundled **without substantially increasing costs**.



# The Replication Cost of Digital Goods Is Zero

- ◆ 2、 What Are the Motivations for Providing Digital Public Goods ?
  - opensource software: (career concerns & complementarity)
    - (1) providing high-quality open-source code is a way to **signal** their skills to potential employers.
    - (2) selling other services that are **complementary** to open-source software make a premium.
  - Wikipedia (social benefits )
    - (1) open data enabled a **wider set of participants** to succeed.
    - (2) enable consumers and workers to access the **same information and improve pedagogy** in developing countries
  - **Welfare may decrease** because of a decision not to exclude digital goods from widespread copying.  
Like **reducing the incentives** to produce information goods and **creating public bads**, such as spam and online crime.





# The Replication Cost of Digital Goods Is Zero

## ◆ 3、 How Do Digital Markets Affect Copyright Policy ?

- Copyright law is more important in digital markets because goods can be copied at zero cost. **Stricter** enforcement of copyright appears to **increase revenue** to the copyright holder.
- The **quality** of music **rise** after the arrival of **free** online copying in 1999 despite declining revenue. The decline in revenue came a decline in the cost of producing and distributing music.
- Digital challenges to copyright protection may affect incentives to build on prior work. Intellectual property protections **limit follow-on innovation** and reduce incentives by others to build on copyrighted work.

# Reduction in Five Costs

- (i) Lower search costs
- (ii) Lower replication costs
- (iii) **Lower transportation costs**
- (iv) Lower tracking costs
- (v) Lower verification costs

The cost of distribution for digital goods approaches zero.

Transportation costs are lower online.



# Lower Transportation Costs

- ◆ 1、 Does Distance Still Matter If Transportation Costs Are Near Zero ?
  - The difference in the cost of nearby and distant communication approaches zero.
  - The digital economic literature has emphasized what **factors** influence the extent to which distance still matters.
    - (1) **Offline retail** affects online purchasing, substitution between online and offline sales.
    - (2) **Tastes** are spatially correlated. People are more likely to visit websites from nearby countries than from faraway countries.
    - (3) The presence of **social networks**. Much online behavior is social, social networks are highly local.
    - (4) **Trust** is easier locally. People follow online product recommendations of others who live near them.



# Lower Transportation Costs

- ◆ 2、 Can Policy Constrained by Geographic Boundaries Shape Digital Behavior ?
  - **Difference between online and offline.**
  - The substitution suggests that online and offline markets should be considered together in the context of antitrust.
  - Regulation can mean that users experience the Internet differently in **different locations**.
  - When regulation does reach the online sphere, it can have a substantial effect on the nature of the Internet across locations.

# Reduction in Five Costs

- (i) Lower search costs
- (ii) Lower replication costs
- (iii) Lower transportation costs
- (iv) **Lower tracking costs**
- (v) Lower verification costs

Digital activity is easily recorded and stored.

Reductions in tracking costs enable personalization and the creation of one-to-one markets.

The **first three** drops in costs, those associated with search, replication, and distance, were **well discussed** in the early digital economics literature. However, the importance of the lowering of the **next two** costs we discuss, tracking and verification, has only **become clear** in the last decade.



# Lower Tracking Costs

- ◆ 1、 Do Lower Tracking Costs Enable Novel Forms of Price Discrimination ?
  - The ability to use digital technologies to track individuals enables **personalized markets**.
  - One form of price discrimination is **behavioral price discrimination** based on an individual's past behavior, which is first-degree price discrimination.
  - Another form of price discrimination is **versioning** based on probabilistic selling, which is a basic form of third-degree price discrimination that precedes most digital markets.



# Lower Tracking Costs

- ◆ 2、 Why Has There Been a Shift in Academic Emphasis from Personalized Pricing to Personalized Advertising ?
  - Not to use personalized profiles to charge different consumers different prices, but instead to show these **different** consumers more appropriate, relevant, and profitable **advertising**.
  - Treat **consumer attention** as scarce and explore advertiser competition for that attention. Many of the largest online companies—in terms of revenues, profits, and users—are **advertising-supported**.
  - Explore competition between online and offline advertising, which has better targeting and higher **advertising effectiveness**.



# Lower Tracking Costs

## ◆ 3、 Why Are Online Goods and Services Often Sold by Auction ?

- It is difficult to choose prices for thousands of advertisements that might be **priced differentially** to millions or even billions of customers.
- **Auctions** are a particularly useful tool for price discovery.
  - (1) Rather than price for the search page, price could be at the level of the search term.
  - (2) The transactions costs of conducting and participating in auctions are lower in the digital context.
  - (3) Many digital goods are **not standardized** in the sense that buyer valuations vary over time and location.





# Lower Tracking Costs

## ◆ 4、 How Do Digital Markets Affect Privacy Policy ?

- The economics literature on privacy--how privacy should be treated in terms of the consumers' utility function.
- Privacy regulation puts a cost on tracking information flows. The **welfare effects** of these costs may be ambiguous.
- ✓ First, there may be knock-on effects to industry structure from privacy regulation.
- ✓ Second, welfare complications of privacy policies are also hard to assess due to a privacy paradox, where consumers state an affinity for privacy, but then act in ways that are not consistent with this stated preference.
- ✓ Third, national security.



# Reduction in Five Costs

- (i) Lower search costs
- (ii) Lower replication costs
- (iii) Lower transportation costs
- (iv) Lower tracking costs
- (v) **Lower verification costs**

The reduction in tracking costs has also led to a reduction in costs associated with the verification of **identity and reputation.**



# Reduction in Verification Costs

- ◆ 1、 How Do Online Reputation Systems Facilitate Trust ?
  - Online rating systems collect ratings from past buyers and sellers are posted for future market participants to see.
  - One key application is to provide information on **product quality**. Positive reviews lead to higher sales.
  - A benefit of improved online verification procedures for individuals has been the ability to **more securely and easily make payments**. Like using mobile devices to digitally verify identity.
  - It is easier not only to establish an online reputation but also **to damage that reputation** using online reputation mechanisms.
  - **Blockchain** is a promising technology for reducing verification costs further.



# Reduction in Verification Costs

## ◆ 2、 Is There a Role for Policy in Reducing Reputation System Failures ?

- One type of failure relates to a **selection bias**: not all consumers provide ratings.
- Another type of failure relates to direct **manipulation** of the ratings by the firms or their competitors.
- Online, quality is hard to assess. And the online reputation system is **insufficient** in many ways.
- The platforms also work to improve their reputation systems.
- At this point, the literature does not point to a specific digital policy with respect to reputation systems failures.
- One aspect of policy related to verification is the nature of intellectual property tools such as trademarks. The trademark serves two purposes: it verifies identity and it provides a path to search for related products.



# Reduction in Verification Costs

## ◆ 3、 How Do Digital Markets Affect Antidiscrimination Policy ?

- The drop in verification costs and the ability to identify an individual and also their characteristics. makes discrimination possible (and potentially low cost) in a digital environment.
- For policy makers is whether there is something unique to the online setting that requires additional regulation beyond existing antidiscrimination law.
- (1) If digital transactions mean that gender and race information is not revealed, then discrimination may fall.
- (2) If gender, race, or other sensitive information is revealed, it is possible that, in the absence of other information, discrimination is high.

A blue-tinted photograph of a large, traditional Chinese-style building with multiple tiers of curved roofs. In the foreground, there is a circular plaza with a statue on a pedestal. Several people are walking around the plaza. The sky is overcast.

03

Different level  
effects



# Country-level Effects

- Macroeconomic productivity literature with respect to Internet technology.
- Measuring the productivity shifts is difficult. A key challenge relates to intangible capital.
- A different stream of work on country-level effects examines how digital communication may affect trade flows for digital and physical goods. Easy international communication on trade.



# Region-level Effects

- The Internet has led to **redistribution** of economic benefits within countries and, in particular, between cities and rural areas.
- Overall, the literature suggests that the **biggest beneficiaries** of digital technologies and data have been in large urban areas.
- The mechanism through which cities appear to have benefited has been shown to depend on agglomeration effects, particularly with respect to skilled workers in local labor markets.
- Internet adoption has some benefits for isolated individuals and rural areas.
- **Agglomeration effects** mean that cities disproportionately benefit. **Low-cost communication**, however, can benefit the geographically isolated. In any particular context, the overall result depends on the balance between these forces. Generally, the more difficult the technology is to use, the more likely that agglomeration effects dominate.





# Firm-level Effects

- There is a large and growing literature that documents a direct link from digital technology adoption and usage to productivity growth at the firm level.
- Digital technology adoption and usage does **enhance** productivity.
- Various factors enhance or mitigate this relationship, including organizational change, skills, geography, regulation, firm size and age, and the potential for spillovers and/or network externalities.
- There are also specific **case studies** on the effects of ICT on productivity. They conclude that ICT does increase productivity, though they find considerable heterogeneity in this effect across countries and type of firm.



# Consumer-level Effects

- **Consumer surplus** driven by the Internet
- Positive
- ✓ With time use data, Goolsbee and Klenow (2006) estimate a consumer surplus of \$3,000 per person-year in 2005.
- ✓ Greenstein and McDevitt (2011) measures the consumer surplus associated with broadband diffusion at \$4.8 to \$6.7 billion between 1999 and 2006.
- ✓ Brynjolfsson, Eggers, and Gannamaneni (2017) provide perhaps the most comprehensive estimate of the consumer surplus of the Internet by using (incentive compatible) choice experiments.
- ✓ Among adopters, consumer surplus (at least relative to overall consumption) is higher for lower-income people.
- Negative
- ✓ online games distracted students. crimes.

A photograph of a large, traditional Chinese-style building with multiple tiers of curved roofs and a central arched entrance. In the foreground, a statue of a man stands on a pedestal. The scene is set in a courtyard with palm trees and a paved ground. The image is overlaid with a semi-transparent blue filter.

04

Conclusion



# Conclusion

- (I) Across a variety of fields, economists examine how digital technologies change economic activity.
  
- (II) Digitization has reduced a number of specific economic costs. We have identified five such costs:  
search, reproduction, transportation, tracking, and verification.

# Thanks!

